CASCA 2018
A New Century for Canadian Astrophysics

Canadian Astronomical Society
Société Canadienne d'Astronomie

ANNUAL GENERAL MEETING

22 - 26 MAY 2018

Victoria Conference Centre
Victoria, BC

National Research Council Canada | Conseil national de recherches Canada

University of Victoria

SPONSORS

We gratefully acknowledge our many generous sponsors who helped make CASCA 2018 possible.

ABB

Association of Canadian Universities for Research in Astronomy (ACURA)

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Canadian Astronomical Society

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Square Kilometre Array (SKA)

Thirty Meter Telescope (TMT)

CASCA 2018

A New Century for Canadian Astrophysics

Un nouveau siècle pour l'astrophysique canadienne

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ACKNOWLEDGEMENTS

The CASCA 2018 LOC is very grateful to Gregory Sivakoff and the University of Alberta CASCA 2017 LOC for providing us with the LaTeX files used to create last year's excellent program. This detailed CASCA 2018 program was (quite obviously) produced using this software.

CODE OF CONDUCT

The organizers are committed to making this meeting productive and enjoyable for everyone, regardless of age, race, ethnicity, sexual orientation, gender identity, gender expression, marital status, nationality, political affiliation, religion, ability status, physical appearance or educational background. We will not tolerate harassment of participants in any form. Attendance at a CASCA meeting implies consent to abide by this code of conduct.

Please follow these guidelines:

- Behave professionally. Harassment and sexist, racist, or exclusionary comments or jokes are not appropriate. Harassment includes sustained disruption of talks or other events, inappropriate physical contact, sexual attention or innuendo, deliberate intimidation, stalking, and photography or recording of an individual without consent. It also includes offensive comments related to gender, sexual orientation, disability, physical appearance, body size, race or religion.
- All communication should be appropriate for a professional audience including people of many different backgrounds. Sexual language and imagery is not appropriate.
- Be kind to others. Do not insult or put down other attendees.

Participants asked to stop any inappropriate behaviour are expected to comply immediately. Attendees violating these rules may be asked to leave the event at the sole discretion of the organizers without a refund of any charge.

Any participant who wishes to report a violation of this policy is asked to speak, in confidence, to any member of the LOC, the CASCA Diversity and Inclusivity Committee, or the CASCA Board. Three members of CASCA's Equity and Inclusivity Committee, Drs. Brenda Matthews (Brenda.Matthews@nrc-cnrc.gc.ca), Kristine Spekkens (kristine.spekkens@rmc.ca) and Bryan Gaensler (bgaensler@dunlap.utoronto.ca) are attending CASCA 2018.

Consequences may range from verbal warning, to ejection from the meeting without refund, to notifying appropriate authorities. Retaliation for complaints of inappropriate conduct will not be tolerated. If a participant observes inappropriate comments or actions and personal intervention seems appropriate and safe, they should be considerate of all parties before intervening.

To avoid any confusion or bias in dealing with reports of violations of the code of conduct, the following protocol will be followed:

- The designated CASCA contact will request a written record of the complaint including time/date plus particulars;
- The designated CASCA contact will bring the incident to the attention of the LOC and the CASCA Board;

- The designated CASCA contact will inform the individual(s) indicated to have violated the code of conduct of the allegation and ascertain and record their version of events.

Based on the nature of the violation and the response, the LOC, in concert with representatives of the CASCA Board, will decide upon appropriate actions. *Where a violation of the policy is deemed to have occurred, a record will be kept to that effect within CASCA.*

This code of conduct is based on the "London Code of Conduct", as originally designed for the conference "Accurate Astrophysics. Correct Cosmology", held in London in July 2015 (https://github.com/apontzen/london_cc/blob/master/codeofconduct.md). The London Code was adapted with permission by Andrew Pontzen and Hiryana Peiris from a document by Software Carpentry, which itself derives from original Creative Commons documents by PyCon and Geek Feminism. It is released under a CC-Zero licence for reuse.

CODE DE CONDUITE

Les organisateurs s'engagent à ce que cette conférence soit une expérience enrichissante et agréable pour tous, et ce, sans égard à l'âge, race, ethnicité, orientation sexuelle, identité de genre (et son expression), état civil, nationalité, affiliation politique, religion, degré d'habileté, apparence physique ou formation académique. Nous ne tolérerons aucune forme de harcèlement envers un ou des participant(s). Votre présence à cette conférence de la CASCA est votre consentement à respecter et à suivre ce code de conduite.

Vous êtes donc priés de suivre les consignes suivantes :

- Comportez-vous toujours de façon professionnelle. Le harcèlement et les commentaires/plaisanteries de nature sexiste, raciste ou d'exclusion sont inappropriés. Le harcèlement inclut les perturbations soutenues de présentations ou autres événements, contacts physiques inappropriés, sous-entendus ou attention de nature sexuelle, et prises de photos ou enregistrements sans consentement. Il inclut aussi les remarques désobligeantes liées au genre, orientation sexuelle, degré d'habileté, apparence physique, taille, race ou religion.

- Toute communication se doit d'être appropriée pour un auditoire professionnel dont les membres proviennent de milieux différents. Les mots et les images de nature sexuelle ne sont pas appropriés.

- Restez courtois envers tous les autres participants, et évitez toute insulte ou autre humiliation.

Les participants auxquels l'on demandera de mettre fin à un comportement inapproprié devront se plier à cette directive immédiatement. Faute de quoi, ils pourraient se voir expulsés de la conférence sans aucun remboursement de leurs frais d'inscription. Le recours à l'expulsion est à la seule discrétion des organisateurs.

Tout participant qui souhaite signaler une violation de cette politique est invité à parler en toute confidentialité à tout membre du COL, au Comité sur la diversité et l'inclusion de la CASCA ou au Conseil de la CASCA. Trois membres du comité d'équité et d'inclusion de la CASCA, Drs. Brenda Matthews (Brenda.Matthews@nrc-cnrc.gc.ca), Kristine Spekkens (kristine.spekkens@rmc.ca) et Bryan Gaensler (bgaensler@dunlap.utoronto.ca) assisteront à la CASCA 2018. Veuillez les contacter directement à cas de problèmes de conduite au cours de la conférence.

Les conséquences d'une infraction pourront aller d'un avertissement verbal à l'expulsion de la conférence sans remboursement. Les autorités locales pourraient aussi être alertées si nécessaire. Aucune représaille suite à une plainte pour comportement inapproprié ne sera tolérée. Si un(e) participant(e) est témoin d'actions et/ou de commentaires inappropriés et qu'il/elle juge une intervention nécessaire et sécuritaire, il/elle se doit de prendre tous et chacun en considération avant de le faire.

Afin d'éviter toute confusion ou biais dans le traitement d'un constat d'infraction, le protocole ci-dessous sera suivi :

- La personne désignée de la CASCA demandera un constat d'infraction écrit avec date et tous les détails pertinents à l'appui ;
- La personne désignée de la CASCA portera l'incident à l'attention du comité organisateur et du conseil d'administration de la CASCA ;
- La personne désignée de la CASCA informera ensuite le (ou les) individu(s) présumément impliqué(s) de cette plainte et recueillera leur(s) version(s) des faits.

Selon la nature de l'infraction et sa suite, le comité organisateur, de concert avec les membres du conseil d'administration de la CASCA, décidera des actions à prendre en réponse à la plainte. *S'il est établi qu'une infraction a effectivement été commise, elle sera entrée dans un registre interne de la CASCA.*

Ce code de conduite est basé sur le «Code de conduite de Londres» écrit à l'origine pour la conférence «Astrophysique précise, cosmologie actuelle» tenue à Londres en juillet 2015 (https://github.com/apontzen/london_cc/blob/master/codeofconduct.md). Le «Code de Londres» a été adapté avec permission par Andrew Pontzen et Hiranya Peiris d'un document de «Charpenterie de logiciels». Ce document a lui-même été dérivé des versions originales écrites par «PyCon» et «Geek Feminism» sous licence «Creative Commons». Il est diffusé sous une licence «CC-Zero» afin qu'il puisse être réutilisé.

WELCOME MESSAGE

Welcome to CASCA 2018!

The CASCA 2018 Local Organizing Committee (LOC) welcomes you to the 49th Annual General Meeting of the Canadian Astronomical Society. The last AGM held in Victoria was in May 2008, and this year's CASCA meeting is again proudly co-hosted by the National Research Council of Canada's Herzberg Astronomy and Astrophysics Research Centre and the University of Victoria.

This year's theme is "A New Century of Canadian Astrophysics." 2018 caps a century of progress in astrophysics in Canada initiated by the opening of the Dominion Astrophysical Observatory here in Victoria. Founding Director J.S. Plaskett and the tiny staff set to work on outstanding scientific problems of the day with a facility "second to none" and shared their discoveries eagerly with the public. Following the same principles over the past century, Canada's prowess in the field grew substantially thanks to the quality of its astronomers and the tools they used to explore the universe. With the dawn of a new century of astrophysics in Canada, the time is ripe to reflect on the successes of the past and the challenges of the future. This year, in addition to the exciting research results normally presented at CASCA meetings, we have special centennial sessions on a wide range of Canadian astrophysics topics. Also, we have dedicated History and Education and Public Outreach sessions for the community to attend. On the meeting?s final evening there is a special centennial visit to the Dominion Astrophysical Observatory.

With more than 300 attendees, this year's meeting is one of the largest CASCA AGMs yet! We hope you take the many opportunities to reacquaint yourself with your colleagues and meet new faces in the Canadian astronomy scene. Furthermore, we hope you enjoy visiting Victoria. Please contact any CASCA 2018 LOC member if you have any questions or requests during this exciting meeting!

ORGANIZING COMMITTEES

Use the email address casca2018@googlegroups.com to contact a few LOC members.

Local Organizing Committee (LOC)

David Bohlender, NRC Herzberg (**co-chair; 250-208-5641**)
Kim Venn, University of Victoria (**co-chair**)
Dennis Crabtree, NRC Herzberg
James Di Francesco, NRC Herzberg (**778-350-1510**)
Ben Dorman, Friends of the DAO (FDAO)
Susan Gnucci, University of Victoria
Jim Hesser, NRC Herzberg
Helen Kirk, NRC Herzberg
Kathryn MacLeod, NRC Communications Branch
Scott Mair, RASC Victoria
Doug Rennehan, University of Victoria
Karun Thanjavur, University of Victoria
Helen Tran, NRC Herzberg

Science Session Organizing Committee (SSOC)

Kim Venn, University of Victoria (**co-chair**)
David Bohlender, NRC Herzberg (**co-chair**)
Dennis Crabtree, NRC Herzberg
James Di Francesco, NRC Herzberg
René Doyon, Université de Montréal
Sarah Gallagher, Western University
Colin Goldblatt, University of Victoria
Jim Hesser, NRC Herzberg
Helen Kirk, NRC Herzberg
Julio Navarro, University of Victoria
Luc Simard, NRC Herzberg)
Karun Thanjavur, University of Victoria

Centennial Session Organizing Committee (CSOC)

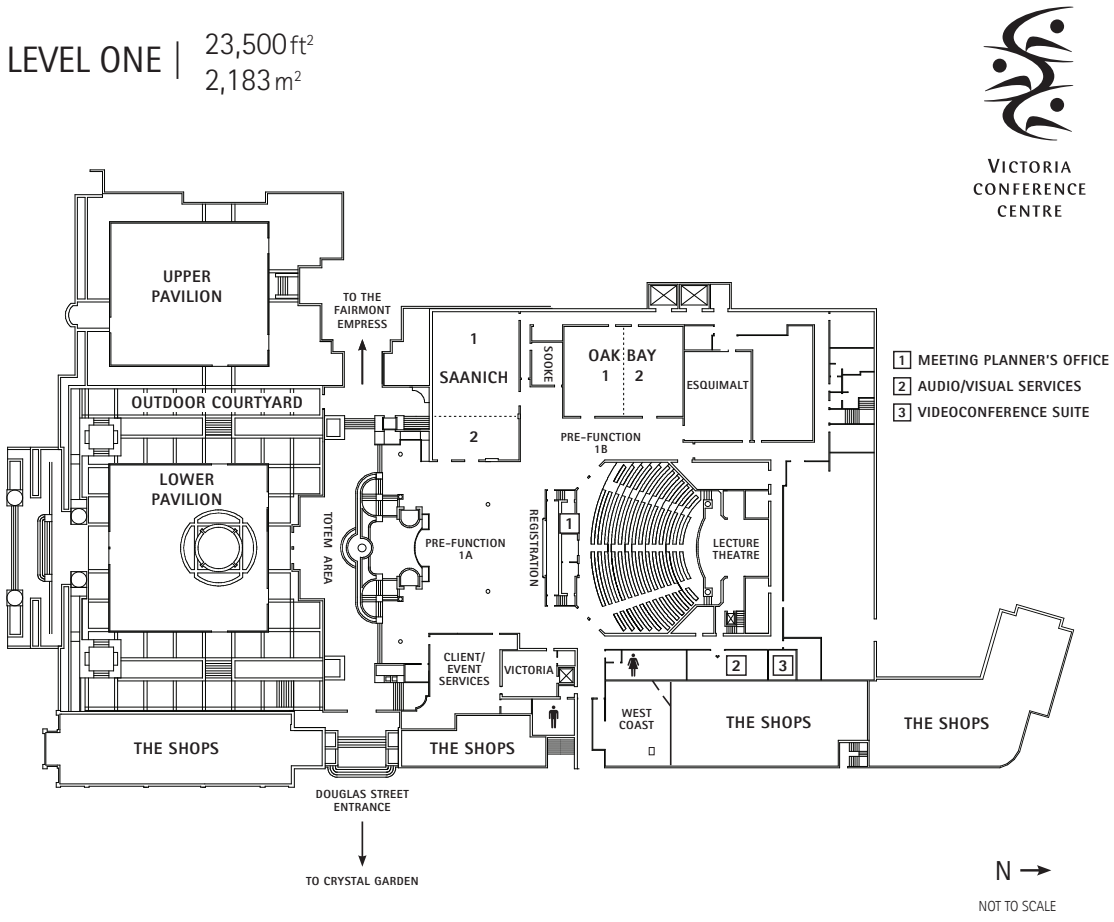
Dennis Crabtree, NRC Herzberg (**chair**)
René Doyon, Université de Montréal
Laura Ferrarese, NRC Herzberg
Jim Hesser, NRC Herzberg
Ernie Seaquist, University of Toronto
Luc Simard, NRC Herzberg
Rob Thacker, Saint Mary's University
Kim Venn, University of Victoria

VENUE AND LOCAL INFORMATION

THE VICTORIA CONFERENCE CENTRE

All CASCA 2018 events, except for the banquet and DAO Centennial Celebration, will be held in Level One of the Victoria Conference Centre (VCC) shown below.

Most scheduled meetings, as well as all of the scientific sessions, are indicated in the conference schedule. Poster papers and demonstration booths can remain set up for the duration of the meeting. Most posters will be displayed in the Oak Bay Room while a few more and all demonstration booths will be located in the Prefunction area. Scientific sessions take place in the Lecture Theatre, the Saanich Room, and the Esquimalt Room. If you have need of a room for a special meeting of your own please see a member of the LOC to discuss availability of the West Coast Room.



REGISTRATION DESK

The Registration Desk is prominently located in the Prefunction area of the VCC. It will be staffed throughout the conference starting at 8:00 AM on Tuesday, 22 May.

WELCOME RECEPTION

The CASCA 2008 Reception will take place in the Prefunction area between 19:00 and 21:00 on Tuesday, 22 May. Light appetizers will be served and a cash bar will be available. Your registration kit includes a complementary drink ticket that can be used at the reception or during subsequent late-afternoon poster sessions with cash bars.

ORAL PRESENTATIONS

To allow for a very smooth transition between talks we are using only conference computers for all CASCA 2018 presentations. All CASCA 2018 prize lectures, invited talks and oral contributions must be loaded onto the conference computers no later than the morning of the presentation, and preferably earlier. We will have Windows and Apple computers in each conference room and can support Powerpoint, Keynote, and PDF formats.

POSTER PAPERS

Poster dimensions should not exceed 4' $\times$ 4'. Poster papers may be set up starting on the morning of Tuesday, May 22, and must be removed by 17:00 on Saturday, May 26. Any papers remaining after this time will be destroyed. Please note your poster identification number in this program and place your paper on the appropriately identified poster panel. Pushpins will be provided for mounting on the poster boards.

Please plan on being near your poster paper during coffee breaks and especially during two special poster sessions with a cash bar scheduled from 17:30 to 18:30 on Wednesday, 23 May and Friday, 25 May.

COFFEE BREAKS

Two coffee breaks will be served in the Prefunction area each day of the meeting. These are also intended to serve as times to interact with poster and demo presenters and our sponsors, but since the breaks are quite short we have also scheduled two special poster sessions at the end of Wednesday's last scientific session and Friday's CASCA Business Meeting. A cash bar will be available in the Prefunction area for each of these.

LUNCH SESSIONS

Lunch sessions are scheduled in the lecture Theatre and Saanich Room on the first three days of the conference. Brown bag lunches will be available for attendees who requested these when they registered for the meeting. **We ask that you do not take a lunch if you did not request one!** Please make sure that you remove your garbage from the Theatre and Saanich Room when you are finished; food is not normally permitted in the Lecture Theatre and the LOC will be charged for any extra cleaning that is required by VCC staff

WIRELESS INTERNET ACCESS:

Wireless internet access is available throughout the VCC on the "VictoriaConference" Wi-Fi network. Upon launching your favourite Web browser, you will automatically be directed to the log in page. Select “ACCESS CODE”, enter the password “19Plaskett18”, select “Yes” in the terms and conditions box and then click “Connect Me”. Please keep your laptop use to a minimum during scientific sessions to avoid annoying other audience members or the speakers!

DEVICE CHARGING

Please note that there are limited power outlets in the VCC rooms. Because of this, a number of power bars have been located in the small Sooke room located between the large Saanich and Oak Bay rooms. However, since the conference rooms will remain unsecured throughout the conference, we do not recommend leaving your computer unattended.

A quick charge station for tablets and phones is available in the Prefunction space to the right of the registration desk.

SOCIAL MEDIA

We recommend the hashtag #CASCA2018 for social media. Those interested in events related to the DAO Centenary will find information on the DAO Centennial Facebook page.

BANQUET AT THE ROYAL BC MUSEUM

Since the CASCA 2008 banquet was well received, this year’s banquet will again be held at the Royal British Columbia Museum, a very short walk from the Victoria Conference Centre, from 19:00 to 22:00 on Thursday, 24 May 2018 in the First Peoples Gallery (3rd floor). LOC members and volunteers will greet you at the Museum entrance to provide directions. **Please try to arrive promptly at, or just before 19:00 so that you do not miss a welcome from the Lekwungen Traditional Dancers.**

Note that this is a somewhat unconventional and informal banquet in that very limited seating is available; multiple ‘grazing’ and beverage stations will be set up throughout the First Peoples Gallery and you are encouraged to wander around the 3rd floor exhibits while you enjoy some great food and beverages and the company of your colleagues. No speeches are planned! Red wine and a few selected fruit juices will not be served in

the museum because of the risk of stains in display areas. You should find your banquet ticket(s) - and a beverage ticket for each banquet ticket - in your registration kit (tucked into your name tag holder).

Attendees needing mobility assistance should contact the LOC to arrange help.

DAO CENTENNIAL EXHIBIT AT ROYAL BC MUSEUM

The Royal BC Museum, in partnership with the National Research Council of Canada, has a new exhibition: *The Dominion Astrophysical Observatory: The First 100 Years*. This bilingual exhibition, accessible for free on the Museum's ground floor, is in Clifford Carl Hall.

The exhibition explores how the site was chosen and how the DAO became a starlit must-see tourist stop! It features multiple panels with text and images, plus objects on loan from the DAO and the University of Victoria. One object is a one-tenth-scale model of the observatory, built to help the designers test all possible positions and motions of the highly-innovative design of the telescope and dome.

From the Royal BC Museum's own archival collection are a Prime Minister's letter of praise to the DAO's first director, John Stanley Plaskett, and medals given for his work in determining the size and rotation of our galaxy. These have not been seen by the public in over seventy years. From the museum's audio visual collection comes rare film from 1919 and television footage of Canada's contributions in the 1970s.

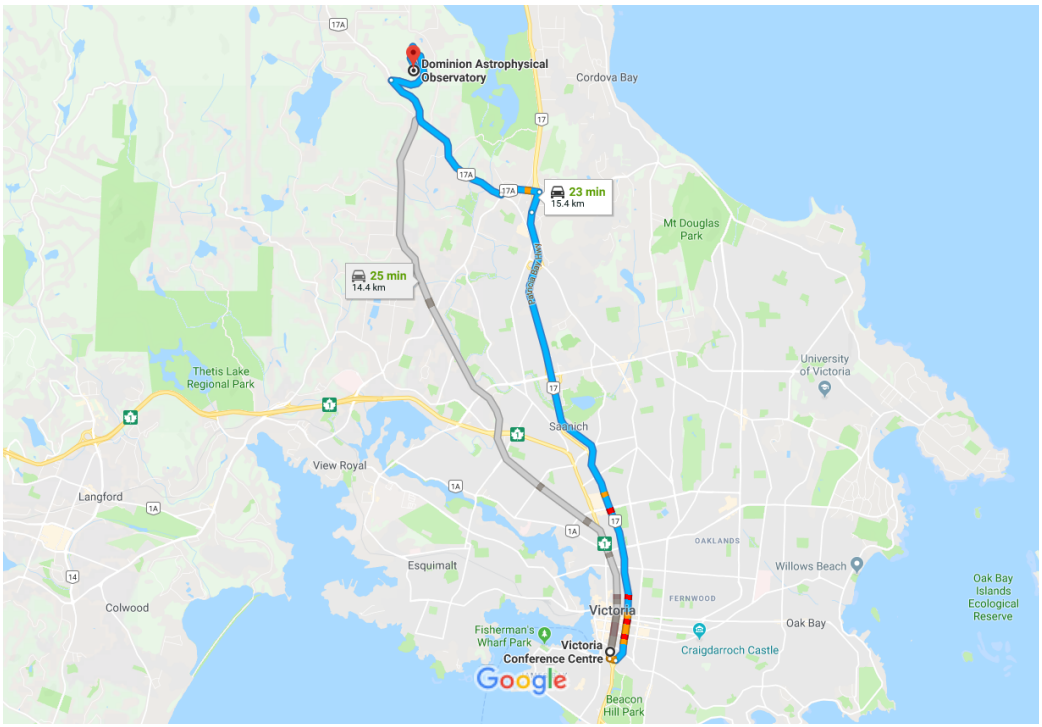
The Museum is preparing an educational tool based on the exhibit for use in schools. After September, 2018 the exhibit is available for display elsewhere in Canada for the cost of shipping; expressions of interest should be directed to Dennis Crabtree.

DAO CENTENNIAL CELEBRATION

A visit to the 100-year old Plaskett 1.8m Telescope and NRC's Centre of the Universe (CU) will take place on the evening of Friday, 25 May. Four buses will leave from near the Douglas Street entrance of the VCC at 19:30 and will leave the Observatory at 22:00, delivering attendees back to the VCC by about 22:30.

If you are using your own vehicle to travel to the Observatory you can find directions on the clickable map below. Note that there is limited parking at the Observatory and you may have to walk up hill from the parking lots near the main office building of NRC Herzberg.

We also ask drivers to abstain from using the cash bar that will be available at the CU. Please feel free to ride the bus even if you originally indicated that you would drive your own vehicle!



BAG CHECK

If you are in need of a safe place to store your bags please see an LOC member at the registration desk. We are able to use the Victoria Room as a secure storage area.

PARKING & TRANSIT

There are a number of parkades and surface parking lots in downtown Victoria. Street parking is also available but many of these do not permit parking for an extended period of time. There is a convenient ParkVictoria App that can be used for street parking. More parking information can be found on the City of Victoria Parking Web site. Note: there is

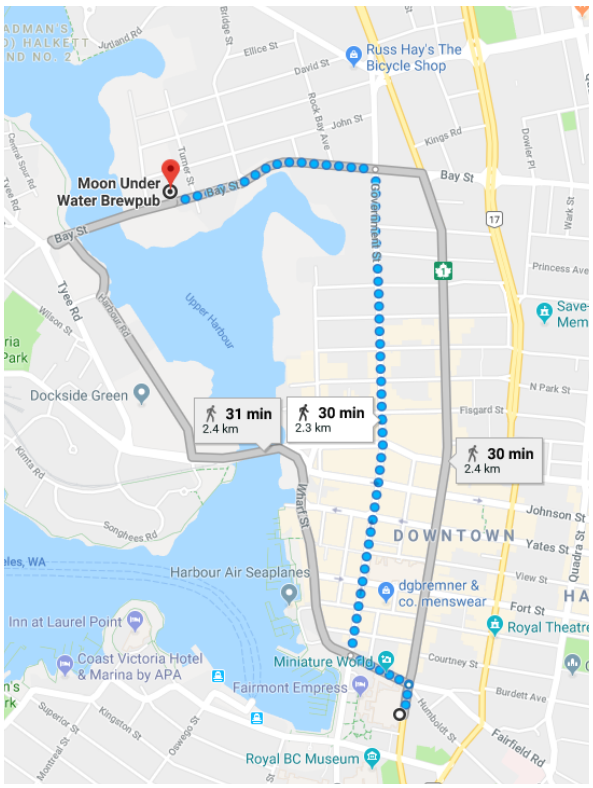
a parkade between the Victoria Conference Centre and the Fairmont Empress Hotel but this is one of the most expensive options available.

Cash fares on the Victoria Regional Transit System are $2.50. Day passes are available for $5.00.

PLASKETT'S BIG D.I.P.A.

During the conference you will have a few chances to sample the commemorative Plaskett's Big D.I.P.A. generously produced by the Moon Under Water Brewery & Pub. Our caterers for the VCC as well as for the conference banquet and DAO centennial celebration have purchased a small supply of 'bombers' to serve attendees. This Double IPA has a high 8% alcohol content so serving sizes will be 12oz (half a bomber). Since you all helped name this beverage you should give it a try it, in moderation! (If you are not a fan of India Pale Ale or its Big Brother, Double IPA, at least one dedicated LOC member will happily buy back any unused product from the caterers.)

In case you want to visit the pub we've included a clickable map below. Since only a modest supply of the beer was brewed it is not being distributed widely to local liquor stores but we're told some quantities will be available at (in order of increasing distance from the VCC) the Strathcona Hotel Liquor Store, Liquor Express on Yates, Hotel Rialto Vintage Spirits on Douglas, and the Harris Green Liquor Store on View Street.



BRIEF PROGRAM

CASCA 2018
A New Century for Canadian Astrophysics
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TUESDAY, MAY 22

09:00	12:00	Graduate Student Workshop	CASCA Board Meeting	JCSA Meeting	
12:00	12:30	CASCA Graduate Student Comm. AGM			
12:30	14:00	Lunch			
14:00	17:00	Graduate Student Workshop	CASCA Board Meeting	JCSA Meeting	CASTOR Meeting
17:00	19:00	Industry/Graduate Student Wine & Cheese Mixer			
19:00	21:00	Opening Reception			

WEDNESDAY, MAY 23

08:30	09:10	Welcoming Remarks	
09:10	10:20	Plenary Session 1: Broughton, Crabtree	
10:20	10:50	Poster, Demo, & Sponsor Interactions	
10:50	12:30	Centennial Session 1: Carlberg, Doyon, Fahlman, Ferrarese	
12:30	14:00	Town Hall Lunch	
14:00	14:45	Plenary Session 2: Dumas & Sanders (TMT)	
14:45	15:30	Parallel Science Sessions: Instruments Planets & Disks I	
15:30	16:00	Poster, Demo, & Sponsor Interactions	
16:00	16:45	Plaskett Medal Lecture: Gwendolyn Eadie	Elementary School Teachers Workshop
16:45	17:30	Dunlap Prize Lecture: Kipp Cannon	
17:30	18:30	Poster Session with Cash Bar	
20:00	21:00	Public Lecture: Bob McDonald (CBC's Quirks & Quarks)	

THURSDAY, MAY 24

08:30	10:10	Centennial Sess. 2: Robishaw, Kirk, Wilson, Dobbs	Secondary School Teachers Workshop
10:10	10:35	Poster, Demo, & Sponsor Interactions	
10:35	12:30	Parallel Science Sessions: Gravitational Waves & Compact Sources Planets & Disks II	Secondary School Teachers Workshop
12:30	14:00	Gemini Lunch	SKA Lunch
14:00	15:30	Parallel Science Sessions: CHIME Stars & Remnants	Secondary School Teachers Workshop
15:30	16:00	Poster, Demo, & Sponsor Interactions	
16:00	16:45	Beals Prize Lecture: Mark Halpern	Secondary School Teachers Workshop
16:00	16:45	Executive Award & Invited Talk: Greg Fahlman	
17:30	18:30	NCOA Session	Poster Session
19:00	22:00	Conference Banquet at the Royal BC Museum	

FRIDAY, MAY 25

09:00	09:50	Centennial Session 3: Hutchings, Simard	
09:50	10:20	Parallel Science Sessions: Radio Initiatives Stellar Halos	
10:20	10:45	Poster, Demo, & Sponsor Interactions	
10:45	12:30	Parallel Science Sessions: AGN / Facilities Cosmology	
12:30	14:00	CFHT Lunch	CITA Lunch
14:00	15:30	Parallel Science Sessions: Space Astronomy Galaxies	History Session
15:30	16:00	Poster, Demo, & Sponsor Interactions	
16:00	17:30	CASCA Business Meeting	
17:30	18:30	Poster Session with Cash Bar	
20:00	22:00	DAO Centennial Celebration (buses depart VCC at 19:30)	

SATURDAY, MAY 26

09:00	09:30	President's Message: Abraham	
09:30	10:15	Qilak Prize Lecture: Thacker	
10:15	10:45	EPO Plenary Talk: Elder Dr. Barney Williams	
10:45	11:15	Poster, Demo, & Sponsor Interactions	
11:15	12:45	Parallel Science Sessions: Theory & Astroinformatics Star Formation & Planetary Systems	EPO Session I
12:45	14:15	Meeting-Free Lunch	
14:15	15:30	Centennial Session 4: Pen, Schade, Steffen	EPO Session II
15:30	16:00	Poster, Demo, & Sponsor Interactions	
16:00	17:00	Closing Activities NSERC Presentation Award Presentations Closing Remarks	

DETAILED SCIENTIFIC PROGRAM

TUESDAY, MAY 22

		Graduate Student Workshop ***Location: Saanich Room*** ***Chair: Douglas Rennehan***	**CASCA BoD, JCSA, and CASTOR Meetings** ***Location: Various***
09:00	10:30	Matthew Taylor and André-Nicolas Chené (Gemini Observatory): Gemini Fast Turnaround Time	All day CASCA BoD meeting (West Coast Room) All day JCSA Meeting (Esquimalt Room) 13:00-17:00 CASTOR Meeting (Victoria Room)
10:30	11:00	Coffee Break	
11:00	12:00	Sébastien Fabbro (NRC Herzberg): Centralized Data Analysis	
12:00	12:30	Graduate Student Committee AGM	
12:30	14:00	Lunch	
14:00	16:00	Industry PechaKucha with Coffee	
16:00	17:00	Speed Networking	
17:00	19:00	Industry Wine & Cheese Mixer	

		Location: Prefunction
19:00	21:00	Opening Reception

WEDNESDAY, MAY 23

		Plenary Session 1 ***Location: Theatre*** ***Chairs: Kim Venn & Karun Thanjavur***
08:30	09:10	Opening Remarks Elder Victor Underwodd "Welcome to the Territory" Presentation of Asteroid (402920) Tsawout plaque to Tsawout First Nations Chief Harvey Underwood Jamie Cassels (President, University of Victoria) Greg Fahlman (Director General, NRC Herzberg)
09:10	09:45	Peter Broughton (Author): John Stanley Plaskett - Northern Star (invited)
09:45	10:20	Dennis Crabtree (NRC Herzberg): The Dynamics of the Milky Way and Other Highlights from the First 100 Years of the DAO (invited)

		Location: Prefunction and Oak Bay Room
10:20	10:50	Poster, Demo, and Sponsor Interactions

		Centennial Session 1: Optical and Infrared Astronomy ***Location: Theatre*** ***Chair: Harvey Richer***
10:50	11:15	Ray Carlberg (University of Toronto): The First University Astronomy: Contributions of the DDO and UTSO (invited)
11:15	11:40	René Doyon (Université de Montréal): The OMM and Domestic Telescopes as Innovation Testbeds (invited)
11:40	12:05	Greg Fahlman (NRC Herzberg): CFHT – Canadian Astronomy at the Top of the World (invited)
12:05	12:30	Laura Ferrarese (NRC Herzberg and Gemini Observatory): Gemini – Access to Both Hemispheres (invited)

		Location: Theatre
12:30	14:00	Town Hall Lunch

WEDNESDAY, MAY 23 (CONTINUED)

		Plenary Session 2 ***Location: Theatre*** ***Chair: Michael Balogh***
14:00	14:45	Christophe Dumas (TMT International Observatory LLC): The Thirty Meter Telescope: Science and Project Perspective (invited)

		Science Session 1: Instruments ***Location: Theatre*** ***Chair: Michael Balogh***	**Science Session 2: Planets & Disks I** ***Location: Saanich Room*** ***Chair: Christian Marois***
14:45	15:00	Suresh Sivanandam (University of Toronto): Gemini IRMOS – A scientific and technical pathfinder for AO-fed, multi-object imaging spectroscopy	Nienke van der Marel (NRC Herzberg Astronomy and Astrophysics): Planet formation with ALMA: zooming in on transition disks in the Lupus star forming region
15:00	15:15	René Doyon (Université de Montréal): The SPIRou Legacy Survey	Ruobing Dong (University of Victoria): New ALMA View of the Protoplanetary Disk MWC 758
15:15	15:30	Anne Boucher (Université de Montréal): Simulations of High Resolution Transit Spectroscopy with SPIRou	Yutong Shan (Harvard University): Towards a Galactic Distribution of Planets: Lessons from Spitzer Binary Lenses

		Location: Prefunction and Oak Bay Room
15:30	16:00	Poster, Demo, and Sponsor Interactions

		Plenary Session 3 ***Location: Theatre*** ***Chair: Roberto Abraham***
16:00	16:45	Plaskett Medal Lecture: Gwendolyn Eadie (University of Washington)
16:45	17:30	Dunlap Prize Lecture: Kipp Cannon (Research Center for the Early Universe, University of Tokyo)

		Location: Prefunction and Oak Bay Room
17:30	18:30	Poster, Demo, and Sponsor Interactions with Cash Bar

		Location: Theatre ***Emcee: Roberto Abraham***
20:00	21:00	Public Lecture: Bob McDonald (Host, Quirks & Quarks, CBC)

THURSDAY, MAY 24

		Centennial Session 2: Radio Astronomy ***Location: Theatre*** ***Chair: Brenda Matthews***
08:30	08:55	Tim Robishaw (Dominion Radio Astrophysical Observatory): DRAO and ARO – The Foundations of Canadian Radio Astronomy (invited)
08:55	09:20	Helen Kirk (Herzberg Astronomy & Astrophysics, NRC): The Move to Higher Frequencies – Contributions of the JCMT (invited)
09:20	09:45	Christine Wilson (McMaster University): ALMA – Canada in the First “World Observatory” (invited)
09:45	10:10	Matt Dobbs (McGill University): Innovative Technologies in Radio Astronomy (invited)

		Location: Prefunction and Oak Bay Room
10:10	10:35	Poster, Demo, and Sponsor Interactions

THURSDAY, MAY 24 (CONTINUED)

		Science Session 3: Gravitational Waves & Compact Sources *Location: Theatre* *Chair: Kipp Cannon*	Science Session 4: Planets & Disks II *Location: Saanich Room* *Chair: Jason Rowe*
10:35	11:05	Michael Landry (LIGO Hanford Observatory/Caltech): Observations of Gravitational Waves from Binary Coalescence (invited)	Sam Lawler (NRC Herzberg): The Architecture of Planetary Systems (invited)
11:05	11:20		Kevin Stevenson (Space Telescope Science Institute): Latest Results From The Ultimate Spitzer Phase Curve Survey
11:20	11:35	John Ruan (McGill University): Our Rapidly-Evolving Understanding of the Non-thermal Afterglow of Neutron Star Merger GW170817	Emily Deibert (University of Toronto): High-Resolution Ground-Based Transmission Spectroscopy of Warm Saturns
11:35	11:50	Daryl Haggard (McGill University): Recent Discoveries in the X-ray Time Domain: Long Term Evolution of GW170817	Steven Rogowski (Université de Montréal): Water detection, methane deficiency, and metallicity constraints for the atmosphere of the warm Saturn-mass exoplanet HAT-P-18b
11:50	12:05	Melania Nynka (McGill University): NICER monitoring of magnetar 4U 0142+61 during outburst	Colin Goldblatt (University of Victoria): The generalized runaway greenhouse: implications for understanding terrestrial planet atmospheres
12:05	12:20	Robert Main (Department of Astronomy and Astrophysics, University of Toronto): Pulsar emission amplified and resolved by plasma lensing in an eclipsing binary	Leslie Rogers (University of Chicago): Journey to the Centre of the Super Earth (invited)
12:20	12:30		

		Location: Theatre	*Location: Saanich Room*
12:30	14:00	Gemini Lunch Session	SKA Lunch Session

