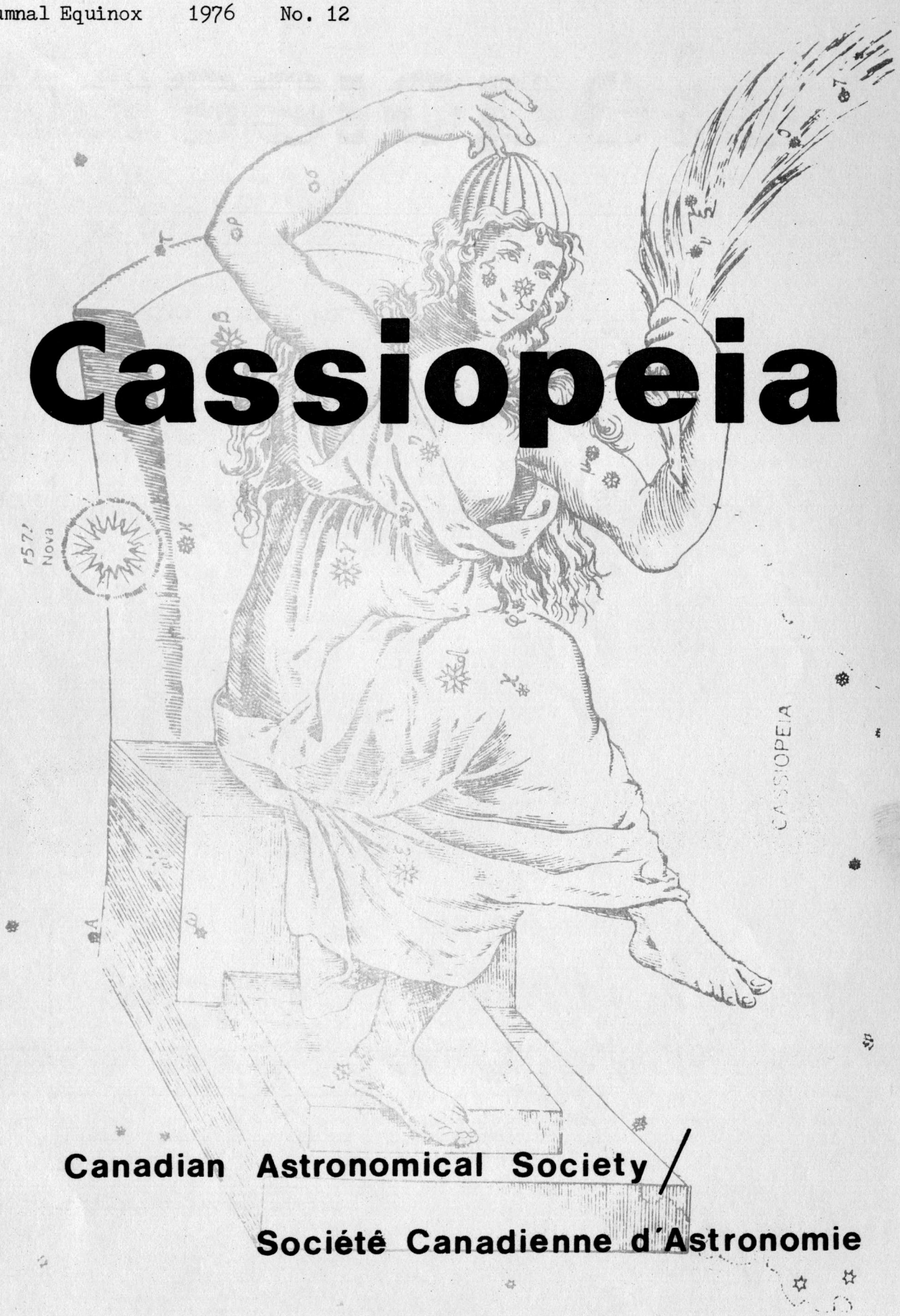
Autumnal Equinox 1976 No. 12

Cassiopeia



Canadian Astronomical Society /

Société Canadienne d'Astronomie

Cassiopeia

No. 12 Autumnal Equinox Issue 1976

CANADIAN ASTRONOMICAL SOCIETY
SOCIÉTÉ CANADIENNE D'ASTRONOMIE

Editor: Dr. John F. Heard, University of Toronto

Assoc. Editor: Dr. David L. DuPuy, St. Mary's University

I missed an issue! The Summer Solstice 1976 issue did not appear because of lack of material and because of extended illness in my immediate family. Therefore, this issue contains some material submitted in late June. I apologize to Cassiopeia readers for the difficulties with the Summer Solstice issue.

Please send contributions for the Winter Solstice issue before the DEADLINE of December 15. This issue will not be mailed until January 1 to avoid the mail problems in December. Please single-space your article, to avoid retyping.

D.L.D.

CANADIAN ASTRONOMY

OBSERVATOIRE ASTRONOMIQUE DU QUEBEC; SEPTEMBRE 1976

PAR RENE RACINE

L'historique des événements qui ont précédés l'attribution des octrois du Conseil National de Recherches du Canada et du Ministère de l'Education du Québec permettant de construire un observatoire au Québec a été donné par l'auteur dans le Journal de la Société Royale