		Science Session 5: CHIME *Location: Theatre* *Chair: Matt Dobbs*	Science Session 6: Stars & Remnants *Location: Saanich Room* *Chair: Gregg Wade*
14:00	14:30	Richard Shaw (University of British Columbia): Probing Dark Energy with the Canadian Hydrogen Intensity Mapping Experiment (CHIME) (invited)	Nicole St. Louis (Université de Montréal): Using Sitelle to learn about the evolution of massive stars (invited)
14:30	14:45	Paul Scholz (DRAO/NRC): The repeating Fast Radio Burst and future prospects from CHIME/FRB	Megan E. Tannock (University of Western Ontario): Weather on Other Worlds: The Three Most Rapidly Rotating Ultra-Cool Dwarfs
14:45	15:00	Deborah C. Good (University of British Columbia): Creating and Calibrating CHIME/FRB, an FFT Beamforming Telescope	Chelsea Braun (University of Manitoba): A Chandra and XMM-Newton Imaging and Spectroscopic study of the Supernova Remnant RCW 103 (G332.4-0.4)
15:00	15:15	Mateus Fandino (University of British Columbia): Cross Correlating the CHIME Pathfinder 21 cm Data with SDSS Quasars	Charli Sakari (University of Washington): The R-Process Alliance: Newly Discovered r-Process Enhanced Metal-Poor Stars in the Milky Way Halo
15:15	15:30	Tristan Pinsonneault-Marotte (University of British Columbia): Cosmological Parameter Sensitivity Forecasts for CHIME	Yue Zhao (University of Alberta): Identification of Faint X-ray Sources in the Globular Cluster M3

		Location: Prefunction and Oak Bay Room
15:30	16:00	Poster, Demo, and Sponsor Interactions

THURSDAY, MAY 24 (CONTINUED)

		Plenary Session 4 ***Location: Theatre*** ***Chairs: Kim Venn & Roberto Abraham***
16:00	16:45	Beals Prize Lecture: Mark Halpern (University of British Columbia)
16:45	17:30	Executive Award & Invited Talk: Greg Fahlman (NRC Herzberg)

		NCOA Session ***Location: Theatre*** ***Chair: David Silva***	***Location: Prefunction and Oak Bay Room***
17:30	18:30	National Center for Optical-Infrared Astronomy Presentation and Discussion	Poster, Demo, and Sponsor Interactions

		Location: Royal British Columbia Museum
19:00	22:00	Conference Banquet with a Welcome from the Lekwungen Traditional Dancers

FRIDAY, MAY 25

		Centennial Session 3: Space Astronomy and Instrumentation ***Location: Theatre*** ***Chair: David Naylor***
09:00	09:25	John Hutchings (NRC-DAO): Canada's Place in Space Astronomy (invited)
09:25	09:50	Luc Simard (NRC Herzberg): Instrumentation as the Gateway to Great Science (invited)

		Science Session 7: Radio Initiatives ***Location: Theatre*** ***Chair: James Di Francesco***	**Science Session 8: Stellar Halos** ***Location: Saanich Room*** ***Chair: Alan McConnachie***
09:50	10:05	Bryan Gaensler (University of Toronto): CIRADA: The Canadian Initiative for Radio Astronomy Data Analysis	Guillaume Thomas (HAA): Tracing the stellar halo with BHBs
10:05	10:20	Jessica Dempsey (East Asia Observatory): Submillimeter All-Sky: wide-field instrument futures at JCMT and beyond	Vincent Henault-Brunet (NRC Herzberg): Revisiting the evidence for intermediate-mass black holes in globular clusters

		Location: Prefunction and Oak Bay Room
10:20	10:45	Poster, Demo, and Sponsor Interactions

		Science Session 9: AGN / Facilities ***Location: Theatre*** ***Chair: Sarah Gallagher***	**Science Session 10: Cosmology** ***Location: Saanich Room*** ***Chair: Douglas Scott***
10:45	11:15	Stéphanie Juneau (NOAO): The Influence of Giant Black Holes on the Fate of Galaxies (invited)	Renée Hložek (University of Toronto): Concordance Cosmology (and Canada!) (invited)
11:15	11:30	Pavan R. Hebbar (University of Alberta): X-ray spectra of proposed AGNs in bulgeless galaxies	Alexander van Engelen (CITA): Gravitational Lensing of the CMB
11:30	11:45	Trystyn Berg (University of Victoria): COS-AGN: Probing the circumgalactic medium of AGN hosts	Simon Foreman (CITA): Gravitational Lensing of Line Intensity Maps
11:45	12:00	Doug Simons (CFHT): CFHT - Current Status and Future Plans	Kiyoshi Masui (University of British Columbia): Deficit of clustering in hydrogen intensity maps cross-correlated with galaxies
12:00	12:15	Michitoshi Yoshida (Subaru Observatory): Update from Subaru	Elizabeth Loggia (University of British Columbia): Replacing dark matter with a slow force
12:15	12:30	Pat Hall (York University): Canada and the Maunakea Spectroscopic Explorer	Joanna Woo (University of Victoria): The Link Between Galaxy Quenching and Morphological Transformation

FRIDAY, MAY 25 (CONTINUED)

		Location: Theatre	***Location: Saanich Room***
12:30	14:00	CFHT Lunch Session	CITA Annual General Meeting

		Science Session 11: Space Astronomy ***Location: Theatre*** ***Chair: Jeremy Heyl***	**Science Session 12: Galaxies** ***Location: Saanich Room*** ***Chair: Sara Ellison***	**History Session** ***Location: Esquimalt Room*** ***Chair: Dennis Crabtree***
14:00	14:15	Patrick Côté (NRC Herzberg): CASTOR: A Flagship Canadian Space Telescope (invited)	Jan Cami (Western University): The ESO Diffuse Interstellar Band Large Exploration Survey: First Results	Virginia Trimble (U California Irvine & Queen Jadwiga Observatory): While Canada Built, Europe Burned: The Impact of WWI on Astronomy and relativity
14:15	14:30		Alessandro Boselli (Laboratoire d'Astrophysique de Marseille): VESTIGE: A Virgo Environmental Survey Tracing Ionised Gas Emission	
14:30	14:45	Els Peeters (Western University): The photochemical evolution of the PAH family and the JWST-ERS program on Photo-dissociation Regions (invited)	Jielai Zhang (University of Toronto): TEnormous low surface brightness stellar disk observed with the Dragonfly Telephoto Array	Alan H. Batten (NRC (Retired)): What did Astronomers know in 1918?
14:45	15:00		Deborah Lokhorst (University of Toronto/Dunlap Institute): Tracing the cosmic web with Dragonfly	Donald C. Morton (Herzberg Astronomy and Astrophysics): Carl Beals and P-Cygni Profiles
15:00	15:15	Antoine Darveau Bernier (Université de Montréal): Transit spectroscopy with the Near-Infrared Imager and Slitless Spectrograph (NIRISS) of the James Webb Space Telescope (JWST)	Matthew Taylor (Gemini Observatory): Neighbourhood Watch: A Survey of Baryonic Structures in the Nearby Universe	George Wallerstein (University of Washington): The Metallicity of Short Period Type II Cepheids
15:15	15:30	John Hutchings (NRC-DAO): Results from the Astrosat observatory	Ivana Damjanov (Saint Mary's University/Harvard-Smithsonian CfA): Constraints on the quiescent galaxy evolution from imaging and spectroscopy	

		Location: Prefunction and Oak Bay Room
15:30	16:00	Poster, Demo, and Sponsor Interactions

		Location: Theatre
16:00	17:30	CASCA Business Meeting

		Location: Prefunction and Oak Bay Room
17:30	18:30	Poster, Demo, and Sponsor Interactions with Cash Bar

		Location: Dominion Astrophysical Observatory, 5071 West Saanich Road, Victoria, BC
20:00	22:00	DAO Centennial Celebration (Buses depart the Victoria Conference Centre near the Douglas Street entrance at 19:30)

SATURDAY, MAY 26

		Plenary Session 5 ***Location: Theatre*** ***Chairs: Karun Thanjavur & Roberto Abraham***
09:00	09:30	Roberto Abraham (University of Toronto): President's Message (invited)
09:30	10:15	Qilak Prize Lecture: Rob Thacker (Saint Mary's University)
10:15	10:45	Elder Dr. Barney Williams (Tla-o-qui-aht First Nations): Education – The Key to Reconciliation (invited)

		Location: Prefunction and Oak Bay Room
10:45	11:15	Poster, Demo, and Sponsor Interactions

		Science Session 13: Theory & Astroinformatics ***Location: Theatre*** ***Chair: Karun Thanjavur***	**Science Session 14: Star Formation & Planetary Systems** ***Location: Saanich Room*** ***Chair: Helen Kirk***	**EPO Session I** ***Location: Esquimalt Room*** ***Chair: Jim Hesser***
11:15	11:30	Falk Herwig (University of Victoria): Large-scale simulations of stars and the challenges of the cyber world (invited)	Christian Marois (National Research Council of Canada): The Gemini Planet Imager Exoplanet Survey and the Future of GPI	Nick Claxton (University of Victoria): Education for Reconciliation in Canada (invited)
11:30	11:45		Wesley C. Fraser (Queen's University, Belfast): The Grand Smack	
11:45	12:00	Hilding Neilson (University of Toronto): Rotation, Evolution and Period Change in classical Cepheids	Michele Bannister (Queen's University Belfast): First arrival from afar: colours of the interstellar planetesimal 'Oumuamua	Jielai Zhang (University of Toronto): The West African International Summer School for Young Astronomers
12:00	12:15	Josef J. Rucska (McMaster University): Increased streaming instability growth rates from vertical dust settling	Laura Fissel (National Radio Astronomy Observatory): The Relationship Between Magnetic Fields and Molecular Cloud Structure: A BLASTPol Study of Vela C	Dennis Crabtree (NRC Herzberg): Operating an Interpretive Center as part of Federal Government
12:15	12:30	Pauline Barmby (Western University): Big data in (little) galaxies: what can astroinformatics do for you? (invited)	Soumen Deb (University of Alberta): A Case Study of Triggered Star Formation in Cygnus X	James E. Hesser (NRC Herzberg Astronomy and Astrophysics): Fostering Local Awareness and Outreach Through Partnering With Museums: The DAO Centennial Experience
12:30	12:45		Ayushi Singh (University of Toronto): Virial Stability of Molecular Clouds: Direct Estimation of Gravitational and Kinetic Energy from Observations	

		Lunch
12:45	14:15	Meeting-Free Lunch

SATURDAY, MAY 26 (CONTINUED)

		Centennial Session 4: Theory and Data ***Location: Theatre*** ***Chair: Jim Hesser***	**EPO Session II** ***Location: Saanich Room*** ***Chair: Julie Bolduc-Duval***
14:15	14:30	Ue-Li Pen (CITA): CITA: A Pillar of the Canadian Astronomical Community (invited)	Hilding Neilson (University of Toronto): Indigenist Astronomy: Reflections on developing and teaching an astronomy course centred around Indigenous Knowledges (14:15 - 14:30)
14:30	14:40		Terry Bridges (Dept of Physics & Astronomy, Okanagan College): Two-Stage Exams: Make your exams into a learning experience (14:30 - 14:45)
14:40	14:55	David Schade (NRC Herzberg): CADC: Data, Data, Data! (invited)	JJ Kavelaars (National Research Council of Canada): RECON: Studying the Outer Solar System through Citizen Science (14:45 - 15:00)
14:55	15:05		Mary Beth Laychak (Canada-France-Hawaii Telescope): CASCA Teacher Workshops: An International Collaboration (15:00 - 15:15)
15:05	15:30	Julie Steffen (American Astronomical Society): AAS Publishing, Then and Now (invited)	

		Location: Prefunction and Oak Bay Room
15:30	16:00	Poster, Demo, and Sponsor Interactions

		Closing Activities ***Location: Theatre*** ***Chair: Nicolas Cowan***
16:00	16:20	Alexandra Reid (NSERC): NSERC News and Discovery Grant Competition Results
16:20	16:40	CASCA 2018 Award Presentations
16:40	17:00	Closing Remarks

SUNDAY, MAY 27

		Location: Terrace Room, Marriott Hotel
19:00	22:00	ACURA Meeting

GRADUATE STUDENT WORKSHOP

The CASCA Graduate Student Workshop will take place on Tuesday, 22 May in the Saanich Room of the Victoria Conference Centre. This year, we have an exciting line-up of presentations and interactive workshops that focus both on science and industry.

Do you or a collaborator work on infrared or optical astronomy? Have you heard of the Fast Turnaround (FT) program? If the answer to the last question is “no” then this Gemini session is for you! The FT program allows researchers and graduate students apply for monthly, short, 20 hour sessions on both telescopes. This is perfect for graduate students exploring short, fun projects, and if the proposal falls through — resubmit next month with the improvements from the referee. Gemini will present on what makes a good FT proposal, and how the program benefits you as a graduate student in more way than one. The Gemini staff present at the CASCA meeting will be available all week to help you with your proposal!

If you want to follow along and fill a proposal on the spot, make sure to have PIT installed: http://software.gemini.edu/phase1/2018A/

Following a coffee break, we will have an hour long information and demonstration session on centralized data analysis. Topics will include machine learning, big data, and working in the cloud, bring your laptops to get a crash course on these!

Before lunch, we will have our annual graduate student committee (GSC) annual general meeting — come to meet the GSC committee, bring up issues you think the GSC should look into, and also to vote for role renewals and new positions on the GSC!

After lunch, prepare for an engaging afternoon with industry leaders from across the country. Thanks to the Astronomy Research Centre (ARC) from the University of Victoria, we will have PechaKucha style presentations from industry representatives on what a career outside of astronomy might look like for you. We will then organize into groups, and for the next hour the representatives will cycle through to answer questions directly to the small groups of graduate students.

The workshop will conclude with a wine and cheese mixer (sponsored by ARC and NSERC) preceding the CASCA welcoming reception, allowing graduate students more time to network with industry partners in a more informal, personal setting.

GRADUATE STUDENT'S WORKSHOP PRESENTERS

The invited graduate student workshop presenters are:

- **Sébastien Fabbro**, Canadian Astronomy Data Centre, NRC Herzberg
- **Matthew Taylor, André-Nicolas Chené**, Gemini Observatory
- **Kim Venn**, University of Victoria
- **Sarah Gallagher**, Western University
- **ABB** http://new.abb.com/
- **Dynamic Structures** http://www.dynamicstructures.com/
- **Honeywell** https://www.honeywell.com/worldwide/en-ca
- **INO** https://www.ino.ca/en/about-ino/
- **MDA** https://mdacorporation.com/
- **3vGeomatics** http://www.3vgeomatics.com/

INVITED SPEAKER

PUBLIC LECTURE

Wednesday, May 23, 8:00 PM, Theatre

Bob McDonald,
Host, Quirks & Quarks, CBC

What If Everything We Know Is Wrong?

To all of our five senses, the Earth is generally flat and unmoving. It took a lot of science to figure out that we are living on a colourful ball that is spinning like a top and falling through an unimaginably large universe. This illustrated presentation will look at how, throughout history, science has shown us how our perceptions were wrong and changed our view of ourselves and our place in the universe. This process continues today as we realize that the vast majority of the cosmos is still unknown.

Biography

The CASCA 2018 public lecture will be given by CBC's Bob McDonald (of 'Quirks & Quarks' fame). Bob McDonald is one of Canada's best known science journalists, bringing science to the public for more than 40 years. In addition to hosting Quirks & Quarks, the award-winning science program that is heard by 500,000 people each week, McDonald is also science correspondent for CBC TV's The National and host and writer of the children's series Head's Up.

PRIZE LECTURE

PLASKETT MEDAL LECTURE

Wednesday, May 23, 4:00 PM, Theatre

Gwendolyn Eadie,
University of Washington

Hierarchical Bayes and the Mass of the Milky Way

The Bayesian paradigm offers a statistical framework for scientific inquiry that is at the same time both strict and flexible. Bayesian methods are strict in the sense that they rely on the rules of probability and necessitate mathematical definitions of prior information, measurement models, and physical model assumptions. At the same time, Bayesian methods provide flexibility for dealing with incomplete or missing data, and allow the researcher to investigate the effects of different prior assumptions. Moreover, hierarchical Bayesian methods use probability distributions at the individual and at the population level, and allow the parameters of these distributions to be estimated simultaneously. In this talk, I will describe the hierarchical Bayesian method that I developed during my PhD to estimate the mass and cumulative mass profile of the Milky Way. The method uses the position and velocity measurements of individual tracer objects, such as globular clusters and halo stars, to constrain the total gravitational potential of the Galaxy. I will also present our most recent results from a suite of blind tests on simulated data from galaxies made in cosmological simulations. Finally, I will discuss the exciting prospects, and challenges, for the hierarchical Bayesian method in the context of Big Data from Gaia and LSST. This method will provide a concrete step forward not only in our understanding of the Milky Way's mass but also in how we approach estimating the masses of other dynamical systems.

Biography

Dr. Gwendolyn Eadie is the recipient of the J. S. Plaskett Medal for 2018. After obtaining a Bachelor of Science degree in Physics from Simon Fraser University, and a Masters degree in Astrophysics from Queen's University, Dr. Eadie completed her doctoral studies at McMaster University under the supervision of Dr. William Harris. In her thesis entitled "Lights in Dark Places: Inferring the Milky Way Mass Profile using Galactic Satellites and Hierarchical Bayes", she developed a high-level statistical method to derive the mass and mass distribution within astrophysical systems. Mass is a fundamental variable driving the evolution of galaxies like our Milky Way, but it is notoriously difficult to measure due to the fact that it is dominated by the dark matter extending well beyond the visible starlight. This challenge is compounded by incomplete data on the positions and velocities of "tracer particles" such as stars, star clusters and dwarf satellites scattered through the galaxy's halo. Dr. Eadie developed a powerful Bayesian formulation of the problem combined with Markov Chain Monte Carlo calculations of the relevant parameters in the problem and their probability distributions. Her formulation also included a hierarchical treatment of measurement uncertainties for each tracer. She used it to place a new constraint on the mass profile and total mass of the Milky Way, and it will be a very powerful tool in the exploitation of future very large datasets from the Gaia mission and the Large Synoptic Survey Telescope (LSST). Dr. Eadie is now a Moore-Sloan, Washington Research Foundation, and DIRAC Postdoctoral Fellow in the Department of Astronomy and the eScience Institute at the University of Washington in Seattle, WA.

CASCA congratulates Dr. Eadie on the receipt of the 2018 Plaskett medal for her groundbreaking work to shed light on the dark side of our Milky Way galaxy and other corners of the Universe.

PRIZE LECTURE

DUNLAP PRIZE LECTURE

Wednesday, May 23, 4:45 PM, Theatre

Kipp Cannon, Research Center for the Early Universe, University of Tokyo

The Unlikely Dawn of Joint Gravitational-Wave and Electromagnetic Astronomy

On August 17, 2017, the gravitational waves from a neutron star collision were observed for the first time, an event dubbed GW170817. Remarkably, and contrary to all reasonable expectations, this discovery was joined a few hours later by the identification of an optical transient consistent with the afterglow of a neutron star collision in NGC 4993. Since then, nearly every kind of astronomical instrument imaginable has been pointed at the source, in one of, if not the, most extensive study of a transient astronomical event. GW170817 very nearly went undiscovered. I will describe how we discovered it, and provide a small glimpse into the drama that unfolded around that world that night.

Biography

Dr. Kipp Cannon, Associate Professor of Physics at the University of Tokyo, is the recipient of the 2018 Dunlap Award for Innovation in Astronomical Research Tools. After receiving his PhD in 2003 from the University of Alberta, Dr. Cannon went to the University of Wisconsin-Milwaukee from 2004 to 2007 to pursue postdoctoral work. He was then a senior postdoctoral research with the LIGO Laboratory at the California Institute of Technology from 2007 to 2010 and a Senior Research Associate at the Canadian Institute for Theoretical Astrophysics (CITA) from 2010 to 2016. He is now an associate professor at the Research Center for the Early Universe on the Hongo campus of the University of Tokyo. Dr. Cannon has made key contributions to data analysis techniques in the search for transients in astronomy that led directly to the discovery of GW170817, the first gravitational wave detected from a neutron star collision, and ultimately to SSS17a, the first optical counterpart associated with a gravitational-wave source. In particular, his work on the development of the GSTCAL pipeline over more than seven years has enabled these transformational discoveries to be made from LIGO observations. Much of the work leading to these discoveries was conducted while Dr. Cannon was at CITA.

CASCA congratulates Dr. Cannon on the receipt of the 2018 Dunlap Award for opening a new and exciting window on the Universe through gravitational-wave astronomy.

PRIZE LECTURE

CARLYLE S. BEALS AWARD

Thursday, May 24, 4:00 PM, Theatre

Mark Halpern,
University of British Columbia

Progress and challenges in experimental cosmology

Measurement of the spectrum of the cosmic microwave background and of the anisotropy of its intensity and polarization with specialized instruments built for this purpose has been an extraordinarily productive research program. These data have played a major role in establishing the standard model of cosmology, a flat, Lambda-dominated universe, and have led to a reduction in the error volume allowed to the parameters of that model by five orders of magnitude. I will review the evidence leading us to our current understanding and describe the experimental challenges facing us moving forward. Chief among these are whether, with all this increased precision, the simple standard model is still a good fit to data and whether measurements, such as CHIME might provide, could guide us to understanding what dark energy is.

Biography

Dr. Mark Halpern is the recipient of the 2018 Carlyle S. Beals Award for his outstanding career contributions to the foundations of modern cosmology. Dr. Halpern is currently Professor in the Department of Physics and Astronomy at the University of British Columbia. He has made many fundamental contributions to cosmological instrumentation and data analysis, and his work has been essential for making the measurements underpinning the Standard Model of Cosmology that is now the accepted framework for our current understanding of the Universe. Over the course of his distinguished career, Dr. Halpern has been involved in a number of high-profile endeavours in the study of the Cosmic Microwave Background (CMB). He made the first measurement of the dipole moment of the CMB at submillimeter wavelengths in the 1980s, he developed prototype bolometers for the Cosmic Background Explorer (COBE) satellite experiment, and he was the only non-US member of the team that built the Wilkinson Microwave Anisotropy Probe (WMAP). The WMAP team won the Gruber Prize in Cosmology in 2012 for determining the Universe's vital statistics – age, geometry and origin. Dr. Halpern has been leading the Canadian Hydrogen Intensity Mapping Experiment (CHIME) which saw first light in Penticton, BC in September 2017. CHIME is set to make unprecedented measurements of Baryon Acoustic Oscillations in the distant Universe.

This portfolio of pioneering work in cosmology makes Dr. Halpern a most deserving recipient of CASCA's Beals Award.

PRIZE LECTURE

QILAK LECTURE

Saturday, May 26, 9:30 AM, Theatre

Rob Thacker,
Saint Mary's University

Imagination's gift

The outstanding visuals that astronomy research creates gives us a beautiful and powerful tool for outreach. Yet radio, the most "non-visual" mass medium, continues to attract a large and diverse audience of people that are looking for stories and news. For the listeners radio's visual vacuum isn't an issue, their imagination can step in – when necessary – and open up new outlets for curiosity. Over the past three years I've been a regular host or guest on four different radio shows and have been able to learn a lot about the way radio, and for that matter news reporting in general, works. I'll tell the story of how this dive into the local media really got started, and outline where I think opportunities are lurking. I'll also highlight some programming approaches that have been especially successful, notably in terms of making content more inclusive, as well as disclosing a few strategies that have been unsuccessful.

Biography

Dr. Robert Thacker of St. Mary's University is the recipient of the Qilak Award for Astronomy Communications, Public Education and Outreach for 2018. Dr. Thacker received his PhD in Physics from the University of Alberta in 1999. He is now Professor and Canada Research Chair at St. Mary's. Dr. Thacker is a passionate communicator of science and a tireless advocate for astronomy research in Canada. In addition to maintaining an internationally recognized research portfolio, he dedicates his time to science outreach through mass media, and as it relates to the public understanding of science. Since 2009 he has participated in a vast number of outreach activities including promoting science weekly to 30,000+ radio listeners in Halifax and across Canada, participation in media (including TV, radio) interviews and science programmes, authoring popular articles for magazines and websites, co-spearheading the renovation of the Burke-Gaffney Observatory, giving public lectures (including prize lectures) and school/student presentations, co-authoring an integrated science textbook for beginning science students and promoting inclusion and accessibility in STEM fields. He has become a well-known subject area expert in the Halifax media earning popular nicknames such as "Dr Rob of the Science Files" and the "Science Ship Pilot".

CASCA is delighted to recognize Dr. Thacker's tireless efforts for communicating astronomy in Atlantic Canada and beyond.

INVITED SPEAKER

PLENARY SESSION 1

Wednesday, May 23, 9:10 AM, Theatre

Peter Broughton, Author

John Stanley Plaskett - Northern Star

In his new job at the Dominion Observatory in Ottawa, and with no training or education in astronomy, J. S. Plaskett initiated professional astrophysics in Canada in 1905. By 1913 he had persuaded the Government of Canada to fund what would become the largest operating telescope in the world and four years later he became the founding director of the DAO. By the 1920s, Plaskett had helped to establish Canada as a nation of international scientific importance. After a brief survey of his life, we will consider his lasting legacy and some possible reasons for his success.

Biography

Peter Broughton received his BSc (specializing in astronomy) and his MSc in mathematics from the University of Toronto. He was a high-school teacher for thirty-three years but maintained his interest in astronomy though the RASC, which he served in nearly every office including President from 1992-94. He has written dozens of encyclopedia articles, book reviews and papers on the history of astronomy ranging from the Journal for the History of Astronomy to the Journal of Geophysical Research as well as two books – *Looking Up: a History of the RASC* and *Northern Star: J.S. Plaskett*, just published by the University of Toronto Press. His service and extensive writing on the history of astronomy led the International Astronomical Union to name a minor planet in his honour.

INVITED SPEAKER

PLENARY SESSION 1

Wednesday, May 23, 9:45 AM, Theatre

Dennis Crabtree, NRC Herzberg

The Dynamics of the Milky Way and Other Highlights from the First 100 Years of the DAO

The opening of the Dominion Astrophysical Observatory (DAO), and it's Plaskett telescope, in 1918 launched Canada onto the world stage of astrophysics. In its 100 years, the DAO, now part of Herzberg Astronomy and Astrophysics, has had many remarkable achievements, both scientific and technical. I will cover the highlights of the 100 years of Canada's first world-class observatory and the indelible mark they have left on Canadian astrophysics.

Biography

Dennis R. Crabtree is Director of the Optical Astronomy Directorate at Herzberg Astronomy and Astrophysics Research Centre. He started at Herzberg in 1986 as the first external hire for the CADC. During his time with Herzberg, he has had the opportunity to work at the CFHT (1996-1999) and Gemini (2007-2010). He is well known for his tracking of observatory bibliometrics and is interested in research metrics in general.

INVITED SPEAKER

CENTENNIAL SESSION 1

Wednesday, May 23, 10:50 AM, Theatre

Ray Carlberg,
University of Toronto

The First University Astronomy: Contributions of the DDO and UTSO

Biography

Raymond Carlberg's main interests are observational cosmology, and telescope design and construction. He was the principal investigator of the Canadian Network for Observational Cosmology cluster and field galaxy surveys and helped lead the Canada-France-Hawaii Telescope Legacy Survey (CFHTLS). A component of the CFHTLS, The Supernova Legacy Survey, made the first accurate measurement of the dark energy equation of state parameter. Carlberg was the PI of awards from NSERC and CFI which enabled Canadians participation in the development of Extremely Large Telescope designs and partnership within the Thirty Meter Telescope project. Carlberg is a member of the Canada-France Imaging Survey and the Euclid Consortium, currently serving as the Euclid Consortium Board member. He is also a member of the Dark Energy Spectroscopic Instrument (DESI) consortium. He currently is Chair of Department of Astronomy and Astrophysics at the University of Toronto.

INVITED SPEAKER

CENTENNIAL SESSION 1

Wednesday, May 23, 11:15 AM, Theatre

René Doyon,
Université de Montréal

The OMM and Domestic Telescopes as Innovation Testbeds

The Observatoire du Mont-Mégantic celebrates its 40e anniversary in 2018. OMM exemplifies the importance of domestic facilities for training and testbed development. Over the years, OMM developed itself as one of the major university-based centers of experimental astrophysics in Canada, enabling and contributing major state-of-the art optical and infrared astronomical instruments for small and large telescopes, including the James Webb Space Telescope. This talk will present an historical overview of OMM, its achievements, ongoing activities and future directions. I will also briefly present other examples of domestic facilities as success stories of Canadian experimental astrophysics.

Biography

René Doyon is a professor at the physics department of the Université de Montréal, Director of the Mont-Mégantic Observatory and the Institute for Research on Exoplanets. His research activities focus on the search and study of exoplanets, young stars and the development of infrared astronomical instrumentation. He is principal investigator of FGS/NIRISS the Canadian-built instrument onboard the James Webb Space Telescope, co-investigator of the Gemini Planet Imager and co-PI of SPIRou and NIRPS, two instruments optimized for the detection of Earth-like planets around nearby low-mass stars.

INVITED SPEAKER

CENTENNIAL SESSION 1

Wednesday, May 23, 11:40 AM, Theatre

Greg Fahlman,
NRC Herzberg

CFHT - Canadian Astronomy a the Top of the World

Canada entered the Tri-Partite Canada-France-Hawaii Telescope in 1974 and so began a new chapter in the history of astronomy in Canada, a story that continues to unfold today. The defining physical characteristic of the CFHT is its site atop Maunakea; occupying what is arguably the single best location on Earth to conduct optical-infrared observations of the sky. Today, after 38 years of scientific operations, CFHT remains a key landmark on Canada's astronomical landscape. An overview of the factors that have contributed to the success of CFHT will be discussed within a context that highlights the impact this telescope has had on the development of Astronomy in Canada.

Biography

Dr. Greg Fahlman, of NRC Herzberg, is the recipient of the 2018 CASCA Executive Award. In alternate years, the CASCA Board has the honour to bestow the Executive Award for Outstanding Service "to an individual who has made sustained contributions in service that have strengthened the Canadian astronomical community and enhanced its impact regionally, nationally and/or internationally."

Among his numerous accomplishments in research and service, Dr. Fahlman is arguably most well known as the leader of the National Research Council Herzberg, Astronomy and Astrophysics Research Centre. During his time in this capacity, which is now 15 years, he has both developed and bolstered what is Canada's *defacto* national laboratory for astronomy. His leadership has contributed both to the development of Canadian astronomy while also helping establish and strengthen our international partnerships. At the same time, his vision and execution have been immensely important to not only the day-to-day operations of our field, but also to its detailed planning process, as facilitated through the 'Long Range Plan' for Canadian astronomy. His commitment to ensuring strong ties between NRC Herzberg and the university research community has provided a platform for the entire field in support of the execution of the two LRPs.

Prior to taking on the leadership of NRC Herzberg, Dr Fahlman was the Executive Director of the Canada-France-Hawaii Telescope (CFHT) and during this time CFHT laid the foundations for some of its most widely cited research to-date. He also continues on in advising capacity for CFHT as a Board Member, leveraging both his operational knowledge of the NRC as well as providing advice to help CFHT further build its international connections as it prepares to evolve towards a new facility. His vast experience of facility operation and development played a pivotal role in Canada moving forward with the Thirty Meter Telescope (TMT) as well as the Square Kilometer Array, both projects singled out as top priorities in LRP2010. With Canadian researchers having been central to the development of the TMT project shortly after the development of the first Long Range Plan (LRP2000), Dr Fahlman's contributions at the administrative level helped chart the path forward to eventual funding in 2015. As the TMT project moves forward Dr Fahlman continues to play a pivotal role on the Board of the TMT Observatory, while at the same time representing Canada's interest in the SKA on its Board of Directors.

A graduate of the University of Toronto in 1970, Dr Fahlman began his faculty career at the University of British Columbia in 1971. His work would cover many different fields in astronomy, from magnetic fields in stars through to stellar clusters. To date, he has authored or co-authored more than 200 papers that have been cited more than 5,600 times by researchers worldwide and most recently is known for his research on the Milky Way's star clusters, both young and old. For almost five decades, Dr. Fahlman has been a driving force and steadfast supporter of astronomy both in Canada and beyond. In bestowing the Executive award the CASCA Board both applauds and recognizes Dr. Fahlman's exceptional accomplishments and contributions.

INVITED SPEAKER

CENTENNIAL SESSION 1

Wednesday, May 23, 12:05 PM, Theatre

Laura Ferrarese,
NRC Herzberg and Gemini Observatory

Gemini - Access to Both Hemispheres

INVITED SPEAKER

PLENARY SESSION 2

Wednesday, May 23, 2:00 PM, Theatre

Christophe Dumas,
TMT International Observatory LLC

The Thirty-Meter-Telescope: Science and Project Perspective

The Thirty Meter Telescope (TMT) will make transformational discoveries across all areas of astronomy and astrophysics. It will be the largest ground based optical telescope in operation in the Northern Hemisphere and, with a collecting area 9 times larger than today's largest optical/infrared facilities, and nearly 5 times better angular resolution than the James Webb Space Telescope at similar infrared wavelengths, TMT will open new spaces of scientific investigations, from the UV to the mid-IR regime. TMT will be equipped with an adaptive optics facility at first-light, delivering diffraction-limited capabilities for up to three of its eight science instruments. The first-light instruments will provide imaging and medium-resolution spectroscopy at visible and near-infrared wavelengths, and the TMT science community is now fully engaged in the definition of its next-generation instrumentation (e.g. multi-object/high-resolution spectroscopy, mid-infrared and high-contrast spectro-imaging). In this talk we will present the many scientific opportunities that TMT will enable, and describe how the operations of this large-scale facility will support many types of science programs. An overview of the construction of the TMT will also be provided, with all of TMT critical systems being either at an advanced phase of design, or having started construction. TMT is expected to start on-site construction in the 2019 time frame, either at Maunakea, Hawaii (main option), or La Palma, Spain (alternate site), and wherever it is built, TMT will produce amazing science opportunities for decades to come. The international TMT partnership includes Canada, China, India, Japan, Caltech, the University of California, and funding is also provided by the Gordon and Betty Moore Foundation. AURA is an Associate Member of TMT on behalf of the US national community. Through a cooperative agreement with the NSF, TMT and a US TMT Science Working Group are developing a model for potential US national partnership in the TMT.

Biography

Dr. Christophe Dumas joined the Thirty-Meter-Telescope in July 2015, as TMT Observatory Scientist and Head of Operations. Previously, he was in charge of the science operations of the European Southern Observatory Very Large Telescope, in the Atacama desert of Northern Chile. Although Dumas has been working in the USA and Chile for the past 25 years, his education background comes from France, where he earned a degree in engineering from Supelec and a PhD in Astrophysics from the University Denis Diderot in Paris. His science interest is focused on studying the physical/chemical characteristics of small primitive solar system bodies, and how they can inform us on the formation of planetary systems at large. To this end, he mainly uses ground-based infrared spectrophotometry techniques in coordination with high-angular resolution and high-contrast adaptive optics instrumentation.

INVITED SPEAKER

PLENARY SESSION 2

Wednesday, May 23, 2:00 PM, Theatre

Gary Sanders,
TMT International Observatory LLC

The Thirty-Meter-Telescope: Science and Project Perspective

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Biography

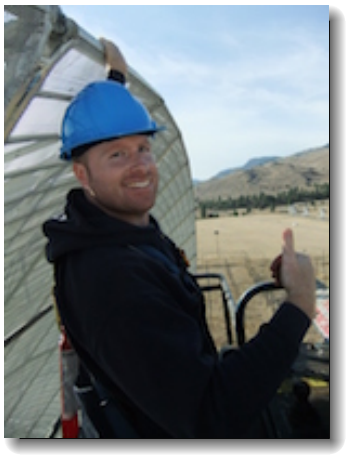
Dr. Gary Sanders spent 25 years performing high-energy physics experiments at laboratories in the United States and Europe. He earned an AB degree in physics from Columbia University and a PhD in high-energy physics from the Massachusetts Institute of Technology. He has been a faculty member in physics at Princeton University and a scientist at Los Alamos National Laboratory.

In 1994, Gary came to Caltech to serve as the Project Manager and Deputy Director for the Laser Interferometer Gravitational Wave Observatory (LIGO) project. Gary joined TMT as its Project Manager in 2004. He is the author or a co-author of more than 200 peer-reviewed publications and he has been elected a Fellow of the American Physical Society.

INVITED SPEAKER

CENTENNIAL SESSION 2

Thursday, May 24, 8:30 AM, Theatre



Tim Robishaw, Dominion Radio Astrophysical Observatory

DRAO and ARO – The Foundations of Canadian Radio Astronomy

In June 1960, the Dominion Radio Astrophysical Observatory (DRAO) was established by the Dominion Observatories branch of Canada's Department of Mines and Technical Surveys. The Algonquin Radio Observatory (ARO) was built by the National Research Council of Canada and also opened in 1960, initially focused on radio studies of the Sun and eventually training their sights further afoot after constructing a 150-foot dish in 1966. We will trace Canada's motivations for pursuing radio astronomy and briefly describe the birth of these two observatories (including newly uncovered colour photographs documenting their construction). An overview of the scientific and technical successes achieved at each observatory will be provided, including the combined April 1967 effort by DRAO and ARO to conduct the first successful astronomical observation using the technique of Very Long Baseline Interferometry. Finally, we will argue that DRAO and ARO provided the foundations for Canada's current scientific and technical involvement in the next generation of radio astronomical observatories.

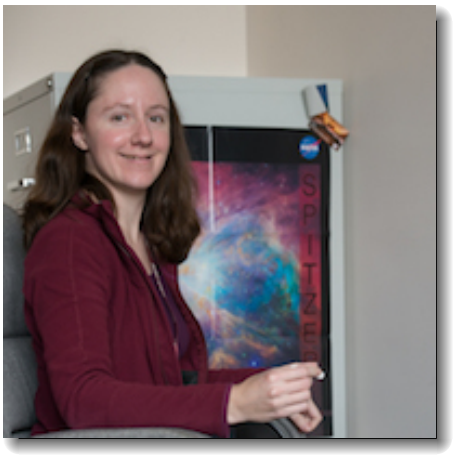
Biography

Dr. Tim Robishaw is an astronomer at the Dominion Radio Astrophysical Observatory. His research interests include the history of radio astronomy, the study of microwave lasers in galaxies far, far away, and measuring the magnetic field in the Milky Way's interstellar medium.

INVITED SPEAKER

CENTENNIAL SESSION 2

Thursday, May 24, 8:55 AM, Theatre



Helen Kirk,
Herzberg Astronomy & Astrophysics, NRC

The Move to Higher Frequencies – Contributions of the JCMT

Built in the mid 1980's atop MaunaKea in Hawaii, to this day, the James Clerk Maxwell Telescope remains the world's largest operating submillimetre single dish telescope. The JCMT continues to revolutionize our understanding of the universe, with insights in topics ranging from comets in our solar system to star-forming galaxies in the early universe. In this talk, I will highlight some of the science and engineering successes that Canada has achieved with the JCMT, and how these have placed us in an excellent position for future endeavours.

Biography

Dr. Helen Kirk is a Research Officer at NRC's Herzberg Astronomy and Astrophysics Research Centre. She completed her PhD at the University of Victoria, and then held an NSERC Postdoctoral Fellowship at the Harvard Smithsonian Center for Astrophysics and a Banting Postdoctoral Fellowship at McMaster University before moving to NRC in 2013 to provide data reduction support for the JCMT's Gould Belt Legacy Survey. Helen's research focuses on the formation of stars, and she is presently working with the Millimetre Astronomy group at NRC to help Canadian astronomers more easily use ALMA data in their research.

INVITED SPEAKER

CENTENNIAL SESSION 2

Thursday, May 24, 9:20 AM, Theatre

Christine Wilson, McMaster University

ALMA – Canada in the First "World Observatory"

ALMA, the Atacama Large Millimeter/submillimeter Array, is a powerful, high-frequency radio telescope that is providing stunning new results from our own solar system to the high redshift universe. ALMA is also a major international collaboration involving astronomers from countries around the world. I will highlight recent scientific results from ALMA, including by astronomers working in Canada. I will also give an overview of key steps and milestones in Canada's involvement in the design, construction, and operation of ALMA.

Biography

Christine Wilson is a Distinguished University Professor at McMaster University. She served as the Canadian ALMA Project Scientist for 15 years and is currently the Past President of CASCA. Her research focuses on the interplay between molecular gas and star formation in nearby galaxies using a variety of millimetre and far-infrared telescopes.

INVITED SPEAKER

CENTENNIAL SESSION 2

Thursday, May 24, 9:45 AM, Theatre

Matt Dobbs,
McGill University

Innovative Technologies in Radio Astronomy

Innovative technologies have driven advances in radio astronomy since its early beginnings. Canada's footprint in this development has been significant. I will discuss these advances with a Canadian perspective, from the first VLBI fringes to the recent completion of the CHIME telescope, then look towards to future.

Biography

Matt Dobbs' research aims to improve our fundamental understanding of the universe, including its origin, history and fate. He is particularly interested in the early universe, where the laws of particle physics and cosmology intersect. His research group builds novel instrumentation and experiments to explore the early universe with millimeter wavelength observations of the Cosmic Microwave Background (CMB) radiation and radio observations of 21cm hydrogen emission.

INVITED SPEAKER

PLENARY SESSION 4

Thursday, May 24, 4:00 PM, Theatre

Greg Fahlman,
NRC Herzberg

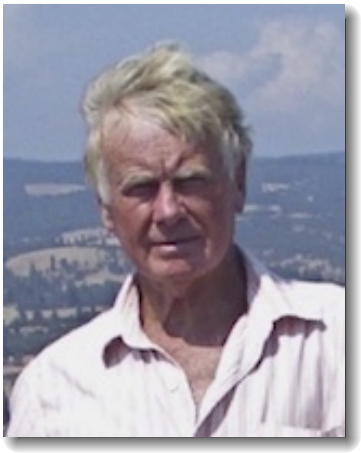
Canadian Astronomy – A Look Back to the Future

How can we know the future? Astronomy is an ancient science deeply rooted in the mystery of human existence. Over the past 100 years or so, it has advanced remarkably through its partner, astrophysics, which has provided both the means to interpret our observations and to frame our questions in a way that guides us toward a deeper understanding of the natural world. Progress in our science is enabled by technological advances and it is driven by the science questions popping forth from the past advances in knowledge and new discovery. The technology we employ is rarely inexpensive and the big questions often require big investments and global partnerships to even begin on an answer. Consequently, the future can seem slow to arrive! As we approach the end of this decade and begin the foresight exercise of how to shape our place within the future of our science, I will look back at our work in Canada to define the future for our community within a forward look at national and global trends.

INVITED SPEAKER

CENTENNIAL SESSION 3

Friday, May 25, 9:00 AM, Theatre



John Hutchings,
NRC-DAO

Canada's Place in Space Astronomy

I will review the Canadian history, achievements, problems, and future plans in space astronomy, since it began in the 1960s.

Biography

John Hutchings has been at the DAO for more than half its 100 years. During that time he pursued research projects on the Plaskett telescope, and became involved in many facilities that followed, ranging from CFHT to the VLA. Space astronomy also developed in this timeframe, from the first OAO, through the HST, Einstein, and the upcoming JWST. He has been involved in developing and using these facilities, and continues today working for the next generation of Canadian telescopes, as envisioned in the Long Range Plan for astronomy. His research interests have included massive stars, X-ray binaries, the ISM, QSOs, and merging galaxies.

INVITED SPEAKER

CENTENNIAL SESSION 3

Friday, May 25, 9:25 AM, Theatre

Luc Simard,
NRC Herzberg

Instrumentation as the Gateway to Great Science

Instrumentation opens up new regions of discovery space and creates a gateway to great science. It is not a linear process, and the interplay between science and instrumentation can in fact take on different forms. I will use a few examples to illustrate how the Canadian astronomical community has been able to take advantage of this interplay with great success. If examples from the past are any indication, the future looks bright!

Biography

Luc Simard is an astronomer at the National Research Council of Canada. He obtained his B.Sc. from Queen's University in 1990 and his Ph.D. from the University of Victoria in 1996. From 1996 to 2002, he held postdoctoral fellowships at the University of California - Santa Cruz and the University of Arizona. His research interests include galaxy formation and evolution, image processing and astronomical instrumentation. He has worked on developing instruments for the Thirty Meter Telescope for twelve years. He is now Director of Astronomy Technology at NRC-Herzberg.

INVITED SPEAKER

PLENARY SESSION 5

Saturday, May 26, 9:00 AM, Theatre

Roberto Abraham, University of Toronto

President's Message

In this talk I'll describe the most important things I've learned as CASCA President. I'll provide some thoughts on the strengths we have, and on the challenges we face, as a community. I'll also try to sketch out a model for using the former to tackle the latter.

Biography

Roberto (Bob) Abraham is a Professor in the Department of Astronomy and Astrophysics at the University of Toronto. He obtained his BSc from UBC and his doctorate from Oxford. His work is focused on observations of galaxy formation and evolution and the development of innovative instruments. He has been awarded the Canadian Astronomical Society's P. G. Martin Award, a Canada Foundation for Innovation Career Award, an NSERC Steacie Fellowship, a Premier's Research Excellence Award, a Canada Council Killam Fellowship, and the University of Toronto Outstanding Teaching Award. He is a Fellow of the Royal Society of Canada and is President of the Canadian Astronomical Society. He has served on the Board of Directors of major international observatories and has advised NASA by serving as panel chair on the Hubble Space Telescope time allocation committee three times, and by serving as Canada's representative on the James Webb Space Telescope Advisory Committee. Being keen on outreach, he has served as Honorary President of the Toronto Centre of the Royal Astronomical Society of Canada for many years.

Prof. Abraham's proudest moment is winning second prize in the Vancouver All-City Elementary School Grade 6 spelling bee, where he lost out for not knowing how to spell the word "satellite", leading eventually to learning how to spell the word "ironic".

INVITED SPEAKER

PLENARY SESSION 5

Saturday, May 26, 10:15 AM, Theatre

Elder Dr. Barney Williams, Tla-o-qui-aht First Nations

Education – the Key to Reconciliation

Biography

Dr Barney Williams is Nuu-chah-nulth and a member of the Tla-o-qui-aht First Nations situated in the Tofino area of Meares Island. He is the husband to Trina Williams and a father to six children and grandfather to nine grandchildren and one great-grandson.

Dr Williams served as Traditional Keeper of the Beach for his nation for over 60 years. In April 2015 this position was passed down to his son Vincent Williams.

Fluent in the Nuu-chah-nulth language, he continues to live a traditional and cultural lifestyle, and incorporate traditional teaching in the healing of First Nations people, lecturing on mental health from a traditional perspective.

His work has included administrative and clinical fields. Some of his experience includes serving as an Executive Director, Social Service Administrator in varied fields, including Mental health, Home School, Alcohol/drug Programming, and Education. His counselling work has focused on areas such as youth, mental health, community prevention specialist, crisis intervention and addictions.

One of his finest achievements was to be involved in the development of a two year Quasa Counselling Program at Malispina University College. Using his vast experience, he has worked with pre- and post-trauma issues related to the Residential School experience. Throughout his work history, Dr Williams has often acted as a bridge between two cultures to ensure that mutual understanding is achieved for First Nations and European people.

From 2008 to 2015, Dr Williams served as committee member for the Truth and Reconciliation Commission and provided cultural and spiritual advice to the commissioners. Dr Williams mentions that this experience enhanced his belief in the importance of cultural healing following the residential experience and the importance of education to future generations stemming from this dark period.

As an apt recognition for all these contributions, Dr Williams was honoured in November of 2017 by the University of Victoria to receive an Honorary Doctorate in Laws.

INVITED SPEAKER

CENTENNIAL SESSION 4

Saturday, May 26, 2:15 PM, Theatre

Ue-Li Pen,
CITA

CITA: A Pillar of the Canadian Astronomical Community

I will review the history of CITA, and potential scenarios for the future. Synergy with the Canadian and global community have been the hallmark, with adaptive catalytic roles in HPC, new funding, HQP and beyond.

Biography

Dr. Pen's area of research is theoretical astrophysics. He studies systems where basic physical effects can be isolated from astronomical complexities. Current projects include the non-linear dynamics of the cosmic neutrino background, 21cm intensity mapping, pulsar VLBI scintillometry, and Canadian Hydrogen Intensity Mapping Experiment CHIME.

INVITED SPEAKER

CENTENNIAL SESSION 4

Saturday, May 26, 2:40 PM, Theatre

David Schade,
NRC Herzberg

The Canadian Astronomy Data Centre at age 32

Many factors influence whether an endeavour succeeds or fails. Factors affecting the performance of data-centric science groups like CADC include staffing (mix of skillsets, team structures), facilities (storage, computing, networks, IT support), management (strategic and tactical decision making, execution of plans), and funding (ongoing budgets and new opportunities). An over-riding consideration is mission integrity (in the sense of wholeness or being undivided). If a mission is well-defined and worthwhile then a high degree of mission integrity is centrally important for success. This means that all the critical factors named above are sufficiently under the control of those directing the endeavour. For example, in the case of CADC a central tenet is that decisions and choices are driven by science. I'll discuss how CADC has benefited from mission integrity and how the present and future may present new challenges.

Biography

David Schade developed an interest in astronomy at the age of 25 stimulated by his mother's acquisition of a telescope upon her retirement. He began observing as an amateur during long, frigid winter nights in the Canadian Rockies. Eventually the desire to understand more about the universe became overwhelming and he abandoned his lucrative career as a barroom blues guitarist to begin university a decade after leaving high school. (It is not true—as Luc Simard frequently repeats—that Dr. Schade is the only scientist he knows who went into astronomy for the money.) David obtained his doctorate in 1990 from the University of Victoria and moved with his wife and children to England to work at Cambridge University on the Hubble Space Telescope (HST) Medium Deep Survey project. He moved to the University of Toronto in 1993 and to Herzberg Victoria in 1996 driven largely by the exciting science produced by HST. Dr. Schade was the Group Leader of the Canadian Astronomy Data Centre from 2002 until 2017 and oversaw vast growth in the scales of data generated by observational facilities. As he nears retirement age he is looking forward to returning to his roots as a barroom blues guitarist.

INVITED SPEAKER

CENTENNIAL SESSION 4

Saturday, May 26, 3:05 PM, Theatre

Julie Steffen,
American Astronomical Society

AAS Publishing, Then and Now

The American Astronomical Society owns and manages two flagship journals in the field, The Astrophysical Journal and The Astronomical Journal. This is arguably one of its most important functions. How are we faring? I will shed some light on the larger world of scholarly publishing and where the AAS' publishing efforts fit in, as well as give an update on current and new initiatives to keep these journals viable for the long term.

Biography

Julie Steffen has been Director of Publishing for the American Astronomical Society since 2014. She spent 25 years at the University of Chicago, where she served many years as Director of Astronomy Publications at the University of Chicago Press. Since working on the team that started the electronic edition of the Astrophysical Journal Letters in 1995, Julie has enjoyed the many challenges of publishing the global astronomy community's research output, from implementing the first LaTex to XML workflows to maintaining a community run, non-profit publishing program in today's increasingly commercial environment. As well as leading AAS Publishing innovation efforts, she is co-PI of an Arthur P. Sloan Foundation funded effort to improve discovery and citation of astronomical software and an NSF funded long tail data repository at the University of Arizona. Julie is based in Tucson, Arizona at the NOAO.

INVITED SPEAKER

GRAVITATIONAL WAVES & COMPACT SOURCES

Thursday, May 24, 10:35 AM, Theatre

Michael Landry,
LIGO Hanford Observatory/Caltech

Observations of Gravitational Waves from Binary Coalescence

On 14 Sep 2015, after roughly 50 years of searching by groups around the world, gravitational waves from the coalescence of binary black holes (BBH) were directly detected by LIGO interferometers. This and a handful of additional events revealed a family of previously undiscovered heavy BBHs. More recently on 17 Aug 2017, the LIGO and Virgo detectors witnessed a binary neutron star coalescence, an event that was also seen in gamma rays, UV/optical/IR light, x-ray and radio waves. The resultant fireball has been identified as a kilonova, objects quite possibly responsible for the production of most heavy-elements in the universe. Gravitational wave astronomy has begun. These detections have tested and validated Einstein's Relativity, served to measure the speed of gravity, and made a completely independent measurement of the expansion of the universe from that made with light. In this talk we briefly describe sources of gravitational waves and the instruments intended to detect them. We will detail the LIGO and Virgo binary coalescence detections to date, and conclude with a brief look at the future of the field and of the detectors that will be state of the art in the upcoming decades.

Biography

Michael Landry is the Head of LIGO Hanford Observatory (LHO), and a physicist with the California Institute of Technology (Caltech). Michael completed his Ph.D. at the University of Manitoba in strange quark physics (Brookhaven/TRIUMF) in 2000, after which he joined LIGO as a postdoctoral scholar with Caltech. Michael has worked on a number of diverse aspects of searches for gravitational waves from astrophysical sources, including LIGO interferometer calibration and commissioning, data analyses for spinning neutron stars, and the leading of the installation of Advanced LIGO at LHO 2010-2014. He was Detection Lead Scientist at the time of LIGO and Virgo's first gravitational wave discoveries of binary black hole mergers in late 2015. In the fall of 2016 he became Observatory Head. He is a Fellow of the American Physical Society.

INVITED SPEAKER

PLANETS & DISKS II

Thursday, May 24, 10:35 AM, Saanich

Sam Lawler,
NRC Herzberg

The Architecture of Planetary Systems

Our Solar System is one of thousands of planetary systems that are now known. Is our Solar System typical, or unusual? Recent large surveys of the Kuiper belt can be carefully debiased, allowing us to study the true orbital structure in detail. We can use this to robustly test dynamical models of how the giant planets migrated to their current architecture early in the Solar System's history, as well as probe the outer reaches of the Solar System for possible undiscovered massive planets. We can learn about planetesimal belts (analogous to the Kuiper belt) around other mature stars by studying debris disks, which are collisionally-generated dust belts easily observed in the infrared and submillimeter. Resolved structures in individual debris disks can reveal the presence of planets that are currently undetectable by any other technique, and the properties of debris disks may place constraints on planetary migration. Currently, planetary systems with inner planets have unexplored outer reaches, and systems with distant planets often have few or no constraints on the inner system. Observations with current and near-future telescopes such as Kepler, ALMA, GPI, JWST, and TESS will help fill in our knowledge of complete planetary systems, and help answer the question of whether or not our Solar System is a typical planetary system.

Biography

Dr. Sam Lawler received her B.S. in astrophysics from Caltech in 2005, followed by 2 years of research work at Caltech's IPAC facility on early Spitzer data of debris disks. She then received her M.A. from Wesleyan University before coming to Canada for her PhD work at UBC. She has been in Victoria ever since her PhD, initially as a UVic postdoc/lecturer, and since 2015 as a Plaskett Fellow at NRC-Herzberg. Her work utilizes dynamical simulations of the effects of planets on debris disks and on the structure of the Kuiper Belt. Several of her recent projects involve dynamically testing the existence of reported planets. She has shown τ Ceti's reported planet system is allowed by its wide debris disk, Fomalhaut b is likely a catastrophically disrupted icy body, and the structure of the Kuiper Belt does not require an additional distant planet in the Solar System. While her dynamical simulations are running on the computer cluster, she likes to play with her kids and grow food.

INVITED SPEAKER

PLANETS & DISKS II

Thursday, May 24, 12:05 PM, Saanich

Leslie Rogers,
University of Chicago

Journey to the Centre of the Super Earth

Sub-Neptune, super-Earth size exoplanets are a new planet class. Though absent from the Solar System, they are found by microlensing, radial velocity, and transit surveys to be common around distant stars. In this talk, I'll review both recent developments and outstanding puzzles in our understanding of the nature and origin of these enigmatic planets.

Biography

Dr. Leslie Rogers is an assistant professor in the Department of Astronomy and Astrophysics at the University of Chicago. Rogers' research focusses on theoretical and numerical studies of exoplanets (planets outside the Solar System) that are Neptune-size and smaller. She has developed models for low-mass planet interiors and has applied them to constrain planet bulk compositions, to evaluate planet formation scenarios, to explore the possibilities for surface liquid water oceans, and to constrain the fraction of planets that are rocky as a function of planet size. Dr. Rogers has been awarded both a NASA Hubble Fellowship and a NASA Sagan Fellowship. She has served on CanTAC, the Hubble Space Telescope Exoplanet Advisory Committee, and is a member of the Habitable Exoplanet Imaging Mission (HabEx) Science and Technology Definition Team. Rogers earned an Honours BSc in Physics and Mathematics from the University of Ottawa in 2006, and a PhD in Physics from MIT in 2012.

INVITED SPEAKER

CHIME

Thursday, May 24, 2PM, Theatre

Richard Shaw,
University of British Columbia

Probing Dark Energy with the Canadian Hydrogen Intensity Mapping Experiment (CHIME)

CHIME will use Intensity Mapping of the 21cm line of neutral hydrogen to map large-scale structure between redshifts of 0.8 and 2.5. By measuring Baryon Acoustic Oscillations (BAO) we will place constraints on the dark energy equation of state as it begins to dominate the expansion of the Universe, particularly at redshifts poorly probed by current BAO surveys. In this talk I will introduce CHIME, a transit radio interferometer designed specifically for this purpose. I will discuss the promise and pitfalls of Intensity Mapping and describe how we plan to confront the many challenges of such observations, in particular removal of astrophysical foregrounds which are six orders of magnitude larger than the 21cm signal. CHIME recently started operating at the DRAO in Penticton, BC and I will report on current progress and lessons already learned.

Biography

Dr. Richard Shaw is a Postdoctoral Fellow at the University of British Columbia. Originally from the UK, he received both his BA/MSci in Physics and Ph.D. in Astronomy from the University of Cambridge. From 2010 to 2015 he was a Postdoctoral Fellow at CITA before moving to UBC. Richard's early work was in theoretical cosmology; his current research interests are in finding novel statistical methods for analysing the data from cosmological surveys. The focus of this work is how to overcome the significant challenges of 21cm Intensity Mapping – a new method for efficiently surveying the large-scale structure of the universe – where we must excise foreground contamination five orders of magnitude larger than the cosmological signal. Richard is heavily involved in CHIME, the pre-eminent 21cm Intensity Mapping experiment, where he is responsible for the real time processing and analysis pipeline.

INVITED SPEAKER

STARS & REMNANTS

Thursday, May 24, 2PM, Saanich

Nicole St. Louis,
Université de Montréal

Using Sitelle to learn about the evolution of massive stars

The most massive stars in the Universe have a strong impact on their surrounding interstellar medium. Their strong winds chemically enrich the gas and impart to it a large amount of energy and momentum. This leaves in the surrounding medium information-rich imprints in the form of ejected nebula and wind-blown bubbles, which trace the mass-loss history of the star as it undergoes its various evolutionary phases before the final supernova explosion. By characterizing the circumstellar medium (CSM) of these stars, one can learn about the various evolutionary phases they have gone through. In this talk, I will describe a project that makes use of the wide-field optical imaging Fourier-Transform Spectrograph, SITELLE, on the CFHT to characterize with high spatial extent and resolution, the CSM of a sample of massive stars. Using this state-of-the-art instrument, we obtain maps of the extinction, density, temperature and abundances of the CSM, which we use to characterize the chemical enrichment, asymmetries and kinematics of the mass ejections that occurred in the intermediate phases between the main sequence and Wolf-Rayet (WR) stages. Various physical processes and binary effects such as tidally induced mixing or mergers affect the surface abundances of massive stars and thus their CSM during their evolution. By comparing the CSM characteristics with models of single and binary stars, we can gain insight into massive-star evolution for which many aspects still remain misunderstood. I will present the first results of this study, namely the analysis of two very different nebula surrounding WR stars, M1-67 and NGC6888.

Biography

Following a M.Sc. degree in Montreal,Dr. Nicole St-Louis obtained a Ph.D. from University College London in December 1990 and spent two years as an NSERC postdoctoral fellow at the Université de Montréal, where she has been a professor since 1993. Her work focuses on massive stars and more specifically Wolf-Rayet (WR) stars, the core helium-burning descendants of main sequence O stars. She is particularly interested in large-scale asymmetries that can form in their dense winds, called Corotating Interaction Regions (CIRs). She specialised on characterizing these structures using extensive spectroscopic, photometric and polarimetric observing campaigns to obtain their characteristics and ultimately gain knowledge on the mechanisms from which they originate. In order to more accurately interpret the observations she also works on theoretical aspects. These structures can impact the evolution of massive stars, particularly the angular momentum budget, with links to long Gamma-Ray Burst (GRB) progenitors. St-Louis also studies the circumstellar medium (CSM) around WR stars to gain insight into massive-star evolution for which many aspects still remain misunderstood. By mapping the density, temperature and abundances of the CSM around these stars, she characterizes the chemical enrichment, asymmetries and kinematics of the mass ejections that occurred in the intermediate phases between the main sequence and WR stages. These characteristics also serves as initial conditions to core-collapse supernova.

INVITED SPEAKER

AGN / FACILTIES

Friday, May 25, 10:45 AM, Theatre

Stéphanie Juneau,
NOAO

The Influence of Giant Black Holes on the Fate of Galaxies

Supermassive black holes - with masses of millions to billions of times that of the Sun - reside in the nuclei of galaxies. While black holes are not directly visible, surrounding material becomes extremely luminous before being accreted, creating telltale signatures of black hole activity. In turn, the amount of activity tells us about black hole growth, and about energy injection back into the host galaxies. This so-called black hole feedback is thought to play a role in regulating the rate at which galaxies form new stars, thereby affecting directly their evolution across cosmic time. After a brief overview, I will present observational and numerical constraints on the fueling of black holes, and on the extent to which they can change the fate of galaxies. I will then highlight new findings from a multi-scale analysis of gas ionization and dynamics thanks to 3D spectroscopy with the VLT/MUSE instrument. Lastly, I will conclude with a global view of black hole growth and feedback in galaxies, including major questions that remain open for new capabilities such as the James Webb Space Telescope (JWST), and large galaxy survey experiments such as DESI and Euclid.

Biography

Dr. Stéphanie Juneau is an associate astronomer at the National Optical Astronomy Observatory, and the Project Scientist for the NOAO Data Lab. She obtained her BSc and MSc in physics from the Université de Montréal, and her PhD from the University of Arizona in 2011. She then moved to CEA-Saclay in France, where she started as a Marie Curie fellow before becoming staff researcher in 2012. She moved back to Tucson, Arizona in 2016 to join the scientific staff at NOAO.

Dr. Juneau's expertise lies primarily in the field of supermassive black hole and galaxy evolution. She is interested in answering questions about the growth of galaxies and that of the black holes that reside in their centers, as well as the interplay between the two. Her work brings together multiwavelength observations, close comparison with numerical simulations, and ranges from detailed case studies to statistical analysis of large datasets. As a member of the DESI and Euclid collaborations, she is looking forward to taking advantages of several millions galaxy and quasar spectra to further our understanding of the black hole-galaxy connection and expand to larger scales.

INVITED SPEAKER

COSMOLOGY

Friday, May 25, 10:45 AM, Saanich

Renée Hložek,
University of Toronto

Concordance Cosmology (and Canada!)

Our universe has evolved from a hot early phase, through the dark ages to the formation of the first stars and galaxies and into the acceleration epoch. We are simultaneously firmly within the 'data-deluge' epoch of cosmological research. That data has allowed us to uncover a simple (if mysterious) concordance cosmological model. The nature of the components of this model: dark energy and dark matter, remains elusive. Now the devil really is in the details, and dealing with systematics is the challenge going forward, as interesting tensions emerge in this simple model. I will discuss the concordance cosmological model, and how we use complementary data sets to understand it - and push beyond the standard picture. I will briefly discuss the tensions between data sets, I will highlight some of the ground-breaking new projects that we are undertaking in Canada to tackle this new and exciting time in contemporary cosmology.

Biography

Dr. Renée Hložek is an assistant professor at Department of Astronomy and Astrophysics and the Dunlap Institute for Astronomy and Astrophysics at the University of Toronto. She is originally from South Africa where she did her undergrad degree and Masters degrees, before moving to the UK in 2008 as a South African Rhodes Scholar. After four years as a Lyman Spitzer Jr Fellow at Princeton University, she moved to Toronto in 2016. Her work uses data from telescopes around the world to test the predictions of novel cosmological theories,with a focus on dark matter and dark energy. She is interested in astrostatistics and using data science techniques applied to astrophysical problems. She is passionate about science communication and was elected as a 2013 TED Fellow and a Senior Fellow for the years 2014-2015. She was elected as a 2017 CASCA Westar lecturer.

INVITED SPEAKER

SPACE ASTRONOMY

Friday, May 25, 02:00 PM, Theatre

Patrick Côté,
NRC Herzberg

CASTOR: A Flagship Canadian Space Telescope

The 2010 Long Range Plan for Canadian Astronomy noted that "Canadian space technology has reached the point that we could led a large space astronomy mission: a Canadian Space Telescope". Since 2012, the Canadian Space Agency (CSA) has been developing a mission concept for a wide-field, nearly diffraction-limited UV/optical space telescope: the Cosmological Advanced Survey Telescope for Optical and uv Research (CASTOR). CASTOR is a 1m telescope that uses a three mirror anastigmat design to provide deep, panoramic imaging in three filters covering the 150-550nm wavelength range. In this talk, I describe the current design of the facility and highlight its extraordinary scientific potential by focusing on specific programs in cosmology and dark energy, galaxy evolution and star formation, AGNs and QSOs, near-field cosmology, Galactic structure, stellar astrophysics, exoplanets and the outer solar system.

Biography

Dr. Patrick Côté received his Ph.D. in astrophysics from McMaster University in 1994, followed by postdoctoral appointments at National Research Council (NRC-Herzberg) and California Institute of Technology. From 2000 to 2004, he was a professor at Rutgers University. In 2004, he returned to NRC-Herzberg where he is currently a Principal Research Officer. His research interests include the structure, evolution and dynamics of nearby clusters and galaxies, as well as the Milky Way and its satellite system. He has published more than 160 papers in the refereed literature, and has been a frequent user of some of the world's premier telescopes including the Hubble, Chandra, Spitzer and Astrosat space observatories. He was the principal investigator, or founding member, of some of the largest surveys of galaxies in the local universe undertaken during the past 15 years, including the Hubble ACS Virgo Cluster Survey and the CFHT Next Generation Virgo Cluster Survey. Since 2011, he has served as the lead scientific investigator for the CASTOR mission concept.

INVITED SPEAKER

SPACE ASTRONOMY

Friday, May 25, 02:30 PM, Theatre

Els Peeters,
Western University

The photochemical evolution of the PAH family and the JWST-ERS program on Photo-dissociation Regions

Massive stars disrupt their natal molecular cloud material by dissociating molecules, ionizing atoms and molecules, and heating the gas and dust. These processes drive the evolution of interstellar matter in our Galaxy and throughout the Universe from the era of vigorous star formation at redshifts of 1-3, to the present day. Much of this interaction occurs in Photo-Dissociation Regions (PDRs) where far-ultraviolet photons of these stars create a largely neutral, but warm region of gas and dust. PDR emission dominates the IR spectra of star-forming galaxies and also provides a unique tool to study in detail the physical and chemical processes that are relevant for inter- and circumstellar media including diffuse clouds, molecular cloud and protoplanetary disk surfaces, globules, planetary nebulae, and starburst galaxies.

The mid-IR spectra of photodissociation regions (PDRs) are dominated by the well-known emission features at 3.3, 6.2, 7.7, 11.3, and 12.7 micron, generally attributed to polycyclic aromatic hydrocarbon molecules (PAHs). PAHs drive much of the physics and the chemistry in these PDRs, e.g. by heating the gas and as a catalyst in the formation of molecular hydrogen on their surfaces. Thus, PAHs and PDRs are intimately connected, and a complete knowledge of PDRs requires a good understanding of the properties of the PAH population.

Here I present the results of hyperspectral imaging studies done with Spitzer/IRS in the 5-20 micron range for a sample of Reflection Nebulae and HII regions. These studies reveal subtle, but significant spatial variations in individual PAH emission bands revealing a spatial sequence with distance from the illuminating star. The overall dominant charge state of the PAH population is certainly a key factor in driving these variations. However, hyperspectral imaging studies allow to probe PAH parameters beyond charge, such as molecular structure and size. Combined with the NASA Ames PAH database to fine-tune band assignments, the observed spatial sequence reveals the photochemical evolution of the interstellar PAH family as they are more and more exposed to the radiation field of the central star in the evaporative flows associated with the PDR.

However, the photochemical evolution of PAHs will only be fully probed by the suite of

instruments on board the James Webb Space Telescope (JWST) which will provide simultaneous high spatial and spectral resolution, high sensitivity and broad wavelength coverage. Of particular relevance to PAHs is the JWST Early Release Science program on PDRs (ID1288). This program plans to obtain the first spatially resolved, high spectral resolution IR observations of a nearby PDR using NIRCam, NIRSpec and MIRI. I will present this program, its goals and science-enabling products.

Biography

Dr. Els Peeters is Associate Professor in the department of Physics and Astronomy at the University of Western Ontario and research scientist at the SETI Institute in California. She obtained her MSc degrees in Physics and Astronomy from the Catholic University of Leuven and the Free University of Brussels (Belgium), and her PhD degree from the University of Groningen (The Netherlands). She was a post-doc at the NASA Ames Research Center and the SETI Institute in sunny California. She was hired as Assistant Professor at the University of Western Ontario in Dec. 2006. Her research focuses on the physics and chemistry of interstellar carbonaceous molecules and dust with a prime emphasis on polycyclic aromatic hydrocarbons (PAHs). She is an observational astronomer and has worked extensively with infrared observations from space-based telescopes, such as the Infrared Space Observatory (ISO), NASA's Spitzer Space Telescope and the Herschel Infrared Space Observatory, the Stratospheric Observatory for Infrared Astronomy (SOFIA) and ground-based telescopes (e.g. VLT, Gemini).

INVITED SPEAKER

THEORY & ASTROINFORMATICS

Saturday, May 26, 11:15 AM, Theatre

Falk Herwig,
University of Victoria

Large-scale simulations of stars and the challenges of the cyber world

The formation of the elements in stars and stellar explosions manifests itself in the solar system abundance distribution and the multitude of galactic and extra-galactic abundance observations. Stellar abundances are increasingly used to track formation and evolution processes of galaxies. Our gaps in understanding the fundamental physics process of turbulent stellar convection and the interaction of turbulence with energetic nuclear reactions constitutes a major limit to our predictive stellar yield simulation capability. To address this problem we are pursuing a long-term program in computationally intensive 3D hydrodynamic simulations of stellar convection. To date our simulations include He-shell flashes in low-mass stars for a variety of conditions, double-shell H-He shell convection in Pop III massive stars, as well as O-C shell convection in massive stars. A recent highlight of our program has been rotating and non-rotating H-burning core convection simulations in a massive star, performed at scale on 2/3 of the new Compute Canada Niagara cluster in Toronto. Simulations at this scale provide, like many other large astronomy data sets, substantial challenges in distributed data access and analytics. We have developed the virtual research environment cyberhubs, that proves useful to our research collaboration to address these cyber challenges.

Biography

Dr. Falk Herwig is a professor at the University of Victoria. He received his doctorate degree at Astrophysical Institute Potsdam (AIP)/University Kiel (Germany) followed by post-doctoral appointments at the University of Victoria, Victoria, BC and Los Alamos National Laboratory, New Mexico (USA). After a first faculty appointment at Keele University (UK) Herwig joined the faculty at the University of Victoria in 2008. His group's research in nuclear and stellar astrophysics advances our understanding of how the elements form in stars and stellar explosions, and how stars evolve in the early universe. An important aspect of this research involves the study of convection in stars, especially how convection interacts with vigorous nuclear burning in the final phase of stellar evolution of low-mass and massive stars. Herwig and his team's work is embedded in international collaborations, such as the NSF Physics Frontier Center Joint Institute for Nuclear Astrophysics (JINA). In his research Herwig constructs computational simulations that require very large computational resources and generate big data outputs. To fully take advantage of these large data sets, Herwig has made contributions to cyber infrastructure projects.

INVITED SPEAKER

THEORY & ASTROINFORMATICS

Saturday, May 26, 12:15 PM, Theatre

Pauline Barmby,
Western University

Big data in (little) galaxies: what can astroinformatics do for you?

In today's astronomical world, we hear a lot about "big data" and "machine learning". Usually these are discussed with reference to giant databases of Milky Way stars or surveys of distant galaxies, such as from GAIA or LSST. Nearby galaxies are a different kind of beast; while the number of nearby galaxies isn't huge, they each contain multitudes. The relations between galaxy constituents and overall galaxy properties contain key information about galaxy formation and evolution. We need to find better ways to extract this understanding from the big datasets produced both by large-scale surveys and targeted observations. Our group has made some initial forays into applying techniques such as (un)-supervised clustering and random forest classification to observations of nearby galaxies. This talk will describe what we have learned so far and potential directions for the future.

Biography

Dr. Pauline Barmby received her BSc in Physics and Astronomy in 1995 from the University of British Columbia, followed by her PhD in Astronomy in 2001 from Harvard University. From 2001-2007 she was a staff astrophysicist at the Harvard-Smithsonian Center for Astrophysics, working as part of the team responsible for building and testing the IRAC camera on NASA's Spitzer Space Telescope. In 2007, she joined Western University's Department of Physics and Astronomy and in 2015 took on the role of Associate Dean, Graduate and Postdoctoral Studies within the Faculty of Science. She was named Acting Dean of Science in 2017. Pauline's research uses multiwavelength observations to study stellar populations and star formation in nearby. She is interested in the use of computer data-mining techniques and community-developed software to facilitate knowledge extraction from astronomical data. She has been an active supporter of science outreach throughout her career and has contributed as a Blogger for Science Borealis, Scientist-in-Residence for the London Children's Museum and a Software Carpentry instructor.

INVITED SPEAKER

EPO I

Saturday, May 26, 11:15 AM, Esquimalt

Nick Claxton,
University of Victoria

Education for Reconciliation in Canada

Rooted within Indigenous knowledge systems, languages and relationships to land, Indigenous nations have always valued education. Starting at the time of contact, formal European education and schooling has had a dark legacy, where the goal of colonizing and assimilating Aboriginal Peoples was the goal. Central to the Colonial Government's assimilation policies, as articulated in the Hawthorne Report (1966) and the Federal Government's 1969 White Paper Policy, were the Indian Residential School and Day School Systems. In response, the National Indian Brotherhood adopted the Indian Control of Indian Education policy paper in 1972. It has always been the goal of Indigenous communities to have an education that gives Indigenous children a strong foundation for living a good life. More recently, all levels of governments are recognizing the social, moral and legal obligations to improve formal education and schooling for Indigenous peoples. This was reinforced by the federal government's Truth and Reconciliation Commission on Residential Schools, which stated that "reconciliation must create a more equitable and inclusive society by closing the gaps in social, health and economic outcomes that exist between Aboriginal and non-Aboriginal Canadians." In the Era of Reconciliation in Canada education can help to lead the way.

Biography

Dr. Nick Claxton's ancestral hereditary name is XEMŦOLTW̱. He is from the SȻÁUTW̱ Community of the W̱SÁNEĆ Nation. Nick received his Master's in Indigenous Governance and his PhD in Curriculum Studies from the University of Victoria, where he is currently an Assistant Teaching Professor in Indigenous Education Department.

LIST OF POSTERS

1. **SPICA - the SPace Infrared telescope for Cosmology and Astrophysics**
   (Session : Posters : Facilities);
   David Naylor *(University of Lethbridge)*
2. **Multi-Archive Query at the Canadian Astronomy Data Centre: One stop shopping for the world's astronomical data.**
   (Session : Posters : Facilities);
   Stephen Gwyn *(CADC)*
3. **Canadian Gemini News: Review of the Impact in Canada of our participation in the Gemini Observatory**
   (Session : Posters : Facilities);
   Stéphanie Côté *(NRC/Herzberg)*
4. **Scientific Opportunities with the Large Synoptic Survey Telescope**
   (Session : Posters : Facilities);
   Melissa L. Graham *(LSST & University of Washington)*
5. **Using CANFAR with ALMA Data**
   (Session : Posters : Facilities);
   Helen Kirk *(Herzberg Astronomy & Astrophysics, NRC)*
6. **The Sustainable Development of Space: Astro-environmental and dynamical considerations**
   (Session : Posters : Facilities);
   Aaron Boley *(The University of British Columbia)*
7. **Gain Modelling for the Canadian Hydrogen Intensity Mapping Experiment**
   (Session : Posters : Instrumentation);
   Sidhant Guliani *(University of British Columbia, Vancouver, BC)*
8. **The GIRMOS spectrograph Science Cases**
   (Session : Posters : Instrumentation);
   Scott Chapman *(NRC-HAA; Dalhousie)*
9. **Enabling precision astrometry science in TMT era**
   (Session : Posters : Instrumentation);
   Mojtaba Taheri *(University of Victoria)*
10. **Megacam Image Classification: A Machine Learning Approach**
    (Session : Posters : Instrumentation);
    Hossen Teimoorinia *(NRC)*
11. **Substraction of tellurics absorption lines in SPIRou data using PCA-based method**
    (Session : Posters : Instrumentation);
    Simon-Gabriel Beauvais *(UdeM, IREx)*

12. **Beam Modelling for the Canadian Hydrogen Intensity Mapping Experiment**
(Session : Posters : Instrumentation);
Meiling Deng *(University of British Columbia)*

13. **SAFECAT: the Herschel SPIRE Automated spectral Feature Extraction CATalogue**
(Session : Posters : Instrumentation);
Locke Spencer *(University of Lethbridge)*

14. **Computational Challenges in Next Generation Surveys: Reverberation Mapping with the Maunakea Spectroscopic Explorer**
(Session : Posters : Instrumentation);
Sarah Gallagher *(Western University)*

15. **Finding another Earth in the Alpha-Centauri system with Tiki**
(Session : Posters : Instrumentation);
Célia Protin-Blain *(University of Victoria, AO Lab)*

16. **Automated Testing of Optical Fibers for the Maunakea Spectroscopic Explorer Project**
(Session : Posters : Instrumentation);
Farbod Jahandar *(University of Victoria)*

17. **Ambient RF in Everyday Life**
(Session : Posters : Instrumentation);
Pamela Freeman *(University of Calgary)*

18. **MICHI, A Thermal-Infrared Instrument for the TMT**
(Session : Posters : Instrumentation);
Chris Packham *(Univeristy of Texas at San Antonio)*

19. **Nifty4Gemini: A New Automated NIFS Pipeline**
(Session : Posters : Instrumentation);
Nathaniel Comeau *(NRC Herzberg)*

20. **In a galaxy far, far away: teaching astronomy from a distance at Athabasca University**
(Session : Posters : EPO);
Christy Bredeson *(Athabasca University)*

21. **CASCA's First Climate Survey**
(Session : Posters : EPO);
Brenda Matthews *(NRC Herzberg Research Centre)*

22. **Bloom Where You're Planted: Exposing Undergraduate Students to Local Research Excellence**
(Session : Posters : EPO);
Terry Bridges *(Dept of Physics & Astronomy, Okanagan College)*

23. **Concentration and Shape Changes in Major Mergers**
(Session : Posters : Cosmology);
Nicole E. Drakos *(University of Waterloo)*

24. **Mocking the Cosmic Web for the Next Generation of Cosmological Experiments**
(Session : Posters : Cosmology);
George Stein *(Canadian Institute for Theoretical Astrophysics)*

25. **Gas and Dust in the Most Luminous Galaxy in the Universe**
(Session : Posters : Cosmology);
Kevin Lacaille *(McMaster University)*

26. **Estimating the Effects of Weak Gravitational Lensing on the Cosmic Microwave Background using Local Statistics**
(Session : Posters : Cosmology);
Victor Chan *(University of Toronto)*

27. **The Spectrum of the Universe**
(Session : Posters : CMB);
Ryley Hill *(University of British Columbia)*

28. **Ages and star formation histories of galaxies in the Gogreen spectroscopic sample**
(Session : Posters : Galaxies);
Kristi Webb *(University of Waterloo)*

29. **Dynamic Localized Turbulent Diffusion and its Impact on the Galactic Ecosystem**
(Session : Posters : Galaxies);
Douglas Rennehan *(University of Victoria)*

30. **Searching Dwarf Satellite Galaxies with Photometric Data**
(Session : Posters : Galaxies);
Chengyu Xi *(University of Waterloo)*

31. **Supernovae Type Ia as Probes of Large-scale Structure**
(Session : Posters : Galaxies);
Anita Bahmanyar *(University of Toronto/ Dunlap Institute)*

32. **A fresh look at substructure in the Virgo Cluster with the Next Generation Virgo Cluster Survey**
(Session : Posters : Galaxies);
Chelsea Spengler *(University of Victoria)*

33. **Galaxy mergers moulding the circum-galactic medium**
(Session : Posters : Galaxies);
Maan H. Hani *(University of Victoria)*

34. **Spatial Distribution of Star Formation Rate and Other Properties of MaNGA Post-Merger Galaxies**
(Session : Posters : Galaxies);
Mallory Thorp *(University of Victoria)*

35. **Star Formation Histories in APOSTLE**
(Session : Posters : Galaxies);
Ruth Digby *(Univeristy of Victoria)*

36. **Denuded Dwarfs Demystified**
(Session : Posters : Galaxies);
Marshall L. McCall *(York University)*

37. **The Canada-France Imaging Survey: Strategic science in the era of large surveys**
(Session : Posters : Galaxies);
Alan McConnachie *(NRC Herzberg)*

38. **Probing the Hierarchical Assembly of the Virgo Cluster**
(Session : Posters : Galaxies);
James Taylor *(University of Waterloo)*

39. **Solo Dwarf Galaxy Survey: Isolated Dwarfs in the Local Group**
(Session : Posters : Galaxies);
Clare Higgs *(University of Victoria)*

40. **Truncated Disks in X-ray Rich Environments**
(Session : Posters : Galaxies);
Melanie Demers *(McMaster University)*

41. **The Curious Molecular Gas Conditions in a z=2.6 Radio-loud Quasar**
(Session : Posters : Galaxies);
Chelsea Sharon *(McMaster University)*

42. **Properties of the Lenses in the South Pole Telescope Survey**
(Session : Posters : Galaxies);
Kaja Rotermund *(Dalhousie University)*

43. **IR Flux Variability and PAH Destruction near an Awakening AGN**
(Session : Posters : Galaxies);
Sherry Yeh *(W. M. Keck Observatory)*

44. **Quenching low-mass satellite galaxies: evidence for a critical ICM density**
(Session : Posters : Galaxies);
Ian Roberts *(McMaster University)*

45. **TREVR: Tree-based REVerse Raytracing in Gasoline - now with adaptive ray tracing!**
(Session : Posters : Galaxies);
Jasper Grond *(McMaster University)*

46. **Searching for nucleus obscuration in ten nearby FR-I Radio Galaxies: A Markov-chain Monte Carlo analysis of infrared spectra**
(Session : Posters : Galaxies);
Robert Gleisinger *(University of Manitoba)*

47. **Gas-rich dwarfs as ultra-diffuse galaxy progenitors: constraining formation models with deep HI observations**
(Session : Posters : Galaxies);
Kristine Spekkens *(Royal Military College of Canada)*

48. **Molecular Gas Properties in the Early Merger System Arp240**
(Session : Posters : Nearby Galaxies);
Hao He *(Department of Physics and Astronomy, McMaster University)*

49. **Local Group Shape and Intrinsic Alignments through APOSTLE**
(Session : Posters : Nearby Galaxies);
Thorold Tronrud *(University of Victoria)*

50. **Reading Galaxies with MaNGA: Surveying Populations of Stars in Nearby Galaxies**
(Session : Posters : Nearby Galaxies);
Marcus Merryfield *(University of Victoria)*

51. **Signatures of stellar migration in simulated non-migrating galactic disks**
(Session : Posters : Nearby Galaxies);
Nic Loewen *(University of Victoria)*

52. **Fast Coherent Differential Imaging on Ground-Based Telescopes using the Self-Coherent Camera**
(Session : Posters : Exoplanets);
Benjamin Gerard *(University of Victoria, NRC Herzberg)*

53. **Finding Earth 2: Blue dot or red herring?**
(Session : Posters : Exoplanets);
Claire M. Guimond *(McGill University)*

54. **Uncovering exoplanets from 0.01 to 100 AU: a novel planet detection technique through high resolution infrared spectroscopy**
(Session : Posters : Exoplanets);
Marie-Eve Desrochers *(Université de Montréal - iREx)*

55. **Is Kepler-33 Dead Inside?**
(Session : Posters : Exoplanets);
Jason Rowe *(Bishop's University)*

56. **Constraining UCD Radio Emission Mechanisms and Implications for the TRAPPIST-1 Planetary System**
(Session : Posters : Exoplanets);
Anna Hughes *(University of British Columbia)*

57. **The Stability and Limits of Tightly-packed Exoplanet Systems**
(Session : Posters : Exoplanets);
Alysa Obertas *(University of Toronto, CITA)*

58. **Only 30% of Sun-like Stars Have Kepler-like Planets**
(Session : Posters : Exoplanets);
Wei Zhu *(CITA)*

59. **The chaotic history of ultra-short-period planets**
(Session : Posters : Exoplanets);
Cristobal Petrovich *(Canadian Institute for Theoretical Astrophysics)*

60. **Nightside Temperatures of Highly Irradiated Giant Planets**
(Session : Posters : Exoplanets);
Dylan Keating *(McGill University)*

61. **Bayesian analysis of the dynamical influence of companion stars in warm and hot Jupiter exoplanet systems**
(Session : Posters : Exoplanets);
Henry Ngo *(NRC Herzberg)*

62. **Photometric Properties of Distant KBOs Observed by New Horizons LOng-Range Reconnaissance Imager (LORRI) at Moderate and High Phase Angles**
(Session : Posters : Solar System);
JJ Kavelaars *(National Research Council of Canada)*

63. **The prevalence of resonances among large-a transneptunian objects**
(Session : Posters : Solar System);
Brett Gladman *(UBC)*

64. **Determining the Plane of the Kuiper Belt with OSSOS**
(Session : Posters : Solar System);
Christa Van Laerhoven *(UBC)*

65. **Thermodynamics of HII regions: Sh2-158**
(Session : Posters : ISM);
Gilles Joncas *(Université Laval)*

66. **Rotation Measures for studying the Galactic Magnetic Field: Is Extended the new Compact?**
(Session : Posters : ISM);
Anna Ordog *(University of Calgary)*

67. **Faraday tomography of the Milky Way ISM with GMIMS**
(Session : Posters : ISM);
Alex S. Hill *(UBC/DRAO/Space Science Institute)*

68. **CHANG-ES – an Overview**
(Session : Posters : ISM);
Judith Irwin *(Queen's University)*

69. **Galactic Magnetic fields: from Disc to Halo**
(Session : Posters : ISM);
Alex Woodfinden *(Queen's University)*

70. **Mixed Aromatic Aliphatic organic nanoparticles (MAON) as carriers of unidentified infrared emission bands**
(Session : Posters : ISM);
Sun Kwok *(University of British Columbia)*

71. **A High Resolution Survey of the Galactic Plane at 408 MHz**
(Session : Posters : ISM);
Roland Kothes *(Dominion Radio Astrophysical Observatory)*

72. **ALMA Observations of the Circumstellar Disk of the EX Lupi Outburst System**
(Session : Posters : Disks);
Lewis Knee *(National Research Council)*

73. **New details on the Galactic spiral arms in the Milky Way**
(Session : Posters : Star Formation);
J.P. Vallée *(NRC Herzberg Astronomy and Astrophysics)*

74. **Kinematic Behaviour of Filaments in the Nearby Star-Forming Regions**
(Session : Posters : Star Formation);
Mike Chen *(University of Victoria)*

75. **Probing Episodic Accretion during the Earliest Stages of Star Formation with ALMA**
(Session : Posters : Star Formation);
Logan Francis *(University of Victoria)*

76. **KEYSTONE: KFPA Examinations of Young Stellar (O-star) Natal Environments**
(Session : Posters : Star Formation);
Jared Keown *(University of Victoria)*

77. **Local Environment Impact on Extragalactic Star-forming Regions**
(Session : Posters : Star Formation);
Laurie Rousseau-Nepton *(CFHT)*

78. **BISTRO: characterizing magnetic fields in star-forming molecular clouds with POL-2**
(Session : Posters : Star Formation);
Pierre Bastien *(Université de Montréal)*

79. **3-axis stability of triaxial magnetized molecular cloud core models via the tensor virial theorem**
(Session : Posters : Star Formation);
Erica Franzmann *(University of Manitoba)*

80. **The JCMT Gould Belt Legacy Survey: a multi-cloud comparison of star-forming structures at 850 microns**
(Session : Posters : Star Formation);
James Lane *(University of Victoria)*

81. **Surprising activity of A-type stars revealed by Kepler: are magnetic fields the culprit?**
(Session : Posters : Stars);
James Sikora *(Queen's University)*

82. **Improving SPH radiative transfer accuracy in red novae simulations**
(Session : Posters : Stars);
Roger Hatfull *(University of Alberta)*

83. **StarNet: An application of deep learning in the analysis of stellar spectra**
(Session : Posters : Stars);
Collin Kielty *(University of Victoria)*

84. **To Boldly Go Where No Neural Network Has Gone Before**
(Session : Posters : Stars);
Spencer Bialek *(University of Victoria)*

85. **Linear polarisation from magnetic massive stars**
(Session : Posters : Stars);
Melissa Munoz *(Queen's University)*

86. **Modelling the Observed Variability of B-emission Star Pleione**
(Session : Posters : Stars);
Keegan Marr *(Western University)*

87. **M1-67: this nebula that we used to know!**
(Session : Posters : Stars);
Marcel Sévigny *(Université Laval)*

88. **The BRITE-Constellation mission: status and recent results**
(Session : Posters : Stars);
Gregg Wade *(Royal Military College of Canada)*

89. **H-He Shell Interactions and Nucleosynthesis in Massive Population III Stars**
(Session : Posters : Stars);
Carolyn Clarkson *(University of Victoria)*

90. **Turbulent convective mixing and neutron-capture branchings at Zr and Eu in Asymptotic Giant Branch He-shell flashes**
(Session : Posters : Stars);
David Stephens *(University of Victoria)*

91. **Low Mass X-ray Binaries: Population at the Roche Lobe Overflow**
(Session : Posters : Stars);
Kenny Van *(University of Alberta)*

92. **3D simulations of main-sequence core convection**
(Session : Posters : Stars);
Robert Andrassy *(University of Victoria, BC, Canada)*

93. **The Canada France Imaging Survey: Using the Milky Way's stellar graveyard to infer its evolution**
(Session : Posters : Stars);
Nicholas Fantin *(University of Victoria)*

94. **X10: A Magnetic Cataclysmic Variable with Pole-switching Accretion**
(Session : Posters : Stars);
Asma Hattawi *(University of Alberta)*

95. **Carbon as a diagnostic tool for explosion mechanisms of Type Ia supernovae**
(Session : Posters : Compact Objects);
Epson Heringer *(University of Toronto)*

96. **Knowns and unknowns of FRBs**
(Session : Posters : Compact Objects);
Ue-Li Pen *(CITA)*

97. **The CHIME/FRB Pipeline**
(Session : Posters : Compact Objects);
Alexander Josephy *(McGill University)*

98. **Black Holes and Neutron Stars in Nearby Galaxies: Insights from NuSTAR**
(Session : Posters : Compact Objects);
Neven Vulic *(NASA GSFC & UMCP)*

99. **XMM-Newton and Radio Observations of the Evolved Pulsar Wind Nebula CTB 87**
(Session : Posters : Compact Objects);
Benson Guest *(University of Manitoba)*

100. **Mode changing and giant pulses in the Black Widow Pulsar**
(Session : Posters : Compact Objects);
Nikhil Mahajan *(University of Toronto)*

101. **Resolving the locations of the Crab Pulsar's radio emission**
(Session : Posters : Compact Objects);
Rebecca Lin *(University of Toronto)*

102. **High-precision Timing Observations of Radio Pulsars with CHIME**
(Session : Posters : Compact Objects);
Emmanuel Fonseca *(McGill University)*

ABSTRACTS

3D simulations of main-sequence core convection

Robert Andrassy *(University of Victoria, BC, Canada)*

(Session : Posters : Stars);

We present a series of 3D simulations of the convective core and the surrounding stable layers of a $25M_\odot$ star performed using the PPMstar code. The simulations are done in 4π geometry on 768^3 and 1536^3 Cartesian grids. The rate of mass entrainment at the convective boundary is numerically converged and is proportional to the luminosity driving convection, which we scale by factors ranging from 100x to 10,000x with respect to our 1D stellar evolution model. The mass entrainment rate extrapolated to the actual luminosity of the stellar model is of order $10^{-11}M_\odot$/s, which would imply the impossible entrainment of order $10^3M_\odot$ of envelope material over the main sequence lifetime of the star. We discuss processes that could limit the rate of mass entrainment on long time scales, our approaches to calibrating a 1D mixing model using the 3D simulations, and we describe the properties of the convection-generated internal waves propagating through the stably stratified envelope.

Supernovae Type Ia as Probes of Large-scale Structure

Anita Bahmanyar *(University of Toronto/ Dunlap Institute)*

(Session : Posters : Galaxies);

Galaxies move with the expansion of the universe but they also have an extra velocity component known as peculiar velocity. This is the local movement of galaxies toward or out of matter over- and under-densities, respectively. This relation to densities means that measuring this velocity accurately helps us study growth of structure in the universe. We use supernovae type Ia (SNe Ia) as bright tracers of peculiar motion since they reside in the galaxies and track their motion. They are also standardizable candles, which means that we can calibrate their light-curves to get their properties including their color and width of the light-curve which gives us their distance modulus. Inverting distance modulus gives the true redshift which can be compared with the observed redshift to get peculiar velocity. Current supernova catalogues have an insufficient number of SNe without sufficient sky coverage, which allows statistical noise to dominate the true signal. The Large Synoptic Survey Telescope (LSST), which is currently under construction, will change the state of the field by detecting thousands of SNe Ia that can be used for the study of peculiar velocities. I will discuss the potential of cadence studies of LSST on peculiar velocity measurements. Naive predictions suggest that we need twenty thousand supernovae to estimate the peculiar velocity at redshift of 0.5. I will discuss the number and distribution of SNe Ia required for this study as a function of systematic effects and observational strategies and discuss peculiar velocity in light of theoretical predictions.

First arrival from afar: colours of the interstellar planetesimal 'Oumuamua

Michele Bannister *(Queen's University Belfast)*

(Session : Solar System);

The first minor planet from beyond our Solar System was discovered in October 2017. 'Oumuamua may have been travelling between the stars for billions of years before its brief visit to us. Its close encounter with the inner solar system was a unique chance to make observations matching those used to characterize the small-body populations of our own solar system. We present near-simultaneous g', r', and J photometry and colours of 1I/'Oumuamua from the 8.1m Frederick C. Gillett Gemini-North Telescope and gri photometry from the 4.2m William Herschel Telescope. Our g'r'J observations are directly comparable to those from the high-precision Colours of the Outer Solar System Origins Survey (Col-OSSOS) on Gemini North, which offer unique diagnostic information for distinguishing between outer solar system surfaces. The colour of the first interstellar planetesimal is like that of some dynamically excited objects in the Kuiper Belt and the less-red Jupiter Trojans.

BISTRO: characterizing magnetic fields in star-forming molecular clouds with POL-2

Pierre Bastien *(Université de Montréal)*

(Session : Posters : Star Formation);

The submillimeter polarimeter POL-2 at the JCMT, which utilizes the capabilities of the SCUBA-2 camera, was recently commissioned for use at both 450 microns and 850 microns. It is currently one of the best instruments to study magnetic fields in molecular clouds at intermediate scales (10"), between interferometers such as ALMA (1") and wide-field instruments such as Planck (1'). Two large programs, the B-fields In STar-forming Region Observations (BISTRO) survey and its follow-up BISTRO-2, are ongoing at the JCMT. An overview of the scientific goals, current status and results of these large programs will be presented during this talk. The star-forming regions covered by these surveys were previously mapped with SCUBA-2 and HARP by the JCMT Gould Belt Legacy Survey. Selected fields include OMC-1 in Orion A, three fields in Ophiuchus, two in Perseus, Serpens, and many others. The polarisation maps obtained by BISTRO allow the magnetic and turbulent properties to be accurately measured and compared in a diverse sample of star-forming environments.

What did Astronomers know in 1918?

Alan H. Batten *(NRC (Retired))*

(Session : History);

Compared with our present knowledge of the structure of the stars and the universe, that of 100 years ago seems almost elementary, although to the astronomers of the time the problems seemed as challenging and as important as our present problems seem to us. Many astronomers were more concerned with positional astronomy and celestial mechanics than with astrophysics, which was in its infancy. Cosmology, in anything like our modern sense did not exist; the question of whether the spiral nebulae were inside or outside our Galaxy was still unsettled. It was unclear whether the stars themselves were gaseous throughout. Few astronomers believed in the existence of a generalized interstellar absorption of light. Despite the pioneering work of William Herschel in the early nineteenth century, little was known about the structure and size of our own Galaxy. Indeed, although the first stellar parallaxes were determined in the late 1830s, only a relatively few were known with any precision. Few stellar masses had been determined and those few were not very precisely known. This was the background to the foundation of the Dominion Astrophysical Observatory and a review of this background helps us to understand the choices made by Plaskett and his staff for the work of the new Observatory.

Substraction of tellurics absorption lines in SPIRou data using PCA-based method

Simon-Gabriel Beauvais *(UdeM, IREx)*

(Session : Posters : Instrumentation);

SPIRou is a near-IR échelle spectropolarimeter and high-precision velocimeter that came online last April at the Canada-France-Hawaii telescope. SPIRou is specifically designed to detect small planets orbiting nearby low-mas stars through precision radial velocimetry. With a spectral resolution of $\sim$74k, SPIRou covers a wide wavelength range, from 0.98 to 2.45 μm. In that range, the atmosphere features strong telluric absorption lines that, if ignored, would degrade the radial velocity (RV) accuracy by several m/s. Here we present a novel and efficient method for subtracting telluric lines through a principal component analysis. This method not only allows for high RV accuracy measurements with SPIRou and other similar infrared precision radial velocity instruments, it enables near telluric-free high-resolution infrared spectroscopy.

COS-AGN: Probing the circumgalactic medium of AGN hosts

Trystyn Berg *(University of Victoria)*

(Session : Galaxies);

Recently, there has been a large focus on studying the copious amounts of baryonic gas residing in the circumgalactic medium (CGM) of galaxies. The COS-Halos and similar surveys have revolutionized the field, demonstrating the similarities and differences in the properties of the CGM around star-forming, passive, and dwarf galaxies, while highlighting the link between the gaseous haloes and the host galaxy's evolution. Active galactic nuclei (AGN) and their role in feedback processes are critical in galaxy evolution. However, AGN feedback is poorly constrained observationally. The COS-AGN survey uses 20 quasar sightlines through the CGM of AGN-dominated galaxies to tackle the question of how AGN feedback can change the metal content and ionization structure of their gaseous haloes. In this talk I will present the results of the COS-AGN survey, focusing on a detailed comparison of the CGM properties from COS-AGN and COS-Halos galaxies, as well as to hydrodynamical zoom-in simulations.

To Boldly Go Where No Neural Network Has Gone Before

Spencer Bialek *(University of Victoria)*

(Session : Posters : Stars);

In this era of massive spectroscopic surveys there exist large homogeneous databases of stellar spectra, providing ideal environments to experiment with the capabilities of a neural network (NN) based approach to the analysis of spectra. Following the successful implementation of StarNet, a NN methodology designed to predict the temperature, surface gravity, and metallicity of tens of thousands of stars from the APOGEE survey, we present ongoing efforts in expanding this work. Included in this is generalizing the method to a larger wavelength coverage, the prediction of a larger number of stellar parameters, and improving upon the generation of synthetic spectra. We believe these NN based methods will be pivotal in future surveys.

Finding another Earth in the Alpha-Centauri system with Tiki

Célia Protin-Blain *(University of Victoria, AO Lab)*

(Session : Posters : Instrumentation);

The Tiki instrument is a new generation 10-micron cryogenic extreme adaptive optics (ExAO) imager being designed for the Gemini South telescope. Tiki aims to detect the thermal emission of potential Earth-like planets orbiting Alpha Centauri A or B. The Tiki collaboration is part of a larger international endeavour known as Breakthrough Watch (BTW). One of BTW goals is to search for Earth-like planets around Alpha Centauri through simultaneous campaigns at the Gemini South, VLT and Magellan telescopes. Tiki will also be a prototype for a future TMT instruments capable of imaging Earth-like planets around a larger star sample, and performing low spectral characterization to search for biomarkers on detected planets.

The Sustainable Development of Space: Astro-environmental and dynamical considerations

Aaron Boley *(The University of British Columbia)*

(Session : Posters : Facilities);

The sustainable development of space is a global (and exo-global) challenge that is not limited by borders or research disciplines. Sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". While the development of space brings new economic and scientific possibilities, it also carries significant political, legal, and technical uncertainties. For example, the rapidly increasing accessibility of space is motivating states to unilaterally adopt legislation for the new era of space use, which may have significant unintended consequences, such as increased risks to space assets, disputes among state as well as non-state actors, and changes to unique astro-environments. Any policy or legal position must be informed by the dynamical and astrophysical realities of space use, creating complex and interwoven challenges. Here, we explore several of these potential challenges related to astro-environmentalism, space mining operations, and the associated dynamics.

VESTIGE: A Virgo Environmental Survey Tracing Ionised Gas Emission

Alessandro Boselli *(Laboratoire d'Astrophysique de Marseille)*

(Session : Galaxies);

I will then introduce the VESTIGE survey, a blind, narrow-band Hα imaging survey carried out with MegaCam at the CFHT (2017-2019 French-Canadian Large Program) to map the whole Virgo cluster region up to one virial radius. This survey has been designed to study at an unprecedented sensitivity ($SHa \sim 2 \times 10^{-18}$ erg sec^{-1}cm^{-2}arcsec^{-2}) and angular resolution ($\leq$1 arcsec) the effects of the environment on cluster galaxies through the observation of the ionised gas component, ideal tracer of an ongoing perturbation. I will summarise the first results obtained after the first observing semester based on the analysis of the core of the cluster and of some representative objects undergoing different kind of perturbations.

Simulations of High Resolution Transit Spectroscopy with SPIRou

Anne Boucher *(Université de Montréal)*

(Session : Instrumentation);

SPIRou, the new infrared spectro-polarimeter of the CFHT, will soon begin operation and provide us with near-infrared spectroscopy at high resolution (R $\sim$ 73500) over an unprecedented large simultaneous spectral range (0.98 - 2.35μm). This will greatly enhance our ability to characterize the atmosphere of exoplanets from the ground via the transit spectroscopy method. I will briefly present the how the method works, the main features of SPIRou, and then simulations showing its capabilities for exoplanet characterization, how it should perform relative to the previous instruments, such as CRIRES, and how it will contribute to advance this field. Namely, SPIRou will be able to detect and constrain the abundance of the main atmospheric constituents of planets ranging from Jupiter to Neptune in size, as well as measure the speed of their upper-atmosphere winds.

A Chandra and XMM-Newton Imaging and Spectroscopic study of the Supernova Remnant RCW 103 (G332.4-0.4)

Chelsea Braun *(University of Manitoba)*

(Session : Compact Objects);

The life of a massive star ends in a catastrophic supernova explosion that disperses the stellar debris into the interstellar (or circumstellar) medium, and forms a supernova remnant (SNR) that shines in X-rays for tens of thousands of years. For young SNRs that are still dominated by the supernova ejecta, studying the remnant in X-rays can reveal information about the progenitor star and its explosion properties. RCW 103 is a young Galactic SNR, approximately 3.1 kpc away, hosting an unusual central compact object (CCO) discovered in X-rays and known to have a period of approximately 6.67 hours. Many studies have been conducted on the CCO to explain the nature of its unusual X-ray periodicity, with the most recent revealing a magnetar-like activity suggesting that this CCO may be the slowest known magnetar. However, very little has been done on the remnant itself that hosts this CCO. Here, we present a Chandra and XMM-Newton imaging and spectroscopic study of the SNR to address unanswered questions about the nature, environment and progenitor of this explosion leaving behind one of the most exotic and puzzling compact objects known in our Galaxy.

In a galaxy far, far away: teaching astronomy from a distance at Athabasca University

Christy Bredeson *(Athabasca University)*

(Session : Posters : EPO);

Athabasca University has been educating students in astronomy from a distance for the past 30 years. There has been an evolution in distance education astronomy courses during that time; what once was done by correspondence has now transitioned into fully web-based courses that are available online. With a rise in interest in new and innovative methods for teaching astronomy online, it must be asked, how can we effectively teach students when we are no longer in a classroom setting? How can we engage students in astronomy from home when it can seem like they are far, far away? This poster will discuss the particulars of how we teach astronomy from a distance to nearly 200 students per year; including an overview of the courses we offer and Athabasca University's unique education model. It will also cover the challenges of teaching astronomy from a distance and possible resolutions.

Two-Stage Exams: Make your exams into a learning experience

Terry Bridges *(Dept of Physics & Astronomy, Okanagan College)*

(Session : EPO);

In two-stage exams, the students first write the exam individually; in the second stage, students redo some or all of the exam in small groups. The final exam mark is a weighted average of the individual and group scores. The two-stage exam is an attempt to combine individual accountability with an opportunity for learning with feedback.

In this presentation, I will:

- summarize recent physics/astronomy education research about two-stage exams
- present practical suggestions for implementing two-stage exams
- discuss the benefits and challenges of two-stage exams in college/university first-year physics and astronomy courses
- discuss what I have learned about two-stage exams in my astronomy and physics teaching, including feedback received from students'

Bloom Where You're Planted: Exposing Undergraduate Students to Local Research Excellence

Terry Bridges *(Dept of Physics & Astronomy, Okanagan College)*

(Session : Posters : EPO);

Okanagan College capitalizes on its long-standing relationship with the Dominion Radio Astrophysical Observatory, bringing students to the facility every semester. These field trips expose students to cutting-edge research, and reinforces the concepts learned in their classes. The realization that world-class research is being performed in the local community engages students tremendously. We present examples of the unanimously positive experiences of our students, and seek to discover other colleges which benefit from such partnerships in other parts of Canada.

The ESO Diffuse Interstellar Band Large Exploration Survey: First Results

Jan Cami *(Western University)*

(Session : ISM);

The ESO Diffuse Interstellar Band Large Exploration Survey (EDIBLES) is a Large Programme that is collecting high-signal-to-noise (S/N) spectra of a large sample of O and B-type stars covering a large spectral range using the UVES spectrograph mounted on the Very Large Telescope (VLT). The goal of the programme is to extract a unique sample of high-quality interstellar spectra from these data that represent different physical and chemical environments, and to characterise these environments in great detail. An important component of interstellar spectra are the diffuse interstellar bands (DIBs), a set of hundreds of unidentified interstellar absorption lines that are commonly found in the spectra of reddened targets. With the detailed line-of-sight information derived from these high-quality spectra, EDIBLES will derive strong constraints on the potential DIB carrier molecules. EDIBLES will thus guide the laboratory experiments necessary to identify these interstellar "mystery molecules", and will turn the DIBs into powerful diagnostics of their environments in our Milky Way Galaxy and beyond. Here, we will present some of our first results showing the unique capabilities of the EDIBLES programme.

Estimating the Effects of Weak Gravitational Lensing on the Cosmic Microwave Background using Local Statistics

Victor Chan *(University of Toronto)*

(Session : Posters : Cosmology);

Traditional detections of weak gravitational lensing in the cosmic microwave background have been dependent on the inter-multipole correlations that lensing introduces, and have often employed the use of four-point estimators. These methods require astonishingly high resolutions (~ 20 arcseconds) and low noise levels ($\sim 0.5\,\mu$K-arcmin) in order to make detections of CMB lensing at very small angular scales ($\ell \gg 3000$). In contrast to a measurement using an all-sky estimate, I present an alternative estimator that computes local lensing statistics using patches on the sky, and correlates the patches to make measurements of the lensing potential power spectrum. At present, the estimator is able to distinctively recognize the presence of weak lensing in a CMB temperature map (to $\sim 30\sigma$) with realistic noise levels. The estimator's confidence in its measurements presents a hopeful outlook towards its use in pioneering CMB lensing detections at extremely small angular scales, and even distinguishing between predictions of the lensing power spectra for varying cosmologies and models of dark matter.

The GIRMOS spectrograph Science Cases

Scott Chapman *(NRC-HAA; Dalhousie)*

(Session : Posters : Instrumentation);

I will highlight the science cases for the Gemini Infra-Red Multi Object Spectrograph, a new Adaptive Optics instrument operating at near-IR wavelengths ($1 - 2.5\mu$m). This instrument will become a facility instrument at Gemini and carry out much needed scientific follow-up for JWST, but will also act as a Thirty-Meter Telescope (TMT) pathfinder, laying the scientific and technical ground-work for developing a second generation instrument for TMT. Technical Innovations for GIRMOS include a modular, high performance Multi Object Adaptive Optics system, and high throughput infrared imaging spectroscopy. These technological innovations will have the broadest impact in the study of the formation and evolution of galaxies, but will also have broad reach in fields such as star and planet formation within our Milky Way and supermassive black holes in nearby galaxies.

Kinematic Behaviour of Filaments in the Nearby Star-Forming Regions

Mike Chen *(University of Victoria)*

(Session : Posters : Star Formation);

Filaments are ubiquitous in molecular clouds and appear to play a crucial role in star formation (André+ 2010). How filaments assemble mass from diffuse molecular clouds at large scales ($\sim$ 10 pc in size) into dense cores at small scales ($\sim$ 0.1 pc) is currently not well understood. The GBT Ammonia Survey (GAS; Friesen+ 2017) provides a unique opportunity to study such a process by enabling a large-sample, systematic study of filament kinematics in the nearby molecular clouds. Here we present the first systematic velocity gradient analysis of velocity-coherent filaments at ~ 0.1 pc scale in these clouds using the GAS data. In our study, we found some of these gradient fields to be orthogonally or parallelly aligned with the filaments, potentially indicative of accretion flow onto and along these filaments, driven by processes such as convergence flow and self-gravitation.

H-He Shell Interactions and Nucleosynthesis in Massive Population III Stars

Carolyn Clarkson *(University of Victoria)*

(Session : Posters : Stars);

Understanding the lives and deaths of the first generations of stars is crucial to our understanding of the early universe and all subsequent epochs. In 1D stellar models of massive Pop III stars, interactions between H- and He-shell convection layers have been reported (Woosley and Weaver 1982, Limongi and Chieffi 2012) but until recently, have not been investigated in detail. Using the 1D stellar evolution code MESA, we find that when this event occurs in a 45$M_{\odot}$ Pop III model, it leads to H-burning luminosities of $L/L_{\odot} \sim 13$ due to convective-reactive mixing at the interface between the two shells. These conditions render 1D models unreliable and we will report on initial results of our new project to investigate the hydrodynamic nature of mixing at the interface between the H- and He-convection zone.

This mixing is similar to H-ingestion events found in other environments, such as He-shell flashes in low-mass stars (Herwig et al. 2011, Herwig et al. 2014) and may lead to the i-process with neutron densities of $\sim$10^{13} cm^{-3}, reproducing the nucleosynthetic abundance patterns existing in some of the most metal-poor stars (Clarkson et al. 2018). We have now also investigated in more detail the conditions for Ca production in Pop III stars, and specifically the role of the 19F(p,g)20Ne reaction. We find that unless mixing between H-and He layers is involved, using default nuclear reaction rates, Ca is produced at a level at least a factor 10 below the value observed in the most Fe-poor star.

Nifty4Gemini: A New Automated NIFS Pipeline

Nathaniel Comeau *(NRC Herzberg)*

(Session : Posters : Instrumentation);

The Gemini Near-Infrared Integral Field Spectrometer (NIFS) is a medium resolution (R $\sim$ 5000) 3D imaging spectrograph currently installed on the Frederick C. Gillett Gemini North Telescope on MaunaKea. Data reduction for NIFS is currently undertaken in part with tasks from PyRAF, Gemini IRAF, and Gemini AstroConda. We present a new Python package, called Nifty4Gemini, that encloses these tasks in an automated and extensible data reduction pipeline. Nifty4Gemini provides a fully automated data reduction from the download and sorting of data from the Gemini Observatory Archive to the merging of flux and wavelength calibrated NIFS data cubes with the full Signal/Noise required for science analysis. A configuration file system streamlines customizing, reproducing, and sharing data reductions.

Canadian Gemini News: Review of the Impact in Canada of our participation in the Gemini Observatory

Stéphanie Côté *(NRC/Herzberg)*

(Session : Posters : Facilities);

In view of the Gemini Assessment Point in November 2018, at which the Gemini participants are to declare their interest in renewing the Gemini Agreement, the Canadian Gemini Office has conducted a review of all the outcomes of Canada's participation in the Gemini Observatory over the past decade in order to provide an independent perspective on the benefits that have accrued to the Canadian Astronomical Community and to Canada as a whole.The poster will present some of the highlights from this review, such as:

- It was found that the overall science Impact of Canadian Gemini papers (based on citations) is higher than the Gemini average, and in fact is higher than any other 8m class telescope worldwide;the canadian papers with the highest mean impact are using GPI.
- the number of PhD theses produced in Canada based on Gemini data is higher than any other astronomical facilities to which Canadians have access to; since 2009 there is an average of 4.9 Gemini canadian thesis per year;
- Canadian astronomers are leaders or collaborators on half of all science press releases released by the Gemini Observatory. Most of the canadian press releases are from GMOS users, however the press releases with the most impact (in terms of visits) are from GPI users.
- there were 33 internships of Canadian co-op students at Gemini since 2009;
- Canada received Gemini contracts totalling about 30% of the whole Gemini Instrument development Funds, much above our 18% partnership share.

Operating an Interpretive Center as part of Federal Government

Dennis Crabtree *(NRC Herzberg)*

(Session : EPO);

While governments often support science and provide funding, including for public engagement, operating a facility as part of a government department means dealing with, e.g., rules on procurement, advertising, human resources and many others.

The Centre of the Universe (CU) opened in 2001 as a purpose-built public interpretive centre dedicated to astronomy and its associated technologies. It was built and operated by the National Research Council (NRC), a department of the Canadian federal government, which has the mandate from the Canadian Parliament to administer federal observatories. Throughout the world astronomy is viewed as an effective way to excited children about STEM careers. During its years of operation the CU staff steadily built presence locally through its bilingual programming (English, French) and outreach to First Nations schools, while contributing to national and international outreach (such as leadership in National Science and Technology Week).

As a result of a 2006 election, the Conservative Party of Canada came to power, initially in a minority government, but becoming a majority government in 2011. This change of government resulted in a dramatic shift in the focus of the NRC which eventually led to the CU being closed 24 August 2013. This closure resulted in considerable negative reaction through traditional, as well as social, media from the local public and politicians, as well as from many other parts of Canada and even abroad. The CU closure resulted in much adverse media coverage for NRC and the Federal Government. Widely seen as part of the Conservative government's perceived "war on science", the closure resulted in multiple petitions for NRC to reconsider the decision and to reopen the CU.

In response to the end of educational programs at the CU, a not-for-profit organization, The Friends of the Dominion Astrophysical Observatory Society (FDAO), was incorporated in June 2015. The FDAO goal is to fulfill the educational and community engagement goals of the CU when it was operated by the NRC.

In this talk we will detail how the CU was affected by operating as part of a federal government department and how the community dealt with its closing. We will also describe the approach that has been taken to reopen the CU in a sustainable fashion.

The many lessons learned from the seventeen year history of the Centre of the Universe will be summarized in the hope that others may benefit from our experience.

Constraints on the quiescent galaxy evolution from imaging and spectroscopy

Ivana Damjanov *(Saint Mary's University/Harvard-Smithsonian CfA)*

(Session : Galaxies);

The synergy between high-quality medium-resolution spectroscopy and deep high-resolution imaging over large fields provides robust quantitative constraints for determining the physical processes governing the evolution of galaxy luminous and dark matter content. I will present two surveys (hCOSMOS and F2-HSC) that combine high-quality imaging with dense spectroscopic coverage to explore properties of quiescent galaxies at $z < 1$. These surveys yield information on stellar population, structural, and dynamical properties of galaxies and on their environments for complete magnitude-limited samples covering 6 square degrees on the sky. We use spectro-photometric measurements to trace changes in stellar age, velocity dispersion, number density, and local galaxy density for massive quiescent galaxies ($M > 10^{10} M_{\odot}$) segregated by stellar mass and size. We observe variations between these redshift trends for quiescent systems in different stellar mass and/or size bins that test the models of galaxy mass assembly. We find that the criteria used to select the most compact quiescent galaxies reveal the set of evolutionary paths that the most extreme systems may take. Our surveys provide a comprehensive view of quiescent galaxy population over the last 5-7 Gyr of cosmic history.

Transit spectroscopy with the Near-Infrared Imager and Slitless Spectrograph (NIRISS) of the James Webb Space Telescope (JWST)

Antoine Darveau Bernier *(Université de Montréal)*

(Session : Instrumentation);

The unprecedented sensitivity of JWST due to its 25 square meters collecting area will open a new window to characterize the atmosphere of exoplanets. More specifically, the NIRISS instrument features a Single Object Slitless Spectroscopy (SOSS) mode which is designed precisely for the purpose of transit and eclipse spectroscopy around bright stars. Its wavelength coverage from 0.6 to 2.8 microns will give access to many molecular absorption features relevant to the determination of the chemical composition of exoplanets. This will play a key role for understanding their formation processes and the physical mechanisms occurring in their atmosphere. I will give a brief overview of the expected performance of the NIRISS SOSS mode. The specific science case of HD209458 b will be taken as an example of the capability to constrain the C/O ratio, the metallicity as well as the atmospheric pressure-temperature profiles. The status of the data reduction pipeline will also be presented.

A Case Study of Triggered Star Formation in Cygnus X

Soumen Deb *(University of Alberta)*

(Session : Star Formation);

The Cygnus X region is one of the richest regions of star formation in the Milky Way Galaxy. It contains hundreds of distinct HII regions, numerous Wolf-Rayet and O-type stars, and several OB associations with Cygnus OB2 at the heart of the region. In a JCMT CO(3-2) pilot study of the area, we detected 47 molecular outflows, 27 of them previously unknown and widespread sequentially triggered star formation. In this talk, I will focus on a cometary feature at the outskirts of Cygnus OB2, which contains two proto-stars with newly discovered molecular outflows. We implement several techniques to analyze CO line emission as well as infrared and radio continuum data. This study helps us to understand the structure of the cometary feature, and more importantly the identification of the radiation source that might have triggered star formation in this molecular cloud

High-Resolution Ground-Based Transmission Spectroscopy of Warm Saturns

Emily Deibert *(University of Toronto)*

(Session : Exoplanets);

Thousands of transiting exoplanets have been discovered, but the extreme brightness contrast between these planets and their host stars makes characterizing their atmospheres particularly challenging. Recent work has focused on transmission spectroscopy during transits, when the light from the host star passes through the planet's atmosphere and allows for the detection of any atomic or molecular species present. While this method has been used to make atmospheric detections around several hot Jupiters, the atmospheres of cooler, lower-mass planets remain elusive. In this talk, I will present our analyses of high-resolution optical data from the Subaru and Gemini telescopes in an effort to characterize the atmospheres of HAT-P-12b and WASP-69b, two sub-Saturn mass transiting exoplanets. Through transmission spectroscopy, we both detect and place constraints on the presence of sodium, potassium, and water absorption features in these planets' atmospheres. This work serves as one of the first successful attempts to apply ground-based transmission spectroscopy techniques to sub-Saturn mass giant planets, and highlights the utility of transmission spectroscopy in atmospheric characterization.

Truncated Disks in X-ray Rich Environments

Melanie Demers *(McMaster University)*

(Session : Posters : Galaxies);

The observed properties of galaxies are correlated with their host environments. In the field, galaxies tend to be disk-dominated and gas-rich. In group and cluster environments, galaxies tend to be bulge-dominated and gas-depleted. In this work we focus on the properties of stellar disks in different environments using a sample of galaxies from Sloan Digital Sky Survey Data Release 7. We compare the disk properties of galaxies at fixed bulge mass as a function of X-ray brightness, group-centric position, and halo mass. At low bulge mass we find that the stellar disks in groups are significantly truncated compared to field galaxies. Furthermore, we find that stellar disks are more truncated in X-ray rich groups than in X-ray weak groups. We show that these results are largely independent of group-centric position and halo mass, with the exception that disk truncation is mildly enhanced near the centres of large-cluster sized halos. We attribute the observed trends to a combination of starvation and ram pressure stripping processes.

Submillimeter All-Sky: wide-field instrument futures at JCMT and beyond

Jessica Dempsey *(East Asia Observatory)*

(Session : Facilities);

In the era of ALMA, and with a decade or more to the next generation of large submillimeter single-dish facilities, the new instrument program at the James Clerk Maxwell Telescope aims to capitalise on the need for the widest-field, most sensitive continuum and heterodyne instruments to pathfind for the growing high-resolution capabilities of ALMA. Canada's long and rich experience in the field is critical in leading these new instrument endeavours. The plans of the East Asian Observatory to look for partnerships as it gathers momentum will be discussed.

Beam Modelling for the Canadian Hydrogen Intensity Mapping Experiment

Meiling Deng *(University of British Columbia)*

(Session : Posters : Instrumentation);

The Canadian Hydrogen Intensity Mapping Experiment (CHIME) is a 21cm intensity mapping experiment designed to help resolve the mystery of dark energy by measuring the Baryon Acoustic Oscillation (BAO) scale over the largest volume of the universe yet surveyed. CHIME consists of four static cylindrical reflectors with 256-element dual-polarized-antenna arrays deployed along each of the telescope's four focal lines. Unlike dish arrays, CHIME's design enables a large field of view and fast mapping speed with no moving parts. CHIME's powerful correlator enables interferometric imaging with sufficient angular resolution to resolve the targeted BAO structure. However, in order to detect the BAO signal, we need to filter the strong galactic foreground from CHIME's data. This requires calibration of CHIME's beam response to $\sim$0.1% accuracy. I will summarize the current successes and challenges we face in calibrating CHIME's beam response, focussing on some of the aspects that are unique to CHIME's cylindrical array design.

Uncovering exoplanets from 0.01 to 100 AU: a novel planet detection technique through high resolution infrared spectroscopy

Marie-Eve Desrochers *(Université de Montréal - iREx)*

(Session : Posters : Exoplanets);

Exoplanet detection has made great strides in the past two decades, detecting planets orbiting at just a few solar radii and imaging gas giants on distant orbits (tens to thousands of AU). While we now know planets at all orbital separations, each detection technique (radial velocities, transit, transit, imaging, astrometry, lensing) has strong detection biases, being virtually blind at some ranges of orbital separation and masses. It's only through the stitching of incomplete detection limits that we currently construct our understanding of planet populations. We develop and demonstrate a novel planet detection technique that has the benefit of allowing the detection of massive, self-luminous, young planets at all orbital separation, from a few stellar radii to tens of AUs, encompassing the orbital separations of all Solar System planets. By cross-correlating the high-resolution spectrum of a young Sun-like star with that of an isolated planetary-mass object template, one can infer the presence of a planet around that star and measure its radial and rotational velocities as well as the molecular contents in its atmosphere. Simulation demonstrates that massive planets can be found around <100 Myr stars through this technique. We obtained observations of AO and RV-detected planets with IGRINS at Gemini South to demonstrate the power of this technique. A positive demonstration will pave the way to a survey that will, for the first time ever, bridge the orbital separations probed by direct imaging (e.g., NICI, GPI) and RV surveys.

Star Formation Histories in APOSTLE

Ruth Digby *(Univeristy of Victoria)*

(Session : Posters : Galaxies);

Star formation histories (SFHs) provide a convenient metric with which to study the processes governing galactic evolution. However, the relative effects of tidal interactions, mergers, reionization, and other processes can be difficult to disentangle. Simulations allow us to track galaxies of interest back through time, revealing how different phenomena enhance or quench star formation, and what signatures they leave in the SFH. I present results on the SFHs of dwarf galaxies in APOSTLE (A Project Of Simulating The Local Environment), with emphasis on the differences between satellite and field galaxies. In particular, I highlight the processes that prevent recent star formation in satellites.

New ALMA View of the Protoplanetary Disk MWC 758

Ruobing Dong *(University of Victoria)*

(Session : Disks);

Structures detected in spatially resolved observations of protoplanetary disks may hint at the presence of unseen planets forming in disks. Previous imaging observations of the transitional disk MWC 758 have revealed an inner cavity, a ring-like outer disk, emission clumps, and spiral arms, all hinting at the presence of low-mass companions. We present ALMA dust continuum emission observations of MWC 758 at 0.87 millimeter (mm) with 43 x 38 mas angular resolution (6.5 x 5.9 AU) and 20μJy beam^{-1} rms. The 48 AU central dust cavity is revealed to be eccentric; once deprojected, its outer edge can be fit by an ellipse with an eccentricity of 0.09 and one focus on the star. The broad ring extending to 97 AU is composed of three narrow rings with two gaps in between. The outer two rings tentatively show the same eccentricity and orientation as the inner ring and the cavity. The two known dust emission clumps are spatially resolved in both the radial and azimuthal directions. Radially their width-to-radius ratios are 21% and 28%, and azimuthally both cover 1/6 of 2π. Perhaps most interestingly, one of the two spiral arms at tens of AU previously imaged in near-infrared (NIR) scattered light is revealed and resolved in ALMA dust emission, at a slightly larger stellocentric distance. We also submit evidence of disk truncation at $\sim$100 AU based on comparing NIR imaging observations with models. The spirals, the north clump, and the truncated disk edge all point to one companion exterior to the spirals at roughly 100 AU.

The SPIRou Legacy Survey

René Doyon *(Université de Montréal)*

(Session : Instrumentation);

SPIRou is a near-infrared, high-resolution spectropolarimeter currently under final integration at the Canada-France-Hawaii Telescope. SPIRou features unique capabilities combining spectropolarimetry, wide infrared wavelength coverage and a site with a very low water vapor column, all of which will make SPIRou the world's premier infrared facility for high-precision velocimetry/spectropolarimetry work. The SPIRou Legacy Survey is a CFHT large program of at least 300 nights over 4 years focused on 1) finding the closest temperate rocky planets around low-mass stars, 2) providing crucial mass measurements of new small transiting planets soon to be unveiled by the Transiting Exoplanet Survey Satellite and other space- and ground-based exoplanet transit surveys and 3) enabling detailed investigations of how magnetic fields impact the early evolution of young stars and their planetary system. This presentation will present the latest SPIRou results and gives an overview of the SPIRou Legacy Survey science programs.

Concentration and Shape Changes in Major Mergers

Nicole E. Drakos *(University of Waterloo)*

(Session : Posters : Cosmology);

Numerical simulations of structure formation predict that dark matter halos have a universal profile, and there is a large amount of literature that investigates how these profiles evolve as a halo grows. Dark matter halos can also be characterized by their concentration (the viral radius divided by a characteristic scale radius) and shape. There is a fairly good understanding of how halos evolves on average, and some suggestion that major mergers can decrease concentration. However, it is difficult to predict how an individual halo will evolve given its mass accretion history. The first step to creating a model for how halos evolve is to study the effect of mergers in isolation. We have performed over a hundred isolated self-similar binary mergers with different halo models and orbits to investigate how density profiles, shape and concentrations of halos change in major mergers. We find that the resulting halos are not, in general, self-similar, but resemble Einasto profiles, and that the change in the Einasto shape parameter depends on orbital energy. Additionally, we find predictable trends in shape changes; radial orbits produce prolate remnants, while tangential orbits produce oblate remnants. The change in concentration is complicated, but appears to depend on both the orbital energy as well as the model for the initial condition – we do find that in some cases major mergers cause a decrease concentration. Overall, we have elucidated qualitatively how halos change in binary mergers, and provided some empirical predictions. Ultimately, model predictions of how halos change in mergers have applications to lensing systematics, the boost factor, cluster scaling relations and may also help provide next generation cosmological tests.

Cross Correlating the CHIME Pathfinder 21 cm Data with SDSS Quasars

Mateus Fandino *(University of British Columbia)*

(Session : Instrumentation);

The CHIME Pathfinder has been acquiring data for over 3 years. While there are still calibration and foreground removal challenges to be overcome before the Pathfinder's complete science goals are realized, it should be possible to detect cosmological 21 cm signal through cross-correlation with other tracers of the large scale structure. Surveys of different tracers have mostly uncorrelated uncertainties, thereby relaxing some calibration and foreground removal requirements. A detection of cross-correlation would provide us with new insights about the 21 cm signal in large scale structure and the Pathfinder instrument itself. I will present ongoing efforts to correlate CHIME Pathfinder data with the SDSS quasar catalog.

The Canada France Imaging Survey: Using the Milky Way's stellar graveyard to infer its evolution

Nicholas Fantin *(University of Victoria)*

(Session : Posters : Stars);

White dwarfs represent the fossil remnants of previous generations of stars and thus their properties can be used to study the formation and evolution of stellar populations. I will present the ongoing studies involving white dwarfs in the Canada France Imaging Survey (CFIS), which currently covers 4,000 of a planned 10,000 square degrees. With this data set, and in combination with STARRS1 and SDSS, we have uncovered more than 30,000 white dwarfs - an increase by a factor of 3 compared to previous photometric studies. I will describe a newly developed model used to simulate the observed white dwarf population in order to yield the star formation history of the thin disk, thick disk, and halo of the Milky Way. Additionally, I will discuss how this dataset will yield the largest number of halo white dwarfs to date, allowing for a study of the formation of the inner halo at the earliest epochs.

The Relationship Between Magnetic Fields and Molecular Cloud Structure: A BLASTPol Study of Vela C

Laura Fissel *(National Radio Astronomy Observatory)*

(Session : Star Formation);

Whether magnetic fields influence the formation and evolution of molecular clouds remains a key open question in our understanding of star formation. In this presentation I will show comparisons between the magnetic field of the young giant molecular cloud Vela C, as traced by the Balloon-borne Large Aperture Sub-mm Telescope for Polarimetry (BLASTPol), and molecular cloud structure, as traced by nine molecular line maps observed with the Mopra telescope. We find that low-density gas tracers 12CO and 13CO are statistically more likely to align parallel to the magnetic field, while molecules with characteristic molecular hydrogen densities greater than about 10^3 cm^{-3} preferentially align perpendicular to the magnetic field. Our results indicate a dynamically important magnetic field, and further suggest that the orientation of the field with respect to the flows of material that created Vela C might have affected the efficiency with which dense gravitationally unstable gas was formed. I will also give an update on the status of our new BLAST Polarimeter, BLAST-TNG, which will provide simultaneous polarization observations at 250, 350 and 500 microns with diffraction limited resolution of 25" at 250 microns and an order of magnitude increase in mapping speed. BLAST-TNG is scheduled to launch in December 2018 from McMurdo Station, Antarctica, and we are making 25% of the science time available for shared risk proposals from the astronomical community.

High-precision Timing Observations of Radio Pulsars with CHIME

Emmanuel Fonseca *(McGill University)*

(Session : Posters : Compact Objects);

The telescope for the Canadian Hydrogen Intensity Mapping Experiment (CHIME) possesses a large field of view and digital-beamforming capabilities that render it a uniquely powerful monitor of radio-transient phenomena. We describe the design, early-science findings and anticipated outcomes of a real-time observing backend for radio-pulsar timing observations with CHIME. In full operation, the CHIME pulsar-timing backend will simultaneously process beamformed time-series data for 10 different pulsars in real time, each implementing coherent de-dispersion across the 400-MHz CHIME bandwidth, and at any given time. The CHIME infrastructure includes an autonomous source scheduler that will be tuned to observe every pulsar in the CHIME sky at varying cadences, enabling many types of scientific inquiries for all known pulsars viewable by CHIME. With half of the pulsar population residing within its field of view, along with the telescope's anticipated role in the detection of nanohertz-frequency gravitational waves, CHIME is poised to propel Canada as a world leader in pulsar astronomy within the next year.

Gravitational Lensing of Line Intensity Maps

Simon Foreman *(CITA)*

(Session : CMB);

Gravitational lensing is a powerful cosmological probe, providing projected maps of large-scale structure that can be used for a variety of model constraints or cross-correlations. Lensing has been robustly detected in photometric galaxy surveys and the cosmic microwave background (CMB), and one can ask whether similar measurements might be possible in upcoming line intensity maps, either of 21cm emission or other lines. I will present some recent work in this direction, focusing on how nonlinearities in the intensity maps affect the lensing reconstruction process. I will discuss how techniques from CMB lensing can be adapted to mitigate these effects, and will also show forecasts for a selection of current and proposed instruments (several of which have Canadian involvement), for both the lensing auto spectrum and cross-correlations between lensing and lower-redshift tracers.

Probing Episodic Accretion during the Earliest Stages of Star Formation with ALMA

Logan Francis *(University of Victoria)*

(Session : Posters : Star Formation);

Variability of pre-main-sequence stars observed at optical wavelengths has been attributed to fluctuations in the mass accretion rate from the circumstellar disk onto the forming star. Detailed models of accretion disks suggest that protostars in the earliest stages of their formation should also exhibit variations in their accretion rates, but these objects are hidden from observation in by their thick natal envelopes of gas and dust. Fortunately, changes in the brightness of the envelope dust at mid-IR to mm wavelengths may be tracked as a proxy for the accretion luminosity. The ongoing JCMT Transient survey is conducting monthly sub-mm monitoring of star forming regions to investigate this, and has found 10% of protostars show secular variations in brightness at about 5%/yr. The JCMT is a single dish telescope however, and can not probe the smallest scales within protostellar envelopes where variability should be strongest. Interferometers such as ALMA offer the resolution and sensitivity to observe small fluctuations at these spatial scales. There are however, many complications for comparing different epochs of interferometer observations. We have developed novel methods for calibrating interferometric data, and applied them to CARMA and ALMA observations separated by a period of eight years for four protostars in Serpens. While we find no brightness variation above a factor of $\sim$2, we cannot test lower levels of variability due to the limited sensitivity of the CARMA observations. We plan future ALMA observations using a well defined and controlled observing strategy to provide robust constraints on models of accretion in the youngest protostars.

3-axis stability of triaxial magnetized molecular cloud core models via the tensor virial theorem

Erica Franzmann *(University of Manitoba)*

(Session : Posters : Star Formation);

We have developed a package called PolCat, which makes use of evolutionary computing techniques to model three-dimensional magnetized molecular cloud cores from submillimetre polarization data. PolCat searches a wide variety of model geometries constrained by maps of polarization and continuum intensity. However, three-dimensional models derived from two dimensional maps are poorly constrained and allow a wide range of geometries, including some with extreme axis ratios very far from equilibrium. While we could manually limit the range of allowed shapes, a more organic method would be to apply a physicality constraint to prefer models closer to stability. Calculating the virial balance for each core provides such a constraint on stability. However, the usual scalar form of virial theorem describes this only in bulk terms. A sharper tool for assessing the stability of our triaxial models is the tensor form, which provides a directional approach to core stability. Since the scalar form of the virial theorem is the trace of the tensor form, it is possible for a core to be in scalar virial equilibrium without being in tensor virial equilibrium. We discuss methods for the efficient numerical computation of the tensor components and their application to modelling triaxial cores. By computing models with and without the tensor virial constraint enabled, we demonstrate that our method provides an effective filter to select physical models of cores without degrading the fit. This addition to PolCat provides an effective and nearly automatic approach to modelling submillimetre polarization maps of cores.

The Grand Smack

Wesley C. Fraser *(Queen's University, Belfast)*

(Session : Solar System);

It is well accepted that the giant planets originated in a more compact, stable, and multi-resonant configuration due to interactions with the gas in the protoplanetary disk. Following the dispersal of the gas, the planets migrated to their current locations through 1) interactions with the planetesimal disk and 2) a dynamical instability during which two or more of the planets experienced mutual close encounters. The latter are necessary to account for the current orbital configuration of the planets. The exact dynamical mechanism which triggered the instability remains an open question. The currently favoured mechanism is the resonant crossing of one of the ice giants and Saturn. Despite accounting for many of the properties of the current Solar System, this scenario has two problematic requirements. Firstly, it demands an extremely compact initial resonant configuration. Secondly, it invokes the presence of a 5th gas-giant in the early Solar System, along with the implicit condition that the 5th planet is ejected! Here we present a new idea, the Grand Smack, in which the instability is triggered by a large impact onto one of the 4 gas-giants. Specifically, we demonstrate that the impact responsible for producing Uranus's large obliquity is also sufficient to cause the system to go dynamically unstable. Our model can broadly account for all the major features of the Solar System's dynamical architecture, including the relative locations of the gas-giants and their orbital excitations, the formation of the Kuiper Belt, and the preservation of the initial low dynamical excitation of the asteroid belt and the terrestrial planets. Critically, compared to models that invoke other instability mechanisms, a broader range of initial orbital configurations is able to reproduce the known Solar System. Our model's strength is that it explains the overall architecture of the Solar System as the result of an event we know has happened - the tilting impact on to Uranus.

Ambient RF in Everyday Life

Pamela Freeman *(University of Calgary)*

(Session : Posters : Instrumentation);

The radio spectrum is flooded with technology that emits at radio frequencies (RF), from private, licensed radios to unlicensed, public Wi-Fi, as well as devices that radiate RF unintentionally. These devices surround us daily, which has led to investigations on possible health effects, on the capability to harvest ambient RF energy, and on interference with other technology. In radio astronomy, our interest in the prevalence and strength of human caused RF reflects our desire to view the sky unobstructed. As my MSc project involves building and characterizing a new correlator for the synthesis telescope at DRAO, the need for radio quiet environments to work in prompted a characterization of my everyday surroundings in RF. I measured two radio astronomy bands (406-410MHz, 1405-1435MHz), two cell phone bands (824-960MHz, 1710-2170MHz) and an unlicensed industrial, science and medical band (2400-2500MHz) using a spectrum analyzer at various public/private, indoor/outdoor, quiet/busy locations in Calgary, Alberta. In this talk, I will share with you my findings; the answers may surprise you!

CIRADA: The Canadian Initiative for Radio Astronomy Data Analysis

Bryan Gaensler *(University of Toronto)*

(Session : Facilities);

Modern radio astronomy pushes computing, algorithms, data storage and visualisation to their limits. To enable new discoveries, we thus do not just need to build telescopes and perform observations, but must find ways to convert the resulting peta-scale raw data sets into advanced science-ready products. The Canadian Initiative for Radio Astronomy Data Analysis (CIRADA) is a newly funded $10M CFI program to produce publicly available images, databases, catalogue and tools, allowing Canadian astronomers to fully exploit the new generation of advanced all-sky radio surveys. Underlying all this is CIRADA's long term goal to establish the Canadian capacity needed to host a science and data centre for the Square Kilometre Array. I will describe the science programs on CHIME, VLASS and ASKAP that underpin CIRADA, and will present the opportunities for the wider community to participate in, contribute to and benefit from this initiative.

Computational Challenges in Next Generation Surveys: Reverberation Mapping with the Maunakea Spectroscopic Explorer

Sarah Gallagher *(Western University)*

(Session : Posters : Instrumentation);

The Maunakea Spectroscopic Explorer is a dedicated 11.25-m spectroscopic survey telescope that will simultaneously obtain thousands of optical/near-infrared spectra. The planning and operations of MSE will require a sophisticated software system to optimize survey design and implementation. Such a system cannot be a post hoc addition to the observatory once built, but must be an integral part of the design process. As a specific case study of survey design optimization, I will discuss reverberation mapping of quasars. The goals of such a program are to measure the black hole masses of thousands of quasars at the peak of the epoch of black hole growth, and to map the structure of their inner regions. The program as envisioned requires repeated observations of thousands of quasars with a relatively low space density, and thus many fibers during the observations will be available for surveys with other science goals. This case study of multi-survey integration and optimization will provide essential information for the next phase of software system design.

Fast Coherent Differential Imaging on Ground-Based Telescopes using the Self-Coherent Camera

Benjamin Gerard *(University of Victoria, NRC Herzberg)*

(Session : Posters : Exoplanets);

Direct detection and detailed characterization of exoplanets using extreme adaptive optics (ExAO) is a key science goal of future extremely large telescopes and space observatories. However, quasi-static wavefront errors will limit the sensitivity of this endeavour. Additional limitations for ground-based telescopes arise from residual AO-corrected atmospheric wavefront errors, generating short-lived aberrations that will average into a halo over a long exposure, also limiting the sensitivity of exoplanet detection. We develop the framework for a solution to both of these problems using the self-coherent camera (SCC), to be applied to ground-based telescopes, called Fast Atmospheric SCC Technique (FAST). Simulations show that for typical ExAO targets the FAST approach can reach $\sim$100 times better in raw contrast than what is currently achieved with ExAO instruments if we extrapolate for an hour of observing time, illustrating that the sensitivity improvement from this method could play an essential role in the future ground-based detection and characterization of lower mass/colder exoplanets.

The prevalence of resonances among large-a transneptunian objects

Brett Gladman *(UBC)*

(Session : Posters : Solar System);

The detached population consists of transneptunian objects (TNOs) with large semi-major axes and sufficiently high perihelia (roughly q > 38 au, but there is no simple cut). However, what constitutes 'large semi-major axis' has been, and continues to be, unclear. Once beyond the apehlia of the classical Kuiper Belt (which extends out to about 60 au), objects with semimajor axes from a = 60-150 au can be detached, but there are a reasonable number of objects in this range known to be in mean-motion resonances with Neptune. Beyond a = 150 au, however, it is a widely-held belief that resonances become 'unimportant', and that a q > 38 au cut (or sometimes q > 50 au) with a > 150 au isolates a set of large semimajor axis detached objects. However, once semimajor axes become this large, the orbit determination of the object discovered near perihelion becomes a much harder task then for low-a TNOs. Because small velocity differences near the perihelion of large-a orbits cause large changes the fitted orbital in semimajor axis, extremely good and long baseline astrometry is required to reduce the semimajor axis uncertainty to be smaller than the few tenths of an astronomical unit widths of mean motion resonances. By carefully analyzing the astrometric data of all known large semimajor axis objects, we show that a very large fraction of the objects are in fact likely in high-order mean-motion resonances with Neptune. This prevealence for actually being resonant with Neptune would imply that hypothesized planets are problematic as they would remove the detached objects from these resonances. Instead, we favor a view in which the large-a population is the surviving remnant of a massive early scattering disk, whose surviving members are sculpted mostly by diffusive gravitational interactions with the four giant planets over the last four gigayears, but whose initial emplacement mechanism (in particular: perihelion lifting mechanism) is still unclear but of critical importance to the early Solar System's evolution.

Searching for nucleus obscuration in ten nearby FR-I Radio Galaxies: A Markov-chain Monte Carlo analysis of infrared spectra

Robert Gleisinger *(University of Manitoba)*

(Session : Posters : Galaxies);

Why are there so many types of active galactic nuclei? Astronomers have proposed numerous active galactic nucleus (AGN) unification models to explain the vast array of different AGN types with a single type of object - a supermassive black hole's accretion disk which is obscured by dusty clouds. Among the most successful of these, at least for high-luminosity AGN, is the "clumpy torus model" formalised by Nenkova et al. (2002). However, the applicability of the clumpy torus model to observations of low-luminosity AGN is controversial. For example, Leipski et al. (2009) found a significant thermal component consistent with a dusty torus in the Spitzer/IRS band of only 4/15 of their sample of Fanaroff and Riley class I (FR-I) radio galaxies. Expanding on the work of Leipski et al. (2009), we present a wide-band infrared spectroscopic analysis of ten nearby FR-I radio galaxies. We used Markov-chain Monte Carlo algorithms to fit a set of models to archival Spitzer/IRS spectra with wide-band behaviour constrained by photometry from the Two Micron All-Sky Survey, Spitzer/IRAC, Spitzer/MIPS, and Herschel/SPIRE. We find that only one of our ten galaxies is best fit by a torus component although four galaxies show thermal narrow-line region components which could be consistent with a torus. We conclude that most of our FR-I radio galaxies do not show evidence of an obscuring dusty torus.

The generalized runaway greenhouse: implications for understanding terrestrial planet atmospheres

Colin Goldblatt *(University of Victoria)*

(Session : Solar System);

The water vapour runaway greenhouse is well known as the inner boundary of the circumstellar habitable zone: a limit exists on the amount of thermal radiation that a moist atmosphere can emit to space, and if more energy is received from the star, there is no stable climate with surface liquid water. This behaviour is, it turns out, quite general amongst the other volatile species: results are shown for carbon dioxide, methane and ammonia. There is a quite narrow range of incident energy space where a condensed volatile reservoir can coexist with a non-trivial atmospheric reservoir of the same species. Results for carbon dioxide and methane correspond well to the current states of Mars and Titan, respectively. Earth would be in a carbon dioxide runaway, were it not for the confounding actions of (bio)geochemistry.

Creating and Calibrating CHIME/FRB, an FFT Beamforming Telescope

Deborah C. Good *(University of British Columbia)*

(Session : Instrumentation);

Fast Fourier transform (FFT) beamforming is poised to revolutionize radio astronomy by reducing the computational cost for beamforming from N-squared to NlogN, drastically increasing the achievable scale of radio telescopes. However, calibration constraints have previously made widespread implementation of FFT beamforming impossible. CHIME/FRB is a novel application of FFT beamforming to the Canadian Hydrogen Intensity Mapping Experiment (CHIME) to search for and localize fast radio bursts, commensally with the cosmology observations. This requires a careful but minimally-intrusive real-time phase calibration and generates an array of 1024 beams, covering a sky area of approximately 250 degrees between 400 and 800 MHz with a spectral resolution of 24 kHz and a time resolution of 0.983 ms. Results from commissioning data show that the calibration and beamforming stages of the CHIME/FRB pipeline are functioning successfully.

Scientific Opportunities with the Large Synoptic Survey Telescope

Melissa L. Graham *(LSST & University of Washington)*

(Session : Posters : Facilities);

The LSST will begin preliminary commissioning next year, and is projected to start its 10-year survey of the southern sky in 2022. I will provide a brief overview of the main science drivers and survey design, and give a status update of the project with a focus on the LSST's Data Management system: the data processing pipelines, the products they generate (images, catalogs, and alerts), the planned user interface for scientific queries and analysis, and the data access timescales and policies that are relevant to Canadian astronomers. I will also cover the current activities of the LSST Science Collaborations, which are actively engaging the community to prepare for LSST, and their existing channels for communication and participation. Finally, I will outline the open opportunities for future users to help LSST refine its observational strategies for the main survey (wide-fast-deep), mini-surveys, and deep drilling fields.

TREVR: Tree-based REVerse Raytracing in Gasoline - now with adaptive ray tracing!

Jasper Grond *(McMaster University)*

(Session : Posters : Galaxies);

We present TREVR (Tree-based REVerse Raytracing), a fast, general algorithm for computing the radiation field in astrophysical simulations in multiple bands. TREVR is fast enough to be coupled on the fly to heating, cooling and dynamics during simulations as well as standard applications such as post-processed mock image creation. TREVR is currently implemented in the Gasoline and ChaNGa parallel SPH codes but is general enough to be added to any code. TREVR combines sources using a tree data structure, similar to many gravity solvers, computing the radiation field in $\mathcal{O}(NlogN)$ time without absorption and $\mathcal{O}(Nlog^2N)$ time with absorption. The absorption can be adaptively refined using a new optical depth criteria unique to TREVR. To illustrate the general applicability of the algorithm we present examples including the Orion nebula HII region and interstellar radiation fields in galaxies.

XMM-Newton and Radio Observations of the Evolved Pulsar Wind Nebula CTB 87

Benson Guest *(University of Manitoba)*

(Session : Posters : Compact Objects);

Pulsar wind nebulae (PWNe) are non-thermal bubbles of relativistic charged particles blown by the magnetized winds of rapidly rotating neutron stars. CTB 87 (G74.9+1.2) is a Galactic Supernova Remnant (SNR) located at a distance of $\sim$6 kpc. Previous Chandra X-ray observations have led to the discovery of the putative pulsar and a pulsar wind nebula (PWN) with cometary morphology, while radio observations show a steep-spectrum source surrounded by larger diffuse emission with a more typical flat spectrum. We present a deep XMM-Newton observation combined with radio observations of the PWN, report on the search for the missing SNR shell, and discuss the physical properties and evolutionary stage of this unique system.

Finding Earth 2: Blue dot or red herring?

Claire M. Guimond *(McGill University)*

(Session : Posters : Exoplanets);

Direct imaging is likely the best way to characterize the atmospheres of Earth sized exoplanets in the habitable zone of Sun-like stars. Previously, Stark et al. (2014, 2015, 2016) estimated the Earth twin yield of future direct imaging missions, such as LUVOIR and HabEx. We extend this analysis to other types of planets, which will act as false positives for Earth twins. We define an Earth twin as any exoplanet within half an e-folding of 1 au in semi-major axis and 1 Earth radius in planetary radius, orbiting a G-dwarf. Using Monte Carlo analyses, we quantify the biases and planetary false positive rates of Earth searches. That is, given a pale dot at the correct projected separation and brightness to be a candidate Earth, what are the odds that it is, in fact, an Earth twin? Our notional telescope has a diameter of 10 m, an inner working angle of $3\lambda/D$, and an outer working angle of $10\lambda/D$ (62 mas and 206 mas at 1.0μm). With no precursor knowledge and one visit per star, 77% of detected candidate Earths are actually un-Earths; their mean radius is 2.3 Earth radii, a sub-Neptune. The odds improve if we image every planet at its optimal orbital phase, either by relying on precursor knowledge, or by performing multi-epoch direct imaging. In such a targeted search, 47% of detected Earth twin candidates are false positives, and they have a mean radius of 1.7 Earth radii. The false positive rate is insensitive to stellar spectral type and the assumption of circular orbits.

Gain Modelling for the Canadian Hydrogen Intensity Mapping Experiment

Sidhant Guliani *(University of British Columbia, Vancouver, BC)*

(Session : Posters : Instrumentation);

CHIME is a new radio interferometer located at the Dominion Radio Astrophysical Observatory (DRAO) in Penticton, BC. The primary goal of CHIME is to constrain the dark energy equation of state by measuring the expansion history of the Universe using the Baryon Acoustic Oscillation (BAO) scale as a standard ruler. CHIME consists of 4 cylindrical reflectors, each populated with 256 dual-polarization antennas along its focal-line. Prior to digitization, each signal chain consists of a low noise amplifier, 50 m of coaxial cable, and a filter amplifier. In order to obtain accurate interferometric imaging, we need to determine the relative complex gain (amplitude and phase vs. frequency) of each analog chain to $\sim$0.3%. The complex gain of each receiver depends primarily on temperature. I will discuss efforts to construct a thermal model of the CHIME analog response and present an analysis of its performance relative to these stringent calibration requirements.

Multi-Archive Query at the Canadian Astronomy Data Centre: One stop shopping for the world's astronomical data.

Stephen Gwyn *(CADC)*

(Session : Posters : Facilities);

Currently, if astronomers want to search for archival data from the world's telescopes, they must visit the websites of several different astronomical data archives. Not only must they visit each site one by one, but these archives each have their distinct features making the exercise somewhat lengthy as one has to learn or re-learn each query system. Therefore, the Canadian Astronomy Data Centre (CADC) has embarked on a project to gather metadata describing the observations available from external astronomical data archives, homogenizes it and makes it searchable via the CADC existing search tool. There are currently five external collections with more to be added over the coming months.

Recent Discoveries in the X-ray Time Domain: Long Term Evolution of GW170817

Daryl Haggard *(McGill University)*

(Session : Compact Objects);

Ambitious X-ray observatories have enabled a rapid expansion in our knowledge of the X-ray time domain. With state-of-the-art facilities like Chandra, XMM Newton, and Swift performing surveys over a decade and counting, variability catalogs are increasingly rich. Meanwhile, high time resolution from the likes of NuSTAR and NICER (and RXTE before them) continue to uncover new physics in individual systems. These efforts have lead to the discovery of the high-energy EM counterpart to the first binary neutron star merger, GW170817, detected via gravitational waves, a likely pulsar-ULX connection, possible magnetar oscillations, X-ray flares from the closest supermassive black hole, Sgr A*, and enabled reverberation mapping of AGN, to name only a few. I will review recent highlights from the X-ray time domain, with an emphasis on GW170817's long term X-ray and radio evolution, and briefly describe what we hope to achieve with upcoming and proposed high energy missions.

Canada and the Maunakea Spectroscopic Explorer

Pat Hall *(York University)*

(Session : Facilities);

A future flagship in 21st century ground based astronomy, the Maunakea Spectroscopic Explorer (MSE) is about to enter its preliminary design phase with a growing partnership after making exceptional progress defining its design and science case. MSE will reuse a large fraction of CFHT's existing facilities while tripling the diameter of the telescope's primary mirror and increasing the height of the enclosure by only 10%. Running as a dedicated spectroscopic facility, MSE will simultaneously deploy over 3000 fibers feeding low/medium resolution spectrometers and 1000 fibers feeding high-resolution ($R \sim 40{,}000$) spectrometers. As a worthy replacement for CFHT, MSE will revolutionize astrophysical studies requiring large spectroscopic datasets: reconstructing the Milky Way's formation history through the chemical tagging of stars, searches for the effects of dark matter on stellar streams, determination of environmental influences on galaxy formation since 'cosmic noon', quasar reverberation mapping through repeat spectroscopy, follow-up of large samples identified in other surveys (Gaia, LSST, SKA, etc.), and many more. Canada has led the development of the science case for MSE, now in the phase of creating the two-year Design Reference Survey, and has taken the lead in designing MSE's Fiber Transmission System, along with other design work. I will update the community on MSE's current status and Canada's role in MSE, and outline a roadmap for future Canadian participation in the technical and scientific aspects of MSE.

Galaxy mergers moulding the circum-galactic medium

Maan H. Hani *(University of Victoria)*

(Session : Posters : Galaxies);

Galaxy evolution is primarily driven by the life cycle of gas. The circumgalactic medium (CGM) is a key part in this cycle, viz. the CGM is a major gas reservoir where inflowing cold gas mixes with outflowing metal enhanced gas and ultimately settles onto the interstellar medium. Galaxy-galaxy mergers have been hypothesized to play a critical role in shaping the CGM's chemical and physical structure. In addition to being a fundamental evolutionary path for galaxies to grow their stellar mass and trigger star formation and AGN activity, galaxy mergers are known to vigorously reshuffle the gas reservoir due to strong tidal torques and feedback processes which are induced by the interaction. However, detailed predictions for the effect of galaxy mergers on the CGM are currently lacking. In this talk, I will present a new analysis of the CGM of major mergers using cosmological zoom-in hydrodynamical simulations. This analysis provides the first constraints on the interplay between mergers and the CGM in a self-consistent cosmological framework. I will demonstrate the long lasting effects of mergers on the metal content of the CGM and its ionization, specifically highlighting the importance of mergers in moulding the CGM of galaxies: increasing its metal content by factors of 2-3, preferentially increasing the covering fractions of high ionization species, and the large radial extent of such enhancements. Finally, I will use these simulations to make predictions of absorption line column densities and metal distributions in the CGM of post-merger galaxies, that can be directly tested with observations (i.e. HST-COS).

Improving SPH radiative transfer accuracy in red novae simulations

Roger Hatfull *(University of Alberta)*

(Session : Posters : Stars);

Contact binary mergers are significant events that have the power to explain many phenomena in the universe. Accurate hydrodynamic simulations of such events are elusive, yet would substantially improve our understanding of the physics involved. High time resolution data exists for red novae primarily in V1309 Sco, which erupted in 2008 and was observed by the OGLE-III, OGLE-IV, and AAVSO projects. These detailed observations are an opportunity for comparison of simulation to reality, and encourage exploration in modeling radiative transfer in the context of Smoothed Particle Hydrodynamic (SPH) code. However, the energy radiated away during the time of the outburst varies from the binding energy by $\sim 10^4$ ergs, so precision within this range is required. We suggest a method for accurately recreating V1309 Sco's donor stellar profile by importing a MESA profile into the SPH code, StarSmasher. In addition, we present a postprocessing code that integrates with SPH code to calculate the outward flux by resolving the photosphere of optically thick particles. Filters can be applied to the flux to compare SPH code to actual observation.

Molecular Gas Properties in the Early Merger System Arp240

Hao He *(Department of Physics and Astronomy, McMaster University)*

(Session : Posters : Nearby Galaxies);

I present results of an ALMA study that explores the physical properties of the molecular gas in the early merger system Arp240. I use spectral line data of 12CO1-0, 13CO1-0 and 12CO2-1 ($\sim$107, $\sim$112 and $\sim$225GHz respectively) for both spiral galaxies in the system, NGC5257 and NGC5258. I focus on analyzing the spectral line data using a radiative transfer model to measure the temperature, number density and opacity of the molecular gas in different areas of both galaxies. I will compare these results to the late merger system NGC2623 to explore the changes in the gas properties in different stages of the merging process.

X10: A Magnetic Cataclysmic Variable with Pole-switching Accretion

Asma Hattawi *(University of Alberta)*

(Session : Posters : Stars);

We analyzed Chandra data of the magnetic cataclysmic variable (mCV) X10 (or W27) in 47 Tucannae. Analysis of the X-ray light curves shows a 4.205 $\pm$ 0.036 hour modulation, which we interpret as the white dwarf (WD) spin period. It also shows that the accretion flow switches between magnetic poles that are $\sim$170 degrees apart, implying a possible asynchronism between the WD spin period and the binary orbital period. Then we roughly constrained the geometry of the system (assuming typical WD parameters and using information obtained from the X-ray spectrum) by simulating a soft X-ray (below 2 KeV) light curve and comparing it to observation.

X-ray spectra of proposed AGNs in bulgeless galaxies

Pavan R. Hebbar *(University of Alberta)*

(Session : Compact Objects);

Identifying and measuring the masses of black holes in small and/or bulgeless galaxies is crucial for studying the co-evolution of black holes and galaxies. The identification (using radio and X-ray data) of a massive black hole and active galactic nucleus (AGN) in the dwarf, bulgeless galaxy Henize 2-10 suggested that massive black holes could precede the growth of galaxies, a significant result that has triggered searches for other such sources. We show that using unbinned X-ray spectra allows searches for emission lines, which can differentiate between supernova remnants and AGN in some cases. We have re-analyzed the X-ray spectra of the claimed AGN in Henize 2-10 using unbinned spectra, and show that a collisionally ionized hot plasma model with strongly super-solar abundances explains the observed spectra much better than a power-law model appropriate for an AGN. We argue that Henize 2-10 does not contain an AGN, but only a starburst (in agreement with the complementary MUSE spectroscopy of Cresci et al. 2017). Our study of another bulgeless galaxy NGC 4178, proposed to host an AGN, shows that a supersolar-abundance hot plasma model is about six times more probable in explaining the X-ray spectra than simple power law model. We will discuss the prospects for emission-line X-ray searches in studying other candidate AGNs, and how these identifications may affect conclusions about how black holes and galaxies co-evolve.

Revisiting the evidence for intermediate-mass black holes in globular clusters

Vincent Henault-Brunet *(NRC Herzberg)*

(Session : Star Clusters);

Intermediate-mass black holes (IMBHs; $\sim 10^3 - 10^4$ solar masses), the possible seeds from which supermassive black holes grew in the early Universe, have been suggested to lurk in the centre of globular clusters (GCs) that survived to the present day. Evidence for 'leftover' IMBHs in GCs however remains controversial. In this talk, I will present comparisons of dynamical models that properly take into account the effect of mass segregation to kinematic and structural data of individual Milky Way GCs. I will revisit recent claims of IMBH detections in some GCs (NGC 6624, Omega Cen, 47 Tuc) and discuss dynamical signatures of populations of dark stellar remnants (white dwarfs, neutron stars, and stellar-mass black holes) in their cores.

Carbon as a diagnostic tool for explosion mechanisms of Type Ia supernovae

Epson Heringer *(University of Toronto)*

(Session : Posters : Compact Objects);

The distribution of carbon in the ejecta of a typical supernova Ia (SN Ia) is important as a diagnostic tool that can be compared against theoretical models; it indicates which regions of the ejecta retain unburned material (either due to mixing or incomplete burning). While other observables are often used for comparison, carbon circumvents some of the uncertainties, which can include non-local thermodynamic equilibrium effects for computing photometry, incomplete nuclear reaction networks for nucleosynthesis calculations, etc. We use a Monte Carlo code to model the radiation transport during the photospheric phase of SN 2011fe. Based on the presence of a carbon signature in the early spectra and its disappearance near maximum light, we are able to constrain the carbon mass fraction across the ejecta. Our results indicate that unburned material is present only in moderate quantities in the regions where intermediate mass elements, such as Si, are produced. From this, explosions models such as the violent merger of two white dwarfs are disfavoured, because too much carbon is predicted to be mixed throughout the whole ejecta. We also find that only very little neutral carbon is present, making it unlikely to influence the NIR spectra, contrary to previously claimed in the literature.

Fostering Local Awareness and Outreach Through Partnering With Museums: The DAO Centennial Experience

James E. Hesser *(NRC Herzberg Astronomy and Astrophysics)*

(Session : EPO);

Notable anniversaries or unusual opportunities open windows for collaboration with local museums that may not include astronomy-focussed outreach in their regular activities or mandate. In turn, museum staff interpretative expertise can significantly enhance the impact of special exhibits developed in partnership with astronomy organizations. Over the past four decades there have been several such collaborative efforts in Victoria with the Royal British Columbia Museum involving differing combinations of NRC Herzberg staff, U. Victoria staff, and community members from the Victoria Centre of the RASC, the newly formed Friends of the DAO, and others. Benefits of such collaborative efforts are particularly well illustrated by the current collaboration between NRC Herzberg and the Royal BC Museum over the past two years to develop the DAO centennial exhibit open to CASCA 2018 participants. The exhibit is designed to travel to other venues. The project includes an education outreach kit for use in schools. We also describe several predecessor activities that illustrate the breadth of successful outreach activities that have been enabled by partnering with local museum staff well experienced in conveying stories to the public in a compelling manner.

Solo Dwarf Galaxy Survey: Isolated Dwarfs in the Local Group

Clare Higgs *(University of Victoria)*

(Session : Posters : Galaxies);

The Solo (Solitary Local) Dwarf Galaxy survey is a volume limited sample of all nearby (< 3 Mpc) and isolated (> 300 kpc from the Milky Way or M31) dwarfs. This survey's wide-field g and i imaging resolves stellar populations, hence we can parameterize these low mass systems and study their faint, extended structures. Comparisons to the well studied satellite dwarf galaxies isolates the evolutionary impact of a large galaxy in close proximity. In addition, the deep, wide field nature of this survey also lends itself to searching for substructure around these dwarfs, both globular clusters and possible faint satellites.

I will present a subset of the closest Solo dwarf galaxies all within the virial radius (1 Mpc) of the Milky Way. This Local Group sample has been characterized using consistent methods, despite their diversity in mass and size. The analysis focuses on extended stellar structure and morphology. We will then examine trends with star formation history, and separation from a large host. This first subset emphasizes the unique challenges and advantages of this survey. The Solo Survey provides detailed look at the extended structure of dwarfs and characterizes the evolution of galaxies in the faint limit.

Faraday tomography of the Milky Way ISM with GMIMS

Alex S. Hill *(UBC/DRAO/Space Science Institute)*

(Session : Posters : ISM);

The Global Magnetoionic Medium Survey (GMIMS) is a project to measure diffuse radio polarization of the entire sky from approximately 400 to 1800 MHz with 40 arcmin angular resolution. These observations will enable Faraday tomography to map the magnetic field in three dimensions over much of the sky. I will present observations from the GMIMS High Band North survey, a 1250-1750 MHz component of GMIMS obtained with the 26m John A. Galt Telescope at the Dominion Radio Astrophysical Observatory. We have combined the GMIMS data with other radio and optical observations to derive information about the global structure of the Milky Way magnetic field toward the Fan Region and the North Polar Spur. I will also discuss the use of Canadian Hydrogen Intensity Mapping Experiment (CHIME) data to provide the northern sky 400-800 MHz component of GMIMS.

The Spectrum of the Universe

Ryley Hill *(University of British Columbia)*

(Session : Posters : CMB);

The cosmic background (CB) radiation, encompassing the sum of emission from all sources outside our own Milky Way galaxy across the entire electromagnetic spectrum, is a fundamental phenomenon in observational cosmology. Many experiments have been conceived to measure it (or its constituents) since the extragalactic Universe was first discovered; in addition to estimating the bulk (cosmic monopole) spectrum, directional variations have also been detected over a wide range of wavelengths. Here we gather the most recent of these measurements and discuss the current status of our understanding of the CB from radio to gamma-ray energies.

Constraining UCD Radio Emission Mechanisms and Implications for the TRAPPIST-1 Planetary System

Anna Hughes *(University of British Columbia)*

(Session : Posters : Exoplanets);

Most terrestrial planets are expected to orbit M dwarfs, so characterizing the stellar environment around these stars is a crucial part of understanding the fraction of potentially habitable planets in the Galaxy. Strong, extended stellar magnetic fields and a high flux of incident energetic particles can threaten surface life on planets hosted by Ultra-Cool Dwarfs (UCDs). While the magnetic field strength and electron energy distribution can be relatively well constrained for early- to mid- M dwarfs, recent observations have shown that UCD radio emission does not fit the same models. The Gudel-Benz relation between x-ray and radio luminosity holds for F to early M stars, but drastically underpredicts radio flux of UCDs. Processes such as the electron cyclotron maser instability or auroral emission fail to explain the radio flux values observed at frequencies >30 GHz. Gyrosynchrotron radiation due to the UCDs' magnetic fields appears to be the most plausible mechanism for the observed emission, but has not been demonstrated conclusively. Gyrosynchrotron radiation is indicative of a substantial magnetic field and accelerates electrons in stellar atmospheres to MeV energies. This could inject high-energy particles into the stellar environment, posing a threat to planet habitability. We present ALMA observations of TRAPPIST-1 at 97 GHz and discuss the implications of its radio emission on the surrounding planetary system.

Results from the Astrosat observatory

John Hutchings *(NRC-DAO)*

(Session : Facilities);

New science investigations and results will be presented from the Astrosat space observatory. Canada has a 5% share in ISROs' Astrosat, as well as participation in the UVIT instrument programs. Astrosat has four X-ray and one UV telescope, working simultaneously. I will give the status of the observatory, some new results, and a summary of the data processing, archive, and proposal pressure.

CHANG-ES – an Overview

Judith Irwin *(Queen's University)*

(Session : Posters : Galaxies);

The CHANG-ES (Continuum Halos in Nearby Galaxies – an EVLA Survey) is a large program constituting over 650 hours of observing time on the VLA and GBT to observe nearby edge-on galaxies. The goal is to examine gaseous halos and the disk-halo connection together with their magnetic fields. This poster will summarize our findings to date, including some new and surprising results on the structure of halo magnetic fields as well as embedded and previously hidden AGNs in galaxies. Images are being publicly released.

Automated Testing of Optical Fibers for the Maunakea Spectroscopic Explorer Project

Farbod Jahandar *(University of Victoria)*

(Session : Posters : Instrumentation);

The high throughput, stability, and durability of optical fibres make them an excellent industrial choice for use in astronomical instrumentation. However, optical fibres do not conserve the etendue of the system, such that when long optical fibres bend, rotate and stretch they can critically impact the quality of the light delivered to the detector. This is characterized as a systematic dispersion in the light output from the fibres, quantified as the Focal Ratio Degradation (FRD). At UVic, we have used the standard collimated beam method, or "ring test," to measure the FRD of MSE-like fibres. The ring test is when the output light from a fibre is not centrally concentrated but is instead distributed in a ring-like pattern due to a high incident angle when the light is injected into the fibre. The ratio of the FWHM to the radius of the ring then determines the FRD. Early ring test results from a sample of MSE-like fibres show an FRD of 5%, which meets the MSE science requirement. In addition, we have automated the ring test for fast, repeatable, and efficient measurements of an individual fibre in multi-fibre bundles. Our future tests will include automated non-static fibres in preparation for the MSE build phases.

Thermodynamics of HII regions: Sh2-158

Gilles Joncas *(Université Laval)*

(Session : Posters : ISM);

HII regions are known to be complex in their structures, kinematics and probably abundances. There are some mysteries behind their physical properties that are still unresolved. The abundance discrepancy problem (ADP) is one of them. Abundance determinations differ according to the use of collisionnal or recombination lines. Many reasons have been put forward to explain the ADP: temperature fluctuations, density or chemical inhomogeneities or a non-Maxwellian energy distribution. We will combine thermodynamic and kinematical approaches to addres this problem and contribute to its solution. We used SITELLE at the CFHT to map the temperature, density and other diagnostic ratios of Sh2-158. A Fabry-Perot interferometer was used at CFHT and the Observatoire du mont Mégantic to obtain the kinematical maps of all the relevant emission lines. Preliminary results will be presented.

The CHIME/FRB Pipeline

Alexander Josephy *(McGill University)*

(Session : Posters : Compact Objects);

In the decade following the discovery of Fast Radio Bursts (FRB), only $\sim$30 of these mysterious sources have been detected. With the large field of view from the Canadian Hydrogen Intensity Mapping Experiment (CHIME) telescope, the CHIME/FRB project will revolutionize the field– potentially detecting tens of events every day. We present an overview of our search pipeline, where 1024 synthesized beams are processed in real time to identify and characterize transient radio signals. This includes dedispersion, three stages of radio frequency interference (RFI) mitigation (with applications of machine learning), known source association, and localization. With commissioning of the system now underway, we are also excited to share the preliminary status of our pipeline's performance.

Photometric Properties of Distant KBOs Observed by New Horizons LOng-Range Reconnaissance Imager (LORRI) at Moderate and High Phase Angles

JJ Kavelaars *(National Research Council of Canada)*

(Session : Posters : Solar System);

From its unique vantage point in the outer Solar System, NASA's New Horizons spacecraft has observed Kuiper Belt Objects (KBOs) at distances ranging from 0.1 to 70 AU and at solar phase angles (α) far larger than those attainable from Earth. On 1-Jan-2019 the spacecraft will make a close (3000km) fly-by of the Kuiper belt object 2014 MU69, covering a very wide range of phase angles during the approach and fly-past. We will review the distant Kuiper belt observations that have been conducted today and set the stage for the first ever close-up examination of an object in the classical Kuiper belt.

The size of Earth's orbit limits Earth-based KBO observations to phase angles $\alpha < 2^\circ$. The LOng-Range Reconnaissance Imager (LORRI) aboard New Horizons. however, can observe KBOs at nearly the full range of solar phase angles, with its viewing geometry limited only by flight rules which prohibit pointing LORRI close to the Sun at $\alpha > 165^\circ$. The sensitivity of LORRI is such that distant KBOs must also have apparent magnitude $V < 21$ in order to be detected. By combining low-phase, Earth-based KBO observations from sources including the Hubble Space Telescope (HST), the Subaru Hyper Suprime-Cam (HSC), and the Canada France Hawaii Telescope (CFHT) with data obtained at higher phase angles by New Horizons' LORRI, we have constructed the first KBO solar phase curves with substantial phase angle coverage using multiple observations at phase angles ranging from $\alpha = 0.06^\circ$ to $\alpha = 74^\circ$. New Horizons' distant KBO targets successfully observed to date include dwarf planets Haumea, Makemake, Quaoar, and 2002 MS4; cold classical KBOs (CCKBOs) 2011 HJ103, 2012 HE85, and 2012 HZ84; and Plutino (15810) Arawn (1994 JR1) (Porter et al. 2016, Astrophys. J. Lett. 828, L15).

We compare the phase functions of these KBOs with those of objects in the Pluto system and other Solar System bodies such as comets,asteroids, and icy satellites. Reflectance measurements at moderate phase angles (e.g. $30^\circ < \alpha < 90^\circ$) constrain physical surface characteristics such as the mean topographic slope, or roughness, while those at extreme phase angles (large and small) constrain directional scattering behaviour and allow us to determine whether particles on these KBO surfaces scatter reflected light preferentially in the forward or backward direction. For KBOs with known geometric albedos, these measurements enable calculation of the phase integral, an important photometric property that characterizes the energy balance on a distant KBO surface. These high-phase angle distant KBO observations will also provide context for the interpretation of New Horizons observations of its Kuiper Extended Mission target, CCKBO 2014 MU69, at a wide range of phase angles. During approach to 2014 MU69, and following the close encounter on 1 January 2019, New Horizons will continue to exploit its capabilities as NASA's only observatory within the Kuiper Belt by acquiring many more distant KBO observations at higher phase angles than those attainable from Earth.

RECON: Studying the Outer Solar System through Citizen Science

JJ Kavelaars *(National Research Council of Canada)*

(Session : EPO);

RECON (Research and Education Collaborative Occultation Network: tnorecon.net) is an innovative project that uses occultation observations from small telescopes in over 50 US sites to determine the sizes and shapes of Trans-Neptunian Objects (TNOs) in the outer solar system. One very attractive feature of RECON is that the participants are mainly high school students, teachers, and amateur astronomers. RECON is thus an excellent way to engage young people in authentic astronomical research, to inspire them to undertake careers in astronomy and physics, and to foster collaborations between schools and amateur and professional astronomers.

We will discuss the activities of the RECON project and our efforts to extend RECON into the Okanagan Valley in BC, which will increase both the length of the network and the chances of successfully observing occultation events. We have identified participants in Osoyoos, Penticton, and Kelowna to date, and are in the process of organize training workshops for interested in participants.

Nightside Temperatures of Highly Irradiated Giant Planets

Dylan Keating *(McGill University)*

(Session : Posters : Exoplanets);

The nightsides of tidally locked planets are sensitive probes of heat transport; detecting flux on the nightside of a tidally locked planet means that energy has been transported from dayside to nightside. We invert phase curves into longitudinally resolved brightness maps, and construct two-dimensional, bolometric maps in order to estimate dayside and nightside effective temperatures, Bond albedos, and day-night heat recirculation fractions for all the hot Jupiters with full-orbit infrared phase curves. For the planets with negative phase curves or brightness maps, we doctor the maps by adding odd sinusoidal modes to the brightness maps before computing the bolometric flux. We find that although dayside temperatures on hot Jupiters are proportional to their irradiation temperatures, nightside temperatures are all approximately 1000K. The three exceptions, WASP-12b, WASP-33b, and WASP-103b, are ultra-hot Jupiters: planets for which hydrogen dissociation and recombination should enhance nightside temperature. More infrared phase curve observations of planets at a range of irradiation temperatures are necessary to determine whether these trends are robust.

KEYSTONE: KFPA Examinations of Young Stellar (O-star) Natal Environments

Jared Keown *(University of Victoria)*

(Session : Posters : Star Formation);

Observations of dust continuum emission from Galactic giant molecular clouds (GMCs) reveal that embedded infrared clusters and massive young stellar objects tend to be located at the intersections of multiple filamentary gas structures. These observations motivate the idea that mass flow along filaments provides the high-density conditions necessary to form stellar clusters and the massive stars (> 8 solar masses) that form within them. This theory has been largely untested, however, due to a lack of large-scale spectroscopic follow-up observations of Galactic GMCs that can reveal the flow of gas along and onto filaments. We present initial results from the KEYSTONE survey, a large project on the 100-m Green Bank Telescope mapping ammonia emission across eleven GMCs. Our ammonia observations not only trace the kinematics of the dense gas in those regions, but also reveal the impact that turbulence and heating have upon forming stellar clusters. We identify over 700 dense gas clumps across the eleven clouds using dendrograms and show that the virial stability of the clumps is highly dependent upon the cloud environment in which they reside. These results suggest that the presence of filamentary intersections may not be the only ingredient for cluster formation.

StarNet: An application of deep learning in the analysis of stellar spectra

Collin Kielty *(University of Victoria)*

(Session : Posters : Stars);

In an era when spectroscopic surveys are capable of collecting spectra for hundreds of thousands of stars, fast and efficient analysis methods are required to maximize scientific impact. These surveys provide a homogeneous database of stellar spectra that are ideal for machine learning applications. In this poster, we present StarNet: a convolutional neural network model applied to the analysis of both SDSS-III APOGEE DR13 and synthetic stellar spectra. When trained on synthetic spectra alone, the calculated stellar parameters (temperature, surface gravity, and metallicity) are of excellent precision and accuracy for both APOGEE data and synthetic data, over a wide range of signal-to-noise ratios. While StarNet was developed using the APOGEE observed spectra and corresponding ASSeT synthetic grid, we suggest that this technique is applicable to other spectral resolutions, spectral surveys, and wavelength regimes. As a demonstration of this, we present a StarNet model trained on lower resolution, R=6000, IR synthetic spectra, describing the spectra delivered by Gemini/NIFS and the forthcoming Gemini/GIRMOS instrument (PI Sivanandam, U. Toronto). Preliminary results suggest that the stellar parameters determined from this low resolution StarNet model are comparable in precision to the high-resolution APOGEE results. The success of StarNet at lower resolution can be attributed to (1) a large training set of synthetic spectra (N $\sim$ 200,000) with a priori stellar labels, and (2) the use of the entire spectrum in the solution rather than a few weighted windows, which are common methods in other spectral analysis tools (e.g. FERRE or The Cannon). Remaining challenges in our StarNet applications include rectification, continuum normalization, and wavelength coverage. Solutions to these problems could be used to guide decisions made in the development of future spectrographs, spectroscopic surveys, and data reduction pipelines, such as for the future MSE.

Using CANFAR with ALMA Data

Helen Kirk *(Herzberg Astronomy & Astrophysics, NRC)*

(Session : Posters : Facilities);

The Millimetre Astronomy Group, in collaboration with the CADC, at NRC-Herzberg is in the process of developing a system to make ALMA data and data reduction more accessible to Canadian astronomers from all backgrounds. Come see our poster to learn more about our efforts!

ALMA Observations of the Circumstellar Disk of the EX Lupi Outburst System

Lewis Knee *(National Research Council)*

(Session : Posters : Disks);

EX Lupi is the prototype of the EXor class of pre-main sequence stars which undergo luminosity variations due to episodic accretion bursts. Using ALMA observations at 0.3" resolution, we resolve for the first time the dust and gas disk around this object. The compact dust continuum disk shows no indications of structures such as clumps, fragments, or asymmetries. Modelling constrains the radius of the dust disk to about 23 au and a dust mass of 33 Earth masses. 13CO and C18O line spectroscopy trace the disk rotation and physical properties. 12CO emission from the disk is detected out to a radius of 200 au and is highly asymmetric, with one side deviating from pure Keplerian rotation. Extended arc-like emission features in blue-shifted 12CO channels is interpreted as the limb-brightened walls of a cavity excavated by an outflow. This is evidence that the bipolar outflow phenomenon persists into the EXor phase, and suggests that EXor and the similar FUor objects form a continuous population of young stellar objects that decrease in outburst/outflow activity over time.

A High Resolution Survey of the Galactic Plane at 408 MHz

Roland Kothes *(Dominion Radio Astrophysical Observatory)*

(Session : Posters : ISM);

We will present a radio continuum survey at 408 MHz covering the Galactic plane between Galactic longitudes of 50 and 195 degrees and Galactic latitudes between -6 and +8 degrees, with an extension to a Galactic latitude of +21 degrees in the Galactic longitude range of 97 to 120 degrees at angular resolution of about 2.8'. Observations were made with the Synthesis Telescope at the Dominion Radio Astrophysical Observatory as part of the Canadian Galactic Plane Survey. The re-calibration of the CGPS 408 MHz data using existing radio source catalogues such as the NVSS and the VLSS created a dataset at for this frequency range unprecedented accuracy of 6% for the flux densities. We will present the calibration procedure resulting in a 408 MHz calibration source catalogue of 7686 sources over the northern sky. We will show the resulting panoramic images at 408 MHz and will give examples of applications of the data to ISM research.

Mixed Aromatic Aliphatic organic nanoparticles (MAON) as carriers of unidentified infrared emission bands

Sun Kwok *(University of British Columbia)*

(Session : Posters : ISM);

The unidentified infrared emission (UIE) phenomenon consists of a family of emission bands, broad emission plateaus, all superimposed on an underlying continuum. While the emission bands are almost certainly due to the stretching and bending modes of aromatic and aliphatic groups, the exact vibrational modes of these bands and the chemical structure of the carrier are not known. We report results of quantum chemistry calculations of large (>100 carbon atoms) molecules with mixed aromatic/aliphatic structures with the goal of identifying the origin of the UIE bands and explore various possibilities of the chemical nature of the UIE carrier.

Gas and Dust in the Most Luminous Galaxy in the Universe

Kevin Lacaille *(McMaster University)*

(Session : Posters : Cosmology);

Sub-millimetre galaxies (SMGs) represent the rarest and most extreme examples of star forming galaxies in the Universe. The most luminous SMGs are found among the brightest sources detected in the wide surveys of the South Pole Telescope (SPT). The SPT has located an intrinsically hyper-luminous galaxy, SPT0348, the most luminous galaxy ever detected in the Universe. Using high resolution images from the Atacama Large Millimeter/Sub-Millimeter Array, SPT0348 has been resolved into two separate SMGs residing at z $\sim$ 5.7 in CO(5-4), N[II], and C[II]. I will present the properties of the gas and dust within and surrounding the galaxies. I will also present kinematical disc modelling and place these results in a cosmological context.

The JCMT Gould Belt Legacy Survey: a multi-cloud comparison of star-forming structures at 850 microns

James Lane *(University of Victoria)*

(Session : Posters : Star Formation);

The JCMT Gould Belt Legacy Survey mapped cold, star-forming dust in nearby (<500 pc) molecular clouds at 850 and 450 microns. We present the first uniform cross-cloud comparison of star-forming structures on multiple size scales. Using a two-step structure identification method, we extract both dense cores and the large scale continuous emission structures in which they reside. We determine the masses, sizes, concentrations, and gravitational stability criteria of the objects, and combine our results with both a catalog of Spitzer-detected protostars and NICEST extinction column density maps. We find that gravitationally unstable structures tend to be compact, contain protostars, and be found in areas of high total column density. A variety of other trends are examined, including: the cumulative mass function, the relationship between central concentration and gravitational instability, and protostar ejection models, among others. In general most regions exhibit remarkable similarities in the properties we study, which suggests an aspect of universality in the low mass star-forming properties of the Gould Belt. We do, however, highlight several notable variations between regions in the context of prior studies.

CASCA Teacher Workshops: An International Collaboration

Mary Beth Laychak *(Canada-France-Hawaii Telescope)*

(Session : EPO);

Hamilton 2015, Winnipeg 2016, Edmonton 2017 and now Victoria 2018, the CASCA teachers' workshop aims to bring real world astronomy knowledge and hands-on activities into local Canadian classrooms. Coordinated between CASCA, Discover the Universe and the Canada-France-Hawaii Telescope, the workshops are free of charge to local teachers and leverage the unique resources of each CASCA conference to provide content rich materials aligned with provincial educational curriculum. This talk will cover the origins of the workshops along with the evolution of the workshop program over the past four years based on the teachers' evaluations.

Resolving the locations of the Crab Pulsar's radio emission

Rebecca Lin *(University of Toronto)*

(Session : Posters : Compact Objects);

The Crab pulsar's radio profile is dominated by two pulse components, the main pulse and the interpulse, comprised entirely of giant pulses. The alignment of the components from radio to gamma observations suggests that the emissions occur near the Crab pulsar's light cylinder radius. It should be possible to verify this through study of the Crab pulsar's scintillation properties. Scattering from structures in the Crab Nebula create scintillation effects which can be used as a lens with a resolution at the pulsar of $\sim$1000 km, comparable to the light cylinder radius. We study this scintillation to measure the physical separation between the two pulse components. To achieve high sensitivity, we resolve the radio-bright nebula using multiple telescopes at large baselines as an interferometer. We look at two observations 10 months apart: the first using the Westerbork array, and the second using the larger European VLBI Network which provide greater signal-to-noise giant pulses detections. Correlations of the giant pulse spectra between the two pulse components in frequency and time can be used to determine the separation between the two emission regions on the sky. We find a significant offset in time in the correlation which suggests that the pulse components arise from distinct physical locations. We then compare our two observations of the Crab with significantly different scattering in the nebula. A change of scattering properties may provide 2-D information on the magnetosphere giving stronger constraints on our result as well as quantify the spatial size of the emitting regions.

Signatures of stellar migration in simulated non-migrating galactic disks

Nic Loewen *(University of Victoria)*

(Session : Posters : Nearby Galaxies);

The present-day observed distributions of stars in the Milky Way is the result of both formation processes and secular evolution, and disentangling their often degenerate signatures is necessary to reconstruct the Galaxy's history. We compare observational results attributed to the radial migration of stars in the Milky Way's disk with the results of a set of simulated galactic disks (which show little to no migration) from the APOSTLE simulations, in order to isolate degeneracies between the effects of migration and disk formation processes. We find that the observed flared chemical subpopulations in the Galactic thin disk can be reproduced by the gradual collapse and enrichment of a flared gaseous disk, without the need for stellar migration. Further analysis of other migration signatures is ongoing.

Replacing dark matter with a slow force

Elizabeth Loggia *(University of British Columbia)*

(Session : Cosmology);

Historically, dark matter emerged to explain inconsistencies in general relativity and galaxy rotation curves, and it has since had success through indirect observation. However, after several decades of searching, there have not been any direct detections, and the constraints on dark matter keep increasing. As such, it is important to explore alternatives. One such alternative idea is an entropic gravity theory where gravity is described as an entropic force, implying it is an emergent phenomenon rather than a fundamental interaction. This theory serves as motivation for the toy model presented here. Instead of dark matter, we consider an extra force. This force couples to baryonic matter and acts in much the same way that gravity does, but with an important distinction: speed. Where gravitational interactions propagate at the speed of light, the interactions from this new force propagate more slowly. The idea is to explore how this delayed gravity-like force affects the dynamics of baryonic matter that were originally explained via dark matter. Theories associated with dark matter have a rich phenomenology. As the parameter space in which dark matter could live continues to shrink with ongoing experiments, this study will provide important insight into the validity of theories alternative to dark matter.

Tracing the cosmic web with Dragonfly

Deborah Lokhorst *(University of Toronto/Dunlap Institute)*

(Session : Galaxies);

The intergalactic medium (IGM), together with its close cousin the circumgalactic medium (CGM), are arguably the most important and least understood baryonic components of the Universe. Denser pockets of the IGM/CGM can be probed in absorption using UV lines, and in emission using radio telescopes. However, both approaches are extremely limited, and we investigate an alternative approach to studying the IGM/CGM, namely direct imaging of the expected ultra-low surface brightness IGM/CGM emission at the wavelength of Hα. We investigate the visibility of three components of the IGM/CGM using the Dragonfly Telephoto Array: (i) the fluorescent 'skin' of local 'dark' HI clouds; (ii) extended halos of galaxies; and (iii) emission from filaments of the IGM itself. Detection of the first two of these is found to be achievable with the current 48-lens Dragonfly array using long integration times (tens of hours). The third component poses a much greater challenge, but may be visible in highly binned low-resolution mode.

Mode changing and giant pulses in the Black Widow Pulsar

Nikhil Mahajan *(University of Toronto)*

(Session : Posters : Compact Objects);

We have made a first detection of mode-switching in a millisecond pulsar. In PSR B1957+20, the Black Widow Pulsar, we find radio pulse emission switching between emission modes (with changes in polarization profiles) with each mode lasting an average of 1.5 seconds. Additionally, we also detect giant pulses in this pulsar. A specific population of these giant pulses seem to be strongly correlated with the mode-switching. This correlation suggests that the emission mechanisms that lead to mode-switching and giant pulses are related and understanding this relationship can help us better understand the nature of radio pulse emission in pulsars.

Pulsar emission amplified and resolved by plasma lensing in an eclipsing binary

Robert Main *(Department of Astronomy and Astrophysics, University of Toronto)*

(Session : Compact Objects);

Radio pulsars scintillate because their emission travels through the ionized interstellar medium via multiple paths, which interfere with each other. It has long been realized that the scattering screens responsible for the scintillation could be used as “interstellar lenses” to localize pulsar emission regions.

I will discuss newly discovered events of extreme plasma lensing in the “Black Widow” pulsar, PSR B1957+20, which occur near the phase in its 9.2 hour orbit in which its emission is eclipsed by its companion’s outflow. During the lensing events, the flux is enhanced by factors of up to $70-80$ at specific frequencies. The strongest events clearly resolve the emission regions, affecting the narrow main pulse and parts of the wider interpulse differently. The events arise naturally from density fluctuations in the outer regions of the outflow, and infer a resolution of our lenses comparable to the pulsar’s radius, about 10 km. Our results thus provide a physical scale of the emission regions, and offer the prospect of mapping their geometry.

The Gemini Planet Imager Exoplanet Survey and the Future of GPI.

Christian Marois *(National Research Council of Canada)*

(Session : Exoplanets);

The Gemini Planet Imager Exoplanet Survey (GPIES) is one of the largest most sensitive direct imaging searches for exoplanets conducted to date, and having observed more than 300 stars the survey is halfway complete. We present highlights from the first half of the survey, including the discovery and characterization of the young exoplanet 51 Eri b and the brown dwarf HR 2562 B, new imaging of multiple disks, and resolving the young stellar binary V343 Nor for the first time. GPI has also provided new spectra and orbits of previous known planets and brown dwarfs and polarization measurements of a wide range of disks. We discuss the constraints placed by the first half of the GPIES campaign on the population of giant planets at orbital separations beyond that of Jupiter. Finally, we will present ongoing work for upgrades that should significantly improve the instrument performances by up to two orders of magnitudes, as well as ongoing validation work at the NEW EARTH Laboratory at NRC.

Modelling the Observed Variability of B-emission Star Pleione

Keegan Marr *(Western University)*

(Session : Posters : Stars);

Pleione (HD 23862, 28 Tau) is a late B-type spectroscopic binary within the Pleiades cluster that is known for its remarkable cyclic variability associated with Hydrogen line emission. The Hα line has been observed to change from a strong emission signature (Be-phase) to a clear double-peak structure with a strong central absorption (Be-shell phase) over a time scale of a few decades. This phenomenon is attributed to a circumstellar disk that has been tilted away from the equatorial plane, likely due to a binary companion. Recently, there has been evidence of the presence of two misaligned disks, an older dissipating disk and a new forming disk. We have acquired Hα spectroscopic observations over a period of more than a decade, from 2005 to 2017, which clearly indicate that Pleione has transitioned from a Be phase to a Be-shell phase during this period. We use the Monte Carlo radiative transfer code HDUST to create detailed models of Pleione's circumstellar environment, and by changing the disk density distribution and the observed inclination of the disk, we reproduce the observed change between the Be and Be-shell phases.

Deficit of clustering in hydrogen intensity maps cross-correlated with galaxies

Kiyoshi Masui *(University of British Columbia)*

(Session : Cosmology);

The precursors to large hydrogen intensity mapping surveys, such as the CHIME, are surveys using modest allocations on existing single-dish radio telescopes. These represent the only detections of large-scale structure using hydrogen mapping to date. I will present results from the survey using the Parkes Observatory, which made a high-significance detection of large-scale structure in cross-correlation with the 2dF Galaxy Redshift Survey at low redshift. The detected cross-correlation probes primarily the small, non-linear scales of structure formation, and it is found that on these scales neutral hydrogen's correlation with galaxies is far weaker than if it were a biased tracer of dark matter. The hydrogen particularly avoids red galaxies, reinforcing the picture that galaxy clusters are depleted.

CASCA's First Climate Survey

Brenda Matthews *(NRC Herzberg Research Centre)*

(Session : Posters : EPO);

Instances of harassment, sexual harassment and discriminatory behaviour within the international astronomical community have been difficult to avoid in the news in the past few years. Many science societies and institutions have undertaken surveys as a means of assessing the experiences of their current membership as a first step towards improving policies aimed at protecting their members. Over a year-long period, the CASCA Board and the Equity and Inclusivity Committee designed the first climate survey for the CASCA membership. The information gathered in this survey is not being used for research purposes, but is being used to understand and improve the professional experience of all our society's members. In the fall of 2017, CASCA distributed the survey to the community; 153 responses were received. We will report some preliminary results to the society.

Denuded Dwarfs Demystified

Marshall L. McCall *(York University)*

(Session : Posters : Galaxies);

Surface brightness profiles of early-type dwarfs (dSphs and dEs) have been studied to identify their placement with respect to the Potential Plane defined by late-type dwarfs (dIs and BCDs). dEs and the most luminous dSphs lie on the Plane, suggesting that they emerged from late-type dwarfs that converted most of their gas into stars. However, there is a critical value of the potential at which dSphs start to fall systematically below the Plane, with the deviation growing as the potential becomes shallower. The displacements are attributed to depletion of baryons through gas loss, smaller galaxies having lost proportionately more gas. The critical potential corresponds to an escape velocity of 50 ± 9 km/s, which is what is expected for gas with a temperature of $13,000 \pm 4,000$ K, typical of a low-metallicity HII region. This suggests that photoionization was responsible for instigating the loss of gas by galaxies with potentials shallower than the critical value, with evacuation occurring over a few tens of millions of years. Because the efficiency with which gas was converted into stars was lower for dSphs with shallower potentials, there should be a minimum baryonic mass for a galaxy below which the stellar mass is negligible.

The Canada-France Imaging Survey: Strategic science in the era of large surveys

Alan McConnachie *(NRC Herzberg)*

(Session : Posters : Galaxies);

The Canada France Imaging Survey (CFIS) is a CFHT Legacy survey involving 40+ Canadians that tackles fundamental questions in astronomy such as the properties of dark matter and dark energy, the growth of structure in the Universe from Galactic to cluster scales, and the assembly of the Milky Way. These ambitious goals are achievable only with homogeneous, multi-wavelength data covering large areas of the sky. CFIS exploits the unparalleled u-band sensitivity, excellent r-band performance and recovered image quality of CFHT through two related components. In addition to the primary "stand-alone" science that focuses on the Milky Way structure and weak lensing, CFIS is also a strategic use of resources for the Canadian community. For example, CFIS is an essential component of redshift derivations for the Euclid mission, which requires complete and contiguous area of the northern sky covered at the required depth, and has been leveraged to provide many Canadians access to this space mission. Further, CFIS has joined forces with Pan-STARRS and is now a major component of a community legacy program, codename UNIONS, that will become the major multi-band wide-field optical survey for the northern hemisphere; essentially, a northern LSST for the static sky. I will discuss these opportunities, the current status of CFIS, and first science results.

Reading Galaxies with MaNGA: Surveying Populations of Stars in Nearby Galaxies

Marcus Merryfield *(University of Victoria)*

(Session : Posters : Nearby Galaxies);

The data products from the Mapping Nearby Galaxies at Apache Point Observatory (MaNGA) survey have the potential to unveil mysteries surrounding how galaxies evolve. The use of integral field spectroscopy in the MaNGA survey allows for the full spectrum fitting of stellar populations in two dimensions. This spatially resolved stellar information for a large sample has the potential to unveil how star formation ceases in galaxies - a process known as 'quenching'. Using data from the latest data release of the MaNGA survey, I have calculated how stellar populations change with respect to their distance from the central bulge of their host galaxy (the age gradient) for each sample galaxy. Then, by seeing how the age gradient of these galaxies changes with respect to the distance of the galaxy from the group/cluster centre and the halo mass of the group/cluster, I show what processes may be dominant in the quenching of galaxies in groups and clusters.

Carl Beals and P-Cygni Profiles

Donald C. Morton *(Herzberg Astronomy and Astrophysics)*

(Session : History);

At the Dominion Astrophysical Observatory from 1927 to 1946 Carlyle Beals became an international authority on Wolf-Rayet stars and the related small class of P-Cygni stars. The latter stars and some Wolf-Rayet stars have narrow absorption lines on the short-wavelength edge of some emission lines often with Doppler velocities exceeding the escape velocity, thus indicating mass ejection from the stellar atmosphere. A far-ultraviolet spectrum obtained in 1965 with a rocket-borne spectrograph discovered the same phenomenon in the normal hot supergiants in the Belt of Orion, demonstrating that the mass loss identified by Beals is a general property of all hot luminous stars.

Linear polarisation from magnetic massive stars

Melissa Munoz *(Queen's University)*

(Session : Posters : Stars);

Magnetic massive stars display periodic variability across numerous observable quantities. This is caused by the presence of an obliquely rotating envelope that surrounds the star. Such a structure is in fact a magnetosphere: a wind channelled region that is held in magnetic confinement. Magnetic O-type stars are known to show phase dependent spectroscopic and photometric variability. Although polarimetric modulations are also expected, they are more rarely analysed. We therefore investigate the amount of linear polarisation produced by the electron scattering magnetospheres of magnetic massive stars. We utilise the recently developed Analytical Dynamical Magnetosphere (ADM) model by Owocki et al. 2016 to simulate the density structure of the magnetosphere. From this, we compute synthetic Q and U Stokes parameters in the optically thin, single electron scattering limit. We apply our Q-U synthesis algorithm to model the linear polarisation variability of HD 191612, a prototypical magnetic Of?p star. Our best-fitted parameters, including the magnetic field strength and magnetic geometry (i.e. magnetic obliquity and inclination angle) agree with previous spectroscopic and photometric modelling results for this star. Our simplified approach to polarimetric modelling will enable us to predict and perhaps even constrain the stellar, wind and magnetic properties of magnetic massive stars.

SPICA - the SPace Infrared telescope for Cosmology and Astrophysics

David Naylor *(University of Lethbridge)*

(Session : Posters : Facilities);

SPICA - an ESA/JAXA observatory class mission under review by ESA as part of its Cosmic Vision M5 call. SPICA will provide imaging, spectroscopic and polarimetric capabilities in the 5 to 350 μm range. SPICA features a ~ 2.5 m class telescope cooled to < 8 K. The combination of a new generation of sensitive detectors and effectively zero emission from the telescope, will allow astronomers to achieve sky-limited sensitivity over this wavelength range. SPICA will be over two orders of magnitude more sensitive than Herschel cover the full wavelength range between 5 and 350 μm, including the missing octave between $28 - 55\mu$m, which lies outside of both the Herschel and JWST domains. SPICA will be the only observatory of its era to bridge the wavelength gap between JWST and ALMA, providing a unique window into fields ranging from galaxy formation and evolution to star-formation and protoplanetary disks. The current status of the project and Canada's potential role will be reviewed.

Indigenist Astronomy: Reflections on developing and teaching an astronomy course centred around Indigenous Knowledges

Hilding Neilson *(University of Toronto)*

(Session : EPO);

Astronomy knowledge in the classroom is typically centred on European history and knowledge. Even though we live and work on Indigenous territory, we rarely include Indigenous perspectives of the sky in our teaching and learning. Being Inclusive of Indigenous methods and knowledges is important to place our astronomy learning terms of location, cultures and offers learners opportunities to explore the Universe using methods other than the standard scientific method. In this talk, In this talk, I will discuss a new program with the goals of learning and honouring Indigenous methods and knowledges of the night sky and creating new learning modules based on those knowledges that can be included in astronomy courses. I will also discuss experiences teaching a first-year seminar course centred around Indigenous knowledge. I will present some lessons and challenges from that experience.

Rotation, Evolution and Period Change in classical Cepheids

Hilding Neilson *(University of Toronto)*

(Session : Stars);

Classical Cepheids are powerful laboratories for understanding stellar physics thank to the relation between Cepheid pulsation and properties. An even better tool is secular period change that is a measure of stellar evolution in real time. In this work, we test the role of stellar rotation, convective core overshooting and enhanced mass loss by comparing population synthesis models of Cepheids with a sample of period change measurements for almost 200 Galactic Cepheids from Turner et al. (2006). We find evidence that all three processes are crucial for understanding Cepheid evolution and we discuss the implications of this result for resolving the long-standing Cepheid mass discrepancy.

Bayesian analysis of the dynamical influence of companion stars in warm and hot Jupiter exoplanet systems

Henry Ngo *(NRC Herzberg)*

(Session : Posters : Exoplanets);

While our solar system's giant planets orbit at separations beyond 5 au, hundreds of giant planets have been found at much closer to their host stars throughout the galaxy. The dynamical history of these giant planets, known as hot Jupiters and warm Jupiters, are not fully known. However, the possibilities can be broadly divided into four categories: 1) in-situ formation, 2) migration due to gas disk interactions, 3) migration due to interactions with other planets in the system, or 4) migration due to interactions with a companion star. Our team's previous work showed that companion stars and planets do not play an important role in the migration of transiting hot Jupiters (orbits less than 0.1 au). This poster extends this work through a survey of 144 systems with warm Jupiters (orbits between 0.1 to 5 au) detected via the radial velocity method. Due to selection effects of radial velocity planet searches, companion stars in these planetary systems are rare. Our survey, the largest of its kind to date, finds eight confirmed binary systems and three confirmed triple systems, including six newly confirmed multi-stellar systems. We combine our results with seven other multi-stellar systems from the literature to determine whether these companion stars influences the orbital parameters of the warm Jupiters. Through a Bayesian analysis, we show that the orbital properties of the warm Jupiters in multi-stellar systems are not different from warm Jupiters in single star systems, indicating that the companion stars are unlikely to play a role in the history of warm Jupiter migration.

NICER monitoring of magnetar 4U 0142+61 during outburst

Melania Nynka *(McGill University)*

(Session : Compact Objects);

Magnetars make up an extraordinary subcategory of neutron stars. While canonical neutron stars or pulsars power their emission rotationally through the loss of angular momentum, magnetars are dominated by the evolution of ultra strong magnetic fields. NICER is well-suited to study the unusual and variable behavior of magnetars which includes large X-ray outbursts, flares, and glitches in timing properties that can be used to probe their extreme environments.

Shortly after the launch of NICER magnetar 4U 0142+61 rapidly brightened in X-ray and was quickly observed by the newly-commissioned observatory. With a subsequent 4-month monitoring program NICER was able to observe the evolution of the spectrum, pulse profile, and timing properties of the magnetar as it slowly transitioned back to its quiescent state. We present the findings from this campaign and discuss the implications for the structure and physical processes that govern magnetars and their magnetospheres.

The Stability and Limits of Tightly-packed Exoplanet Systems

Alysa Obertas *(University of Toronto, CITA)*

(Session : Posters : Exoplanets);

Neighbouring pairs of exoplanets in observed systems are very closely spaced, roughly 4 times closer than the inner Solar System's terrestrial planets. These tightly-packed systems, which typically host four or more planets all with periods under 150 days, are ideal for probing the dynamics and stability of multi-body systems. N-body simulations suggest that observed systems are packed close to their dynamical limit, but the mechanism setting this limit is not yet understood. We will present a set of numerical integrations demonstrating that the stability times of synthetic planetary systems can plummet by several orders of magnitude near mean motion resonances (MMRs), i.e. when planets' orbital periods are integer ratios. We will discuss how MMR overlap in tightly-packed systems leads to dynamical instability, our plan to test this mechanism, and the implications it has on sculpting observed systems to their present-day architectures.

Rotation Measures for studying the Galactic Magnetic Field: Is Extended the new Compact?

Anna Ordog *(University of Calgary)*

(Session : Posters : ISM);

Magnetic fields are believed to play an important role in stellar and interstellar processes, with the large-scale Galactic magnetic field (GMF) likely being integral to the formation and evolution of the Milky Way. For this reason, accurately determining the present-day GMF structure is indispensable for a complete understanding of Galactic dynamics. We present an analysis of a measurement technique that holds great promise in contributing to achieving this goal. One of the most valuable techniques for indirectly observing the GMF is to determine Rotation Measures (RM) for different lines of sight through the Galaxy by observing how Faraday rotation of polarised emission varies with wavelength. Typically, compact sources are used as RM probes of the interstellar medium (ISM), because their emission can be approximated as originating from a single point in space, with Faraday rotation occurring primarily due to the magnetized plasma of the ISM. However, there is an abundance of data in the form of extended, polarised emission from synchrotron radiation within the ISM, which has not yet been thoroughly investigated. Extended emission RMs are more difficult to interpret than compact source RMs due to both emission and Faraday rotation occurring along the entire line of sight. Using polarisation data from the Canadian Galactic Plane Survey (CGPS), we compare RMs of extended emission to compact source RMs along similar lines of sight. We investigate how the two types of RM sources compare in different regions covered by the CGPS, and hypothesize about the possible causes of variation. The results from this study will lead to a better understanding of how to interpret extended emission RMs, which will be invaluable in continued studies of the GMF.

MICHI, A Thermal-Infrared Instrument for the TMT

Chris Packham *(Univeristy of Texas at San Antonio)*

(Session : Posters : Instrumentation);

With the imminent launch of the JWST, the field of thermal-IR astronomy will enjoy a revolution. It is easy to imagine that all areas of IR astronomy will be greatly advanced, but perhaps impossible to conceive of the new vistas that will be opened. To allow both follow-up JWST observations and a continuance of work started on the ground-based 8m's, we continue to plan the science cases and instrument design for a thermal-IR imager and spectrometer for early operation on the TMT. When combined with the mid-IR adaptive optics (AO) system (MIRAO), the instrument will afford $\sim$15 times higher sensitivity and $\sim$4 times better spatial resolution (0.07") with a greatly improved and stable Strehl ratio at 10um compared to 8m-class telescopes. Compared to the JWST, MICHI will afford $\sim$4.5 times improved spatial resolution and improved high-contrast imaging. Further, through exploiting the TMT's large collecting area we plan a high-dispersion spectroscopy mode, unrivaled by the JWST and other space-based observatories. Such capabilities offer the possibility for transformative science, as well as 'workhorse' observing modes of imaging and low/moderate spectral resolution. New technology advances hold great promise to significantly improve previous instrument concepts. We present the current status of our science cases and the instrumentation plans, harnessing expertise across the TMT partnership. We especially welcome the involvement of the Canadian community. This instrument was recently proposed by the MICHI team as a second-generation instrument in the upcoming call for proposals.

Knowns and unknowns of FRBs

Ue-Li Pen *(CITA)*

(Session : Posters : Compact Objects);

I summarize my interpretations of what we have learned about FRB's, overview some potential source mechanisms, point out some common misconceptions, and speculate on future theoretical, observational and conceptual developments.

The chaotic history of ultra-short-period planets

Cristobal Petrovich *(Canadian Institute for Theoretical Astrophysics)*

(Session : Posters : Exoplanets);

Over one hundred of rocky planets in very short orbital periods (<1 day) have been discovered by the Kepler mission. These planets, known as ultra-short-period (USP) planets, are unlikely to have attained their current orbits when their birth protoplanetary disk were present, posing a challenge for planet formation theories. We propose a scenario in which these planets reach their orbits by high-eccentricity migration driven by secular chaos from outer planetary companions. This scenario naturally explains the observation that the USP planets have more distant companions than their longer-period counterparts, while still fitting in the overall orbital architecture of the Kepler planets. I will describe our predictions for the spin-orbit angles and properties of the companions of USP planets that can test our proposal in preparation to the upcoming discoveries from TESS. Broadly speaking, our proposed scenario situates the USP planet population in the context of the solar System through Mercury's chaotic evolution and hints a common origin with the population of hot Jupiters.

Cosmological Parameter Sensitivity Forecasts for CHIME

Tristan Pinsonneault-Marotte *(University of British Columbia)*

(Session : Cosmology);

The Canadian Hydrogen Intensity Mapping Experiment (CHIME) is a transit interferometer located at the Dominion Radio Astronomy Observatory in Penticton, BC. It is designed to map large-scale structure in the universe by observing 21 cm emission from the hyperfine transition of neutral hydrogen between redshifts 0.8 and 2.5. CHIME will perform the largest volume survey of the universe yet attempted and will characterize the BAO scale and expansion history of the universe with unprecedented precision in this redshift range. CHIME achieved first light in the fall of 2017 and instrument commissioning is underway. I will present sensitivity forecasts for CHIME and derive constraints on several cosmological parameters given CHIME's nominal survey. CHIME's broad redshift range will enable tight constraints to be placed on the Hubble constant, independent of CMB or local recession velocity measurements. Precision measurements in this redshift range will shed new light on the tension between direct measurements of the Hubble constant vs. those inferred from high-redshift observations, notably the CMB anisotropy.

Dynamic Localized Turbulent Diffusion and its Impact on the Galactic Ecosystem

Douglas Rennehan *(University of Victoria)*

(Session : Posters : Galaxies);

Developing detailed predictive models for the evolution and observed properties of galaxies is an immense challenge due to the large number of complex interconnected processes involved, and the huge dynamic range in spatial and temporal scales over which they operate. One critical, often overlooked, aspect is properly modelling the re-distribution of fluid properties such as thermal energy, momentum, and metals in highly turbulent, gaseous environments. The majority of simulations avoid modelling this aspect or use models known to over-mix these fluid properties in non-turbulent flows. Here we present a study on the first usage of a dynamic localized turbulent mixing model in cosmological simulations based on the work of Germano et al. (1991), where we investigate the impact of localizing redistribution of fluid properties to only those regions identified as turbulent. In a series of isolated and cosmological experiments, we find that this maximally impacts the gas-phase metallicity distributions associated with the interstellar and circumgalactic media, where the dynamic localised model predicts less mixing than the over-mixing case. Specifically, we find that the mass of gas with [Z] > -5 in the cool circumgalactic medium is halved when using the dynamic model compared to the over-mixing case. The dynamic localised turbulent mixing model is not limited to cosmological simulations and finds general use in any hydrodynamical simulation including stellar interiors, planetary formation, and star formation.

Quenching low-mass satellite galaxies: evidence for a critical ICM density

Ian Roberts *(McMaster University)*

(Session : Posters : Galaxies);

We leverage a sample of SDSS galaxy clusters with high-quality Chandra X-ray coverage to directly study the influence of the dense intracluster medium (ICM) on the quenching of satellite galaxies. With >3000 satellite galaxies across 33 clusters, we show that the quenched fraction of low-mass galaxies is independent of ICM density below a critical density ($\rho_{\rm crit} \sim$ few $\times\ 10^{-29}\,{\rm g\,cm^{-3}}$) and increases sharply at higher densities, near the cluster centres. This trend is well matched, both qualitatively and quantitatively, by a simple analytic model of ram pressure stripping where quenching is efficient when more than 60 per cent of the pre-infall cold gas reservoir in a galaxy becomes susceptible to stripping. We interpret these results in terms of a model where low-mass satellites are rapidly quenched when they reach a critical ICM density after infall. Our findings are consistent with the 'delayed-then-rapid' picture of satellite galaxy quenching.

Journey to the Center of the Super Earth

Leslie Rogers *(University of Chicago)*

(Session : Exoplanets);

Sub-Neptune, super-Earth size exoplanets are a new planet class. Though absent from the Solar System, they are found by microlensing, radial velocity, and transit surveys to be common around distant stars. In this talk, I'll review both recent developments and outstanding puzzles in our understanding of the nature and origin of these enigmatic planets.

Water detection, methane deficiency, and metallicity constraints for the atmosphere of the warm Saturn-mass exoplanet HAT-P-18b

Steven Rogowski *(Université de Montréal)*

(Session : Exoplanets);

One of the most powerful and actively employed techniques for studying exoplanet atmospheres is transmission spectroscopy. While earlier work with this method focused on "hot-Jupiters" with masses $\gtrsim M_J$ and equilibrium temperatures of a few 10^3 K, more recent studies have extended our knowledge of atmospheric properties into the regime of sub-M_J gas giants and/or those with cooler ($\lesssim 10^3$ K) equilibrium temperatures. Even so, there remain only a dozen or so such studies for these sub-Jupiter mass exoplanets on wider orbits, which appear to be a far more common outcome of planet formation than hot Jupiters. Here, we present the first such analysis of the warm, Saturn-mass exoplanet HAT-P-18b using HST/WFC3 and *Spitzer* transit observations. In addition to a strong (5σ) detection of $\mathrm{H_2O}$ absorption at 1.4 μm in the planet's atmosphere, we derive an upper limit for its atmospheric metallicity and find a reduced $\mathrm{CH_4}$ abundance relative to expectation assuming Solar composition. This work contributes to our understanding of the processes that govern planet formation and evolution while offering an opportunity to hone our analysis and modeling of transit spectra in preparation for future observations with JWST.

Properties of the Lenses in the South Pole Telescope Survey

Kaja Rotermund *(Dalhousie University)*

(Session : Posters : Galaxies);

We present the properties of ~ 100 lenses uncovered in the South Pole Telescope (SPT) survey of dusty, thermal spectrum sources over 2500 deg^2, the first time a large, uniformly source-selected sample of strong gravitational lenses has been assembled. We present optical and near-infrared imaging identifying the lenses, and spectroscopic redshifts complete for 50% of the sample. From these we derive K-band luminosities and inferred stellar masses for the lenses. We compare the properties of the lenses to other lenses discovered through other means (SLACS, BELLS, Herschel), and highlight various aspects of our source-selected sample. Our lens sample clearly extends to higher redshifts and shows a larger diversity in lens masses and morphologies than optical lens-selected samples. We discuss implications for lensing cross sections and future lensing surveys.

Local Environment Impact on Extragalactic Star-forming Regions

Laurie Rousseau-Nepton *(CFHT)*

(Session : Posters : Star Formation);

Star formation is a self-regulatory mechanism that drives galaxy evolution. Star-forming regions, and more particularly HII regions containing one or more massive stars, are ideal laboratories to study the star formation process. Massive stars inject energy in the surrounding gas from photoionization, stellar winds, and supernovae, and also enrich the local element abundances of the gas. The slope of the HII region Hα luminosity function and their size are known to vary between galaxies, but the physical explanation for these discrepancies remains unknown. Also, among the HII region population, variations in mass, brightness, and spatial extent are observed and are still not fully understood. Possible differences in their stellar initial mass function have even been reported in some cases. What influences these characteristics in the local environment of an HII region? To get insights on the small-scale physics involved in the star formation process and what affects it, one needs to dissect large samples of HII regions and study them individually in their environmental context. In this presentation, we will show the effort deployed to put constraint on how stars form in different galactic environments using SITELLE, the imaging Fourier transform spectrograph at the Canada-France-Hawaii Telescope.

Is Kepler-33 Dead Inside?

Jason Rowe *(Bishop's University)*

(Session : Posters : Exoplanets);

Kepler-33 (KOI-707, KIC 9458613) is a Kp = 14 star with five validated transiting planets ranging in period from 5 to 41 days. The planets are in nearly co-planar orbits with a remarkable similarity of the observed transit durations when appropriately scaled to orbital periods and can be understood as the consequence of an ensemble of planets transiting the same star with similar impact parameters. The planetary system is closely-packed dynamically and thus transit-timing-varitions can be observed. Photodynamical analysis of transit times provides a strong constraint on the eccentricity of the orbiting planets which allows for a precise measurement of the mean stellar density of the host star. The combination of spectroscopy to measure atmospheric metallicity, temperature and gravity with dynamical constraints place interesting constraints on evolutionary models of the host star. Models show a degeneracy in solutions. Kepler-33 is either a 1.2 solar mass star on the sub-giant branch with shell burning or a 1.4 solar mass star that is undergoing core contraction before on the onset of shell burning. With upcoming GAIA parallax data, we expect to break the degeneracy and determine if Kepler-33 is indead 'Dead Inside'. Such studies are only possible due to the existence of transiting extrasolar planets which provide 'astroseismic' constraints on fundamental stellar parameters.

Our Rapidly-Evolving Understanding of the Non-thermal Afterglow of Neutron Star Merger GW170817

John Ruan *(McGill University)*

(Session : Compact Objects);

The multi-messenger detection of both gravitational waves and electromagnetic emission from neutron star merger GW170817 is one of the most exciting discoveries in decades. Although thermal optical/IR emission from the kilonova faded on timescales of days, the non-thermal radio/X-ray afterglow continues to brighten up to 160 days post-merger. I will discuss current post-merger models for the observed non-thermal afterglow, including structured jets and mildly-relativistic cocoons from short gamma-ray bursts. Looking ahead, LIGO/Virgo will begin Observing Run 3 in Autumn 2018 after sensitivity upgrades, and I will discuss the implications of current post-merger models for new multi-messenger discoveries in the near future.

Increased streaming instability growth rates from vertical dust settling

Josef J. Rucska *(McMaster University)*

(Session : Disks);

The mechanisms by which grains in protoplanetary disks grow to planetesimals are poorly constrained. Small grains collide and stick to build larger objects. However, around one metre, current models expect collisions to be primarily destructive. Metre-sized objects also radially drift rapidly into the star. The streaming instability (SI) could overcome these barriers by quickly forming larger objects. We present simulations of dust evolution in shearing boxes using the Athena astrophysics code. Squire and Hopkins (2017) analytically predict that including a vertical dust streaming velocity enhances the growth rates of the SI even for low dust mass fractions and small grain sizes. We aim to demonstrate these enhancements in numerical simulations. This work seeks to show that the streaming instability is robust, and hence a viable mechanism for overcoming the fragmentation barrier.

The R-Process Alliance: Newly Discovered r-Process Enhanced Metal-Poor Stars in the Milky Way Halo

Charli Sakari *(University of Washington)*

(Session : Stars);

The rapid (r-) neutron-capture process is responsible for creating many of the heavy elements in the Universe, but the primary astrophysical nucleosynthetic site of the r-process still remains debated. The discovery and optical follow-up of the GW 170817 has demonstrated that neutron star mergers can create r-process elements—however, open questions remain as to whether neutron star mergers are responsible for all the r-process elements across cosmic time. The R-Process Alliance (RPA) is a collaboration with the goal of investigating r-process nucleosynthesis across cosmic time. I will present the results from an RPA northern hemisphere survey of stars in the Milky Way halo, conducted at Apache Point Observatory, in which I have identified a large number of metal-poor stars ([Fe/H] < -1.5) that are enhanced in r-process elements ([Eu/Fe] > 0.3; five have [Eu/Fe] > 1). The detailed abundance patterns in these stars, the degree of r-process enrichment, and kinematic data from Gaia all provide valuable constraints on where these stars originated, what physical conditions were necessary to create the r-process pattern, and often such nucleosynthetic events must occur.

The repeating Fast Radio Burst and future prospects from CHIME/FRB

Paul Scholz *(DRAO/NRC)*

(Session : Compact Objects);

Fast Radio Bursts (FRBs) are bright millisecond-duration radio bursts of unknown extragalactic origin. Their durations and energetics imply that they involve compact objects. The discovery of repeat bursts from FRB 121102 in Fall 2015 using the Arecibo telescope showed that the source can repeat and thus cannot be explained by a cataclysmic origin. It is as yet unclear whether this applies to the entire FRB population, or a subset. The repeating nature of FRB 121102 allowed the first, and to date only, subarcsecond localization of the bursts which led to the identification of the host galaxy to be a high-metallicity dwarf. The CHIME/FRB project at DRAO in Penticton BC will utilize the large field of view and sensitivity provided by the Canadian Hydrogen Intensity Mapping Experiment (CHIME) to find several to dozens of FRBs per day and reobserve the same locations on the sky daily, giving it unparalleled efficiency to discover repeating FRB sources. In this talk, I will review our knowledge of FRB 121102 and what it means for the wider FRB population as well as the prospects for expanding our understanding of the FRBs using CHIME-discovered repeating sources.

M1-67: this nebula that we used to know!

Marcel Sévigny *(Université Laval)*

(Session : Posters : Stars);

Thanks to SITELLE, an imaging Fourier transform spectrometer (iFTS), standards in spectroscopy have changed concerning large and expanded objects as nebulae, like M1-67, WR nebula formed by the ejections of its central Wolf Rayet star WR 124. Although the latter is well documented and a lot studied in the past, our new observations are more than promising, revealing major characteristics so far ignored by previous papers, unable to cover completely M1-67. Whether we're talking about its bipolar ejections, those important abundance distinctions or even its spatial velocity distribution, confirming the presence of one shell or even more, M1-67 has just started to reveal his secrets to us.

Towards a Galactic Distribution of Planets: Lessons from Spitzer Binary Lenses

Yutong Shan *(Harvard University)*

(Session : Planets and Disks);

Gravitational microlensing can characterize compact objects ('lenses') at kpc distances. However, important physical properties of the lensing system, such as mass and distance, are often degenerate. Simultaneous observation from the ground and a satellite can measure the 'microlensing parallax', which disentangles the physical parameters to constrain the exact location and nature of the lens. Since 2014, the Spitzer microlens parallax campaign has observed hundreds of events and yielded a dozen well-characterized binaries and planet systems. We describe the modelling of one system, OGLE-2014-BLG-0962, a low-mass stellar binary residing close to the galactic centre. The current Spitzer sample suggests an excess occurrence of binaries and planets at an intermediate distance (3-5 kpc) towards the Galactic centre. This demonstrates that the method for mapping the Galactic distribution of exoplanets can produce a statistically significant result even with a sample of only 12 objects. Also, in the absence of satellite data, Bayesian analysis with a galactic model is customarily used to infer physical properties, though its accuracy has rarely been tested. We use the Spitzer sample to confirm that the Bayesian predictions for the physical properties are accurate (if imprecise) on the whole.

The Curious Molecular Gas Conditions in a z=2.6 Radio-loud Quasar

Chelsea Sharon *(McMaster University)*

(Session : Posters : Galaxies);

Theoretical work suggests that AGN play an important role in quenching star formation in massive galaxies. In addition to molecular outflows observed in the local universe, emission from very high-J CO rotational transitions has been one of the key pieces of evidence for AGN directly affecting the molecular gas reservoirs that fuel star formation. However, very few observations of $J_{upper} > 9$ transitions exist for galaxies in the early universe. Here we will present the peculiar molecular gas conditions in MG 0414+0534 (MG 0414 hereafter), one of the few high-z galaxies with very high-J CO detections. MG 0414 is a strongly lensed IR-bright radio-loud quasar with broad Hα emission at z = 2.6390. We recently confirmed the CO(3-2) detection from Barvainis et al. (1998), but were unable to detect the CO(1-0) line. The 3σ lower limit on the 3-2/1-0 line ratio (in units of brightness temperature) is r3,1 > 5.72, which is significantly higher than the r3,1 < 1 typical for thermalized optically thick emission in other z $\sim$ 2-3 AGN host galaxies. In addition, the CO(11-10) line was detected to high significance using the Atacama Large Millimeter/submillimeter Array, and the CO(11-10) line FWHM is nearly double that of the CO(3-2) line. We will discuss possible explanations for the peculiar line ratios in MG 0414 (such as optically thin emission, molecular outflows, and differential lensing) and what the origin of these ratios imply for molecular gas observations of other high-z AGN host galaxies.

Surprising activity of A-type stars revealed by Kepler: are magnetic fields the culprit?

James Sikora *(Queen's University)*

(Session : Posters : Stars);

A recent analysis of photometry obtained using the Kepler spacecraft has revealed the highly unexpected result that approximately 40% of main sequence A-type stars exhibit periodic variability that may be attributable to starspots. This is surprising in light of the fact that such activity is normally associated with the presence of magnetic fields, which are rare amongst stars much more massive than the Sun. Furthermore, a significant number of the Kepler A-type stars exhibit unusual signals in their periodograms, which have been speculatively attributed to a high frequency of hot Jupiters orbiting these stars. We have recently begun a spectroscopic survey of a subsample of the stars found to be exhibiting both of these unexpected properties. This survey is designed to test two specific hypotheses related to these discoveries including if spotted A-type stars are substantially more common than previously believed. We will summarize our preliminary findings and discuss our ongoing efforts to understand the origins of the discoveries.

NSF's National Center for Optical-Infrared Astronomy - Benefits for Canada!
David Silva *(AURA/NOAO)*
(Session : Facilities);

At the request of the U.S. National Science Foundation (NSF), the Association of Universities for Research in Astronomy (AURA) will combine the current activities of the Gemini Observatory and National Optical Astronomy Observatory (NOAO) into a single administrative organization and then add the planned activities of LSST Operations as they ramp up. This new organization will be called the National Center for Optical-Infrared Astronomy (NCOA). The transition to NCOA has already started and will be completed over several years. Strictly respecting the authority and autonomy of the LSST Operations and Gemini Observatory governance boards is a requirement. This talk will provide a concise NCOA overview and then discuss how NCOA can help enable key Canadian priorities such as the Thirty Meter Telescope (TMT), the Maunakea Spectroscopic Explorer (MSE), and data-intensive astronomy as well as sustain a healthy and high-impact Gemini Observatory.

CFHT - Current Status and Future Plans
Doug Simons *(CFHT)*
(Session : Facilities);

An update of progress made on many fronts at CFHT over the past few years will be provided with a particular emphasis on SPIRou, the latest instrument to arrive at CFHT. Future plans based upon evolving operations and instrumentation, as well as MSE, will be summarized. Thoughts about the challenges to and future of Hawaii astronomy in the 21st century will also be presented.

Virial Stability of Molecular Clouds: Direct Estimation of Gravitational and Kinetic Energy from Observations
Ayushi Singh *(University of Toronto)*
(Session : Star Formation);

The stability of molecular clouds is often characterized by the virial parameter, which is a comparison between kinetic and gravitational energy. Maps of line tracers are used to provide the kinetic information, whereas the gravitational energy is mainly parameterized by the estimated mass and effective radius of the cloud. This requires assumptions about the structure of the cloud. I will present a new strategy for obtaining the virial ratio that involves a direct estimate of gravitational and kinetic energy with minimal assumptions. I will discuss the result of this method tested on simulated clouds and aim to apply it to observations of the Gould Belt regions. Ammonia observations from the Green Bank Telescope will be used to estimate the kinetic energy, while gravitational energy will be calculated using the column density maps that I have produced from Herschel Space Observatory dust continuum emission maps.

Gemini IRMOS - A scientific and technical pathfinder for AO-fed, multi-object imaging spectroscopy

Suresh Sivanandam *(University of Toronto)*

(Session : Instrumentation);

We have been funded by CFI to construct the Gemini Infrared Multi-Object Integral Field Spectrograph (GIRMOS), which will carry out simultaneous high-angular-resolution, spatially-resolved infrared spectroscopy of four objects within a two arcminute field of regard. This capability does not currently exist anywhere in the world and offers significant gains over a very broad range of scientific topics in astronomical research. For example, current scientific programs for high redshift galaxies are pushing the limits of what is possible with infrared spectroscopy at 8-10-meter class facilities by requiring several hours of observing time per target. When combined with adaptive optics, multiplexing, the observation of multiple objects simultaneously, is absolutely necessary to make effective use of telescope time and obtain statistically significant samples for high redshift science. With an expected commissioning date of 2023 and an overall goal of becoming a facility-class instrument at Gemini, GIRMOS's capabilities will also make it a key follow-up instrument for the James Webb Space Telescope when it is launched next year, as well as a true pathfinder for future TMT multi-IFU spectroscopic instrumentation. I will provide an overview of the instrument's capabilities and opportunities for the Canadian community to engage in its development. More details of key Galactic and extragalactic scientific programs will be given in another talk.

Gas-rich dwarfs as ultra-diffuse galaxy progenitors: constraining formation models with deep HI observations

Kristine Spekkens *(Royal Military College of Canada)*

(Session : Posters : Galaxies);

We constrain formation models for ultra-diffuse galaxies (UDGs) in dense environments – red systems with stellar masses akin to dwarf galaxies but effective radii comparable to that of the Milky Way – using deep HI observations of candidate progenitors in the field. Given their faintness in the optical, distance and dynamical mass measurements for UDGs remain scarce; nonetheless, the available data suggest that many are low surface brightness dwarfs. How are UDGs related to gas-rich field dwarfs, and what are their evolutionary histories? Numerical simulations offer two distinct possibilities: UDGs may stem from the high-spin tail of the dark matter halo distribution, or their large effective radii may arise from gas outflows during past star formation episodes. These scenarios imply different physical properties for UDG progenitors in the field, which we constrain by characterizing their HI reservoirs. We have detected HI in five blue UDGs around Hickson Compact Groups using the GBT, finding low-mass objects with high-spin halos and gas richnesses that correlate with their effective radii. In this contribution, we will confront these observations with predictions from UDG formation models to test the hypothesis that gas-rich dwarfs are UDG progenitors. We will also report on our on-going campaign to follow up dozens of UDG candidates in the Coma cluster outskirts identified in DESI pre-imaging data in HI with the GBT, yielding the first measurements of their gas content as a function of environment, colour, surface brightness and dynamical mass.

SAFECAT: the Herschel SPIRE Automated spectral Feature Extraction CATalogue

Locke Spencer *(University of Lethbridge)*

(Session : Posters : Instrumentation);

The European Space Agency Herschel Space Telescope provided the first full-sky and broad-band access to the cosmos in the Far-Infrared (FIR) spectral region. Herschel was comprised of three instruments which conducted imaging and spectroscopy in the FIR, including the Spectral and Photometric Imaging Receiver (SPIRE), with the Canadian contribution to SPIRE directed by the University of Lethbridge Astronomical Instrumentation Group.

We present the creation, validation, and exploration of the SPIRE Spectral Feature Finder (FF) Catalogue, a spectral line catalogue based on an automated custom spectral line fitting algorithm. The SPIRE FF presents line and continuum parameters based on the spectral line fitting of ALL of the Herschel/SPIRE spectrometer observation data, including both single-pointing and mapping modes. The publicly available, and searchable, spectral line catalogue is available online through the Herschel Science Archive: www.cosmos.esa.int/web/herschel/spire-spectral-feature-catalogue.

A fresh look at substructure in the Virgo Cluster with the Next Generation Virgo Cluster Survey

Chelsea Spengler *(University of Victoria)*

(Session : Posters : Galaxies);

Galaxy clusters are valuable tools for constraining large-scale structure formation, cosmological models, and the role of environment in galaxy evolution. Given its proximity and its clear complex substructure, the Virgo Cluster is an ideal choice for exploring these topics. The unprecedented depth and coverage of the Next Generation Virgo Cluster Survey, expanding our sample of Virgo Cluster members to new low-mass regimes, enables a new look at the structure of this dynamically young cluster. In this talk, I will introduce the use of a novel density-based hierarchical clustering algorithm to identify substructures and assign galaxy membership to each group. In addition, I will present a comparison of the identified substructures in Virgo with their simulated analogues from the ILLUSTRIS cosmological simulation, and discuss the results' implications for galaxy evolution and structure formation.

Mocking the Cosmic Web for the Next Generation of Cosmological Experiments

George Stein *(Canadian Institute for Theoretical Astrophysics)*

(Session : Posters : Cosmology);

Simulations of the cosmic web are necessary for a large number of problems in cosmology, from the creation of accurate foreground maps for cosmic microwave background analyses, to correctly inferring cosmological parameters from galaxy clustering surveys. We have developed a massive suite of large scale structure simulations, and combined them with astrophysical models, to create accurate mocks for many important cosmological experiments. I will showcase how we have used these mocks for the study of CMB secondary anisotropies and for the inference of cosmological parameters. I will discuss our Canadian led effort to continue to provide ever-improving simulations to experimental collaborations such as Euclid, the Atacama Cosmology Telescope, and the Carbon Monoxide Mapping Array Pathfinder, among others.

Turbulent convective mixing and neutron-capture branchings at Zr and Eu in Asymptotic Giant Branch He-shell flashes

David Stephens *(University of Victoria)*

(Session : Posters : Stars);

In intermediate mass stars during their asymptotic giant branch phase the slow neutron-capture process (s process) nucleosynthesis takes place in recurring He-flash convection zones. In 3 $M_{\odot}$ models, the temperature rises high enough within the He-flash convection zone for the activation of 22Ne(α,n)25Mg neutron-source reaction. This rearrangement of the isotopic ratios of the s-process elements through nucleosynthesis branch points of isotopes such as 95Zr and 154Eu, where neutron capture and beta decay compete, depends on the physics of convective mixing. We are probing this uncertain physics through comparison of simulation results with measurements of isotopic ratios in pre-solar meteoric SiC grain yields. Preliminary results show that the per mil δ(96Zr / 94Zr) differ by $\sim$100 between models with convective mixing properties taken from mixing lengths theory and 3D hydrodynamic simulations with the latter better matching observations.

Latest Results From The Ultimate Spitzer Phase Curve Survey

Kevin Stevenson *(Space Telescope Science Institute)*

(Session : Exoplanets);

Exoplanet phase curves provide a wealth of information about exoplanet atmospheres, including longitudinal constraints on atmospheric composition, thermal structure, and energy transport, that continue to open new doors of scientific inquiry and propel future investigations. The measured heat redistribution efficiency (or ability to transport energy from a planet's highly-irradiated dayside to its eternally-dark nightside) shows considerable variation between exoplanets. Theoretical models predict a correlation between heat redistribution efficiency and planet temperature; however, the latest results are inconsistent with current predictions. I will present the latest results from a 660-hour Spitzer phase curve survey program that is targeting seven short-period extrasolar planets. I will discuss how the measured heat redistribution efficiencies correlate with planet temperature and rotation rate, trends in the phase curve peak offset, and potential cloud coverage constraints. I will conclude with how to move forward with phase curve observations in the era of JWST.

Enabling precision astrometry science in TMT era

Mojtaba Taheri *(University of Victoria)*

(Session : Posters : Instrumentation);

In the next few years, thirty-meter class telescopes like TMT will arrive, becoming a central pillar in Canadian astronomy. Thanks to unprecedented large aperture size and state of the art multi-conjugate adaptive optics (MCAO) systems, these massive instruments would provide access to very high precision astrometric data. These advances would enable us to do new science. From measuring the precise orbits of stars rotating around the supermassive black hole in the center of the galaxy, to the internal dynamics of globular clusters. However, to reach the true astrometric precision of these systems, it is essential to fully understand the different sources of distortion and find ways to eliminate them. We used Gemini south telescope and Gems (the only operational MCAO system) to better understand the astrometric performance of these systems, enabling us to achieve more precise science with TMT. We are also developing a method to measure, calibrate and deal with different sources of distortions to get the best possible astrometric precision from ground-based MCAO observations.

Weather on Other Worlds: The Three Most Rapidly Rotating Ultra-Cool Dwarfs

Megan E. Tannock *(University of Western Ontario)*

(Session : Stars);

We present the discovery of rapid photometric variability in three ultra-cool dwarfs from long duration monitoring with the Spitzer Space Telescope. The T7 L3.5, and L8 dwarfs have the shortest photometric periods known to date: 1.08, 1.14, and 1.23 hours respectively. We investigate the effects of this fast rotation and constrain the physical parameters of the T7 dwarf, the fastest of the three rotators, using R=6000 near-infrared spectroscopy. While the three objects spin at likely < 50% of their break-up velocities, the clustering of the shortest rotation periods near 1 hour could indicate proximity to an upper limit to the angular momentum of brown dwarfs.

Probing the Hierarchical Assembly of the Virgo Cluster

James Taylor *(University of Waterloo)*

(Session : Posters : Galaxies);

The SHIVir survey has recently determined dark matter mass within the outer radius of close to 200 galaxies in the Virgo cluster. We consider theoretical predictions for the dark matter density on these scales in galaxy halos, and show that, through a combination of empirical scaling relations, it is expected to depend only weakly on stellar or halo mass, but strongly on the formation redshift of the halo. In cosmological simulations, we find this inner density is generally conserved as galaxy halos merge into clusters, and thus provides a potential tracer of the age. Plotting the dark matter density as a function of position on the sky for the entire SHIVir sample, we find that densest galaxy halos are strongly clustered around the 2-3 most massive galaxies in the cluster. Thus, it seems we may be tracing the assembly of the Virgo cluster through the properties of its galaxy halos.

Neighbourhood Watch: A Survey of Baryonic Structures in the Nearby Universe

Matthew Taylor *(Gemini Observatory)*

(Session : Galaxies);

The advent of modern wide-field imaging cameras on large (> 3 - 4m) aperture telescopes has enabled relatively small research groups to conduct intermediate-scale surveys capable of deeply imaging areas of sky ranging from dozens to 100s of sq. degrees. In this contribution I will provide an overview of the ongoing Neighbourhood Watch campaign, which is imaging giant galaxies in a range of environments (e.g. isolated, groups, clusters) throughout the nearby (<20 Mpc) universe in the optical u', g', and i' bands with the Dark Energy Camera, and the NIR J and Ks filters with VISTA/VIRCam. Neighbourhood Watch is designed to image nearby galaxy systems out to their respective virial radii and detect $>$99% of compact objects like globular clusters (GCs) and ultra-compact dwarf galaxies, as well as low-surface brightness baryonic structures down to ~ 27 i-mag/arcsec^2 including 100s of low-mass dwarf galaxies. After an overview of the survey design and primary goals of Neighbourhood Watch, I will summarize the exciting first results including the detection of $>$3000 compact stellar systems around the nearby giant elliptical galaxy NGC5128, new faint stellar structures enveloping the nearby shell galaxy NGC3923, and a multi-band characterization of $>$600 faint dwarf galaxies swarming around the Fornax galaxy cluster.

Megacam Image Classification: A Machine Learning Approach

Hossen Teimoorinia *(NRC)*

(Session : Posters : Instrumentation);

Optical images taken by ground-based telescopes, such as the Megacam instrument mounted on CFHT, cover a wide range of images in terms of quality. Low-quality images contain problems regarding the telescope tracking, bad sky conditions (e.g., bad seeing and cloudy conditions) and different problems in the background, such as high background fluctuations, very bad object saturations and dead CCDs. At the Canadian Astronomy Data Center (CADC), we have developed a Machine Learning method to classify Megacam images into different categories in order to separate the 'good' and usable images from the low-quality ones. We use information from the pixels in all 36 or 40 CCDs of an exposure and present different probabilities associated with the different classes for each CCD. The good images are selected based on the obtained probabilities and a set of decision boundaries considering the probability distributions. We have tested our trained network on different, independent test data (randomly selected from $\sim$220,000 exposures which contain $\sim$9,000,000 CCDs) and obtained $\sim$ 97% accuracy. This method will be applied on more than 1,000,000 exposures in CADC database, in a fully automated way.

Tracing the stellar halo with BHBs

Guillaume Thomas *(HAA)*

(Session : Nearby Galaxies);

Using the Canada-France-Imaging survey (CFIS), an ongoing CFHT Large Program that will map 10,000 deg^2 of the northern sky in the u-band to a depth 2.7 mag greater than SDSS, combined with Pan-STARRS1 griz bands, we are able to trace the shape of the smooth stellar halo out to $\sim$ 110 kpc in a large fraction of the Northern sky. During this talk, I will present our method to identify the BHBs with respect to other A-type stars. Since they are good tracers of distance, this enables the study of the shape of the stellar halo through their radial distribution, and also the clumpiness through the clustering of the BHBs stars. I will also discuss the impact of our recent study on the shape of the dark matter halo using the BHBs and Gaia proper motion.

Spatial Distribution of Star Formation Rate and Other Properties of MaNGA Post-Merger Galaxies

Mallory Thorp *(University of Victoria)*

(Session : Posters : Galaxies);

Galaxy merging is a process essential to galaxy evolution, altering properties such as star formation rate, metallicity, morphology, and AGN activity. Given the rarity of nearby merging events, galaxy surveys are necessary to provide statistically robust information of merging effects, both for interacting and post-merger galaxies. The Mapping Nearby Galaxies with Apache Point Observatory (MaNGA) survey, a component of the Sloan Digital Sky Survey, provides indispensable integral field unit (IFU) spectroscopy for over two thousand galaxies so far. IFU spectroscopy provides spectra for thousands of points across a galaxy's surface, allowing us to study how star formation rate and metallicity behave at different distances from the galactic center. Mergers have been studied extensively with single object spectroscopy, but IFU spectroscopy provides the novel opportunity to constrain the spatially distributed changes in merging effects that up to this point have remained ambiguous. Visually classifying 50 post-merger galaxies from the MaNGA survey by morphology, we present results concerning the radial variation in starburst activity to better understand the effects of merging on a local scale.

While Canada Built, Europe Burned: The Impact of WWI on Astronomy and relativity

Virginia Trimble *(U California Irvine & Queen Jadwiga Observatory)*

(Session : History);

For astronomers, WWI began with the capture of an eclipse expedition sent at the urging of Einstein to look for bending of light by the sun. They were captured and interned. But the war ended with another, successful expedition and the founding of the International Astronomical Union, for those nations "at war with the central powers." In between came multiple solutions to Einstein's equations, some from scientists serving on the front lines, careful dissemination of ideas across battle lines, shortages of optical glass and expert personnel, and much else.

Local Group Shape and Intrinsic Alignments through APOSTLE

Thorold Tronrud *(University of Victoria)*

(Session : Posters : Nearby Galaxies);

The APOSTLE simulations provide an unprecedented look into the formation of local-group-like clusters, which allows us to examine the orientations of matter within the context of our own Local Group. We find that there is a well-defined triaxial distribution of matter - well-traced by the field galaxies - which allows for direct comparison between the distributions of APOSTLE field dwarves and observed galaxies within 3 Mpc. Using a monte-carlo method to account for the zone of avoidance, we can place bounds on the axial ratios for the observed Local Group, as well as likely directions for the principle axes, related to established objects. Next, I examine the intrinsic alignments of the different components of matter. In order to decide which trends are statistically significant, I use the Kolmogorov-Smirnov test to eliminate any patterns that are below 95% significance. This leaves me with an APOSTLE-driven model for a "typical" local group.

New details on the Galactic spiral arms in the Milky Way

J.P. Vallée *(NRC Herzberg Astronomy and Astrophysics)*

(Session : Posters : Star Formation);

We investigate some details about spiral arms in our Milky Way disk galaxy.

- How far are we from the Center of the Galaxy?
- Can the CO spine (mid-arm) differ from the dust lane (arm edge) by 300 pc?
- Where does the Norma spiral arm start, near the Galactic Center?
- Why are there so many "three-kpc" arms: are they the same ?
- Can one get a better arm pitch, from the large angular length of spiral arms?
- Can a new fit to the large scale dynamics of spiral arms yield higher speeds?
- Are there spatial offsets from masers to the middle of the Perseus arm?
- Where is the 'co-rotation' radius in the Milky Way?
- Where does the so-called Local Armlet (near the Sun) comes from?

References: Vallée, J.P. 2016, Astrophys. J., 821, 53;; Vallée, J.P. 2017, Astrophys. Space Sci., 362:79; Vallée, J.P., 2017, Astrophys. Space Sci, 362, 84; Vallée, J.P., 2017, Astrophys. Space Sci., 362, 173; Vallée, J.P. 2017, Astron Rev. 13, 113; Vallée, J.P., 2017, New Astron. Rev., 79, 49; Vallée, J.P., 2018, in press.

Low Mass X-ray Binaries: Population at the Roche Lobe Overflow

Kenny Van *(University of Alberta)*

(Session : Posters : Stars);

We present a new method for constraining the mass transfer evolution of low and intermediate-mass X-ray binaries – a reverse population synthesis technique. This is done using the detailed 1D stellar evolution code MESA (Modules for Experiments in Stellar Astrophysics) and evolving a range of binary systems with different magnetic braking prescriptions. These simulated systems are then compared to the observed properties seen in persistent low mass X-ray binaries and allowing us to determine possible progenitors to these binaries. In addition to constraining progenitor systems of observed systems, this study also allows us to further constrain magnetic braking recipes. For this, we compare the populations formed with different magnetic braking laws and the observed populations, using Bayesian statistics. While an absolute probability of producing an observed system cannot be found, comparisons between prescriptions is possible giving and indication where different magnetic braking schemes encounter problems.

Planet formation with ALMA: zooming in on transition disks in the Lupus star forming region

Nienke van der Marel *(NRC Herzberg Astronomy and Astrophysics)*

(Session : Disks);

Protoplanetary disks of gas and dust around young stars are the birth cradles of planets. Of particular interest are the so-called transition disks with large inner dust cavities, a sign of active evolution and potential early planet formation. The arrival of ALMA has revolutionized our view of the structure of these disks: both gas and dust are depleted inside the dust cavities, an indicator of recently formed giant planets. However, statistical comparisons with exoplanet populations remained so far impossible due to observational biases. ALMA is now conducting surveys of entire star forming regions for a better global understanding of disk evolution and planet formation. In a recent study I have analyzed all transition disks in the Lupus star forming region, and compared their properties with the other disks in the region and with exoplanets around full-grown systems. Transition disks with large cavities appear to form a separate population of disks, possibly evolutionarily linked with large massive disks such as HL Tau. The transition disk fraction is much higher than the population of giant planets at wide orbits, indicating either migration or additional mechanisms to explain the presence of these extraordinary disks. I will discuss the implications for our understanding of planet formation and the next steps in disk studies.

Gravitational Lensing of the CMB

Alexander van Engelen *(CITA)*

(Session : Cosmology);

Gravitational lensing of the CMB is an emerging field which allows us to make high-precision maps of the matter in the Universe, including dark matter. After a brief review of the concepts, I will discuss current efforts, including ongoing analyses with the ACTPol survey. I will then discuss prospects for new surveys being planned, including the Simons Observatory and CMB-Stage 4.

Determining the Plane of the Kuiper Belt with OSSOS

Christa Van Laerhoven *(UBC)*

(Session : Posters : Solar System);

We present the OSSOS-based measurement of the semi-major axes dependent orientation of the Kuiper Belt plane. A Kuiper Belt object's (KBO's) inclination can be broken down into a forced component and a free component. The inclination and longitude of ascending node of the forced inclination define the 'forced plane,' the plane about which the KBO's inclination will precess. Secular theory predicts that this forced plane should depend on semi-major axis. For example, the nu18 secular resonance should create a significant warp in the forced plane near 40.5 au (Chiang and Choi 2008). Not predicted by secular theory is a warp in the distant Kuiper Belt (semi-major axes greater than 50 au) seen by Volk and Malhotra 2016 using KBOs from the Minor Planet Catalog. We investigate what the inclination distribution is for objects beyond Neptune as a function of semi-major axis using the OSSOS characterized sample. Through use of the OSSOS survey simulator we test various underlying orbital distributions and compare how the survey would have observed those populations to the actual observed sample. In particular, we test various widths for the inclination distribution about various local forcing planes for the kernel, stirred, and hot classical Kuiper Belt. Through most of the main Kuiper Belt (between the 3:2 and 2:1 resonances), we can reject both the ecliptic plane and the invariable plane as the true forced plane. Only as the expected secularly forced plane approaches the invariable plane does the invariable plane become non-rejectable. In the outer Kuiper Belt we reject the nominal mean-plane measured by Volk and Malhotra, but smaller warps are still allowed by the data.

Black Holes and Neutron Stars in Nearby Galaxies: Insights from NuSTAR

Neven Vulic *(NASA GSFC & UMCP)*

(Session : Posters : Compact Objects);

Nearby galaxy surveys have long classified X-ray binaries (XRBs) by the mass category of their donor stars (high-mass and low-mass). The NuSTAR observatory, which provides imaging data at E >10 keV, has enabled the classification of extragalactic XRBs by their compact object type: neutron star (NS) or black hole (BH). We analyzed NuSTAR/Chandra/XMM observations from a NuSTAR-selected sample of 12 galaxies within 5 Mpc, detecting 128 NuSTAR sources. Using NuSTAR color-intensity and color-color diagrams we classify 43 of these sources as candidate NS and 47 as candidate BH. We further subdivide BH by accretion state (soft, intermediate, and hard) and NS by weak (Z/Atoll) and strong (accreting pulsar) magnetic field. We produce NS and BH-only X-ray luminosity functions (XLFs) and determine the overall BH to NS ratio is 1 in the 4-25 keV energy band and 2 in the 12-25 keV energy band. We find that NS XLFs show a decline beginning at the NS Eddington limit, whereas the BH fraction shows an approximate monotonic increase with X-ray luminosity in the 4-25 and 12-25 keV energy bands.

The BRITE-Constellation mission: status and recent results

Gregg Wade *(Royal Military College of Canada)*

(Session : Posters : Stars);

This poster provides an update of the status and recent results of the Bright Target Explorer (BRITE) Constellation nanosatellite space astronomy mission.

The Metallicity of Short Period Type II Cepheids

George Wallerstein *(University of Washington)*

(Session : History);

The Type II Cepheids were Helen Sawyer Hogg's favorite stars. We have found that those with periods of 1-3 days may be divided into two subgroups; the BL Her stars with [Fe/H] slightly below solar and the UY Eri stars with [Fe/H] between -1.5 and -2.0. The former seem to belong to the Galaxy's thick disk, while the latter are probably members of the Galactic halo.

Ages and star formation histories of galaxies in the Gogreen spectroscopic sample

Kristi Webb *(University of Waterloo)*

(Session : Posters : Galaxies);

Quiescent galaxies are those which have no active star formation, and therefore evolve passively. How a galaxy transforms from a star-forming state to quiescent depends on how the gas processes which fuel the star formation change – either as a result of external (environment-driven) or internal mechanisms. Detailed star formation histories (SFHs) of galaxies in a variety of environments are necessary to discern the relative importance of the different quenching processes. The Gemini Observations of Galaxies in Rich Early Environments survey (GOGREEN) was designed to obtain spectra for galaxies with a wide range of stellar masses and halo masses in the redshift range $1 < z < 1.5$, where the star formation rate was roughly twice as high as it is today. In fitting population synthesis models to the spectroscopy of $\sim$500 members of galaxy systems, we use characteristic spectral features to infer ages and SFHs of each galaxy. Through detailed comparisons of the SFHs of the quiescent galaxies as a function of mass and environment, we can distinguish which quenching mechanisms is significant in each case. Moreover, in combination with existing observations in the local neighbourhood, we will be able to outline galaxy evolution through the last two-thirds of the age of the universe.

The Link Between Galaxy Quenching and Morphological Transformation

Joanna Woo *(University of Victoria)*

(Session : Galaxies);

It is well established that the cessation of star formation in galaxies ("quenching") correlates strongly with dense galaxy morphology, but the physical reasons behind this relationship remain disputed. One popular idea posits AGN as the heating source that causes the quenching. In this picture, AGN are triggered by the same processes that fuel a central starburst which changes the morphology of the galaxy (such as mergers and disk instabilities). A useful diagnostic of such processes is the global specfic star-formation rate (sSFR)-central surface density diagram for galaxies. I will show that the NIR-selected AGN fraction peaks in exactly the region of this diagram where energy injection is needed to quench galaxies as they build up their central densities (at $z\sim0$ and at $z\sim2$). Furthermore, my results from new IFU surveys (including from the exquisite MUSE instrument as well as the MANGA survey) indicate that galaxies in this region of the diagram (with high surface densities) have positive or flat age gradients compared with the negative gradients in other galaxies. This indicates that dense galaxies built up their central density relatively recently and likely triggered their AGN. Galaxies in groups and clusters occupy a different region of the sSFR-surface density diagram. In contrast to field galaxies, age gradients are positive for transitioning galaxies that are less dense. This indicates that cluster processes also trigger some centrally concentrated star formation before quenching, but not enough to significantly alter their morphology.

Galactic Magnetic fields: from Disc to Halo

Alex Woodfinden *(Queen's University)*

(Session : Posters : ISM);

The shape and structure of galactic magnetic fields remains a mystery. We present a selection of solutions of exact dynamos under the assumption of scale invariance in classical dynamo theory. Analytic solutions are found that are axially symmetric and self-similar in time as well as spirally symmetric and time dependent. The fields predicted show both magnetic spirals in disks as well as vertical X-shaped and poloidal fields as expected from observations from the milky way and other external galaxies. Rotation measure screens can be produced from these fields and can be compared with observed rotation measures from real galaxies. This is done using the CHANG-ES survey of edge-on galaxies and results are presented as they relate to NGC 4631.

Searching Dwarf Satellite Galaxies with Photometric Data

Chengyu Xi *(University of Waterloo)*

(Session : Posters : Galaxies);

Faint dwarf satellite galaxies are extremely important for small-scale structure studies, but are still poorly characterized outside the Local Group. Spectroscopic observations are rarely available for these faint galaxies, and thus it is difficult to precisely determine their dynamics relationship with their surroundings. We have developed a hierarchical group finder algorithm with an adaptive searching radius, which allows us to statistically identify group centrals and satellites with only photometric data.

IR Flux Variability and PAH Destruction near an Awakening AGN

Sherry Yeh *(W. M. Keck Observatory)*

(Session : Posters : Galaxies);

Time domain-based studies, such as reverberation mapping of AGN variability to measure the distribution of ISM and dust near black holes, offers an alternative approach for studying astrophysics on fine scales without extremely large aperture facilities to achieve high angular resolutions. The nucleus of a LINER galaxy, once unremarkable, flared sometime between 2008 to 2012, revealing a 8-year-old AGN. We have been monitoring the target since 2015 using different aperture sizes to probe the regions between 25 pc to 1 kpc around the AGN. We have active programs to monitor the galaxy using Keck, Subaru, and SOFIA. Comparing to the pre-outburst data, our post-outburst data suggest that PAH emission is almost absent in the inner 400 pc, and the dust continuum has significantly weakened. This implies that the recent AGN outburst may have a strong impact on the ambient dust, thus modulating the dust continuum and PAH emission significantly.

Enormous low surface brightness stellar disk observed with the Dragonfly Telephoto Array

Jielai Zhang *(University of Toronto)*

(Session : Galaxies);

Neutral gas is commonly believed to dominate over stars in the outskirts of galaxies, and investigations of the disk-halo interface are generally considered to be in the domain of radio astronomy. This may simply be a consequence of the fact that deep HI observations typically probe to a lower mass surface density than visible wavelength data. I'll present low surface brightness optimized visible wavelength observations of the extreme outskirts of the nearby spiral galaxy NGC 2841 done with the Dragonfly Telephoto Array. This galaxy has an an enormous warped low-surface brightness stellar disk and contrary to expectations, the stellar mass surface density does not fall below that of the gas mass surface density at any radius. I will discuss possible formation mechanisms for this enormous stellar disk: stellar migration, accretion and in-situ star formation.

The West African International Summer School for Young Astronomers

Jielai Zhang *(University of Toronto)*

(Session : EPO);

The West African International Summer School for Young Astronomers (WAISSYA) is a week-long introduction to astronomy for university students and teachers from West Africa, organized by a collaboration of scientists from Nigeria, Ghana, Gabon, Canada, and Germany. WAISSYA is held bi-annually – so far in Ghana (2017) and Nigeria (2013 and 2015). WAISSYA's vision is to: (1) Contribute to building a critical mass of astronomers in West Africa; (2) Contribute to empowering young West Africans in becoming scientific leaders; and (3) Share ideas about teaching and learning between West Africa and North America / Europe. I will present (1) our innovative curriculum focusing on "inquiry," in which students ask and investigate their own mini-research questions in small teams. (2) how the international collaboration work and teach together to learn new teaching methods.

Identification of Faint X-ray Sources in the Globular Cluster M3

Yue Zhao *(University of Alberta)*

(Session : Star Clusters);

Deep observations with the Chandra X-ray Observatory have revealed that globular clusters (GCs) harbour a large population of faint X-ray sources ($L_X < 10^{33-34}$), thought to be close binaries formed in the dense cluster cores. Using multi-band observations with the Hubble Space Telescope (HST), possible optical counterparts to these sources have been detected, suggesting different classes of X-ray binaries (XRBs). These include quiescent low-mass X-ray binaries (qLXMBs), cataclysmic variables (CVs), millisecond pulsars (MSPs), and chromospherically active binaries (ABs). I will report X-ray analyses, together with optical identifications, of faint Chandra sources in the globular cluster M3 (NGC 5272). By combining 30 ks of Chandra observations, 16 X-ray point sources were detected within the cluster's half-light radius. With optical data from HST's WFC3/UVIS and ACS/WFC, we found 7 optical counterparts. Besides the previously identified counterpart to the super-soft X-ray source 1E1339.8+2837, 4 X-ray sources were associated with counterparts with obvious FUV excess, suggesting a CV nature. Two sources are likely to be ABs, one of which is likely a red giant while the other appears to be a red straggler. Of the 4 CV candidates, 3 are only detected in the UV bands; 1 was also detected in V and I bands with a redder colour. I will also discuss how the sources in M3 add to our understanding of the origins (primordial binaries, vs. formed through stellar interactions) of faint X-ray sources in globular clusters.

Only 30% of Sun-like Stars Have Kepler-like Planets

Wei Zhu *(CITA)*

(Session : Posters : Exoplanets);

Observations in the past decade have detected thousands of exoplanets, most of which are the so-called super Earths: planets with masses/radii between Earth and Neptune and orbital periods within 100 days. Previous studies claimed that more than 50% of all Sun-like stars should have such planets, but the assumption on which this result was based on has been turned out unrealistic. Here I will present results from our recent study (arXiv:1802.09526), in which we constrain the abundance of super Earth systems by correctly modeling their intrinsic architectures. We find that only 30% of Sun-like stars have super Earths, and that each system has on average three such planets.

LIST OF PARTICIPANTS

Wei **Zhu**, CITA 78, 165

NOTES

CASCA 2018
A New Century for Canadian Astrophysics
Un nouveau siècle pour l'astrophysique canadienne

Wednesday, 23 May

Plenary 1: (Theatre) 08:30 – 10:20
- Opening Remarks:
  - Elder Victor Underwood: "Welcome to the Territory"
  - Jamie Cassels (President, University of Victoria)
  - Greg Fahlman (Director General, NRC Herzberg)
- Broughton: John Stanley Plaskett – Northern Star
- Crabtree: Highlights from the First 100 Years of the DAO

Poster, Demo, and Sponsor Interactions: 10:20 – 10:50

Centennial 1: Optical & Infared Astronomy (Th) 10:50 – 12:30
- Carlberg: The First University Astronomy: Contributions of the DDO and UTSO
- Doyon: The OMM and Domestic Telescopes as Innovation Testbeds
- Fahlman: CFHT – Canadian Astronomy at the Top of the World
- Ferrarese: Gemini – Access to Both Hemispheres

Town Hall Lunch (Theatre)
12:30 – 14:00

Plenary 2: (Theatre) 14:00 – 14:45
- Dumas and Sanders: The TMT: Science and Project Perspective

S1: Instruments
(Theatre) 14:45 – 15:30
- Sivanandam
- Doyon
- Boucher

S2: Planets & Disks I
(Saanich) 14:45 – 15:30
- Van der Marel
- Dong
- Shan

Poster, Demo, and Sponsor Interactions: 15:30 – 16:00

Plenary 3: (Theatre) 16:00 – 17:30
- Eadie: Hierarchical Bayes and the Mass of the Milky Way (Plaskett Medal)
- Cannon: The Unlikely Dawn of Joint Gravitational-Wave and Electromagnetic Astronomy (Dunlap Prize)

Interaction Session & Cash Bar: 17:30 – 18:30

Elementary School Teachers Workshop + Dinner (Es)
16:00 – 20:00

CASCA Public Lecture: (Theatre) 20:00 – 21:00
Bob McDonald (CBC): What If Everything We Know is Wrong?

Thursday, 24 May

Centennial 2: Radio Astr. (Th) 8:30 – 10:10
- Robishaw: DRAO and ARO – The Foundations of Canadian Radio Astronomy
- Kirk: The Move to Higher Frequencies – Contributions of the JCMT
- Wilson: ALMA – Canada in the First "World Observatory"
- Dobbs: Innovative Technologies in Radio Astronomy

Secondary School Teachers Workshop (Es)

Poster, Demo, and Sponsor Interactions: 10:10 – 10:35

S3: Gravitational Waves & Compact Sources
(Th) 10:35 – 12:20
- Landry (Invited)
- Haggard
- Ruan
- Nynka
- Main

S4: Planets & Disks II
(Sa) 10:35 – 12:30
- Lawler (Invited)
- Stevenson
- Deibert
- Rogowski
- Goldblatt
- Rogers (Invited)

Secondary School Teachers Workshop (Es)

Gemini Lunch (Theatre)
12:30 – 14:00

SKA Lunch (Saanich)
12:30 – 14:00

S5: CHIME
(Th) 14:00 – 15:30
- Shaw (Invited)
- Scholz
- Good
- Fandino
- Pinsonneault-Marrotte

S6: Stars & Remnants
(Sa) 14:00 – 15:30
- St. Louis (Invited)
- Tannock
- Braun
- Sakari
- Zhao

Secondary School Teachers Workshop (Es)

Poster, Demo, and Sponsor Interactions: 15:30 – 16:00

Plenary 4: (Theatre) 16:00 – 17:30
- Halpern: Progress and Challenges in Experimental Cosmology (Beals Prize)
- Fahlman: Canadian Astronomy – A Look Back to the Future (Executive Award)

Secondary School Teachers Workshop (Es)

NCOA Session (Theatre)
17:30 – 18:30

Interaction Session:
17:30 – 18:30

Banquet at the Royal BC Museum: 19:00 – 22:00

Friday, 25 May

Centennial 3: Space Astronomy & Instrumentation
(Theatre) 9:00 – 9:50
- Hutchings: Canada's Place in Space Astronomy
- Simard: Instrumentation as the Gateway to Great Science

S7: Radio Initiatives
(Theatre) 09:50 – 10:20
- Gaensler
- Dempsey

S8: Stellar Halos
(Saanich) 09:50 – 10:20
- Thomas
- Henault-Brunet

Poster, Demo, and Sponsor Interactions: 10:20 – 10:45

S9: AGN / Facilities
(Theatre) 10:45 – 12:30
- Juneau (Invited)
- Hebbar
- Berg
- Simons
- Yoshida
- Hall

S10: Cosmology
(Saanich) 10:45 – 12:30
- Hložek(Invited)
- Van Engelen
- Foreman
- Masui
- Loggia
- Woo

CFHT Lunch (Theatre)
12:30 – 14:00

CITA Lunch (Saanich)
12:30 – 14:00

S11: Space Astr.
(Th) 14:00 – 15:30
- Côté (Invited)
- Peeters (Invited)
- Darveau Bernier
- Hutchings

S12: Galaxies
(Sa) 14:00 – 15:30
- Cami
- Boselli
- Zhang
- Taylor
- Damjanov

History
(ES) 14:00 – 15:15
- Trimble
- Batten
- Morton
- Wallerstein

Poster, Demo, and Sponsor Interactions: 15:30 – 16:00

CASCA Business Meeting (Theatre)
16:00 – 17:30

Interaction Session & Cash Bar: 17:30 – 18:30

DAO Centennial Celebration: 20:00 – 22:00
Buses Depart VCC at 19:30

Saturday, 26 May

Plenary 5: (Theatre) 09:00 – 10:45
- Abraham: President's Message
- Thacker: Imaginations Gift (Qilak Award)
- Elder Dr. Barney Williams: Education – the Key to Reconciliation

Poster, Demo, and Sponsor Interactions: 10:45 – 11:15

S13: Theory & Astroinformatics
(Th) 11:15 – 12:45
- Herwig (Invited)
- Neilson
- Rucska
- Barmby (Invited)

S14: Star Formation & Planetary Systems
(Sa) 11:15 – 12:45
- Marois
- Fraser
- Bannister
- Fissel
- Deb
- Sing

EPO I
(Es) 11:15 – 12:30
- Claxton (Invited)
- Zhang
- Hesser
- Crabtree

Meeting-Free Lunch (12:45 – 14:15)

Centennial 4: Theory & Data Science
(Theatre) 14:15 – 15:30
- CITA: A Pillar of the Canadian Astronomical Community (Pen)
- CADC: Data, Data, Data! (Schade)
- Steffen: Publishing in AAS Journals

EPO II
(Sa) 14:15 – 15:15
- Neilson
- Bridges
- Kavelaars
- Laychak

Poster, Demo, and Sponsor Interactions: 15:30 – 16:00
Poster papers not removed by 17:30 will be discarded

Closing Activities (Theatre): 16:00 – 17:00
- NSERC Presentation
- Award Presentations
- Closing Remarks

VCC Room Legend: Th = Theatre; Sa = Saanich; Es = Esquimalt; Poster Displays/Demos in Oak Bay and Pre-Function

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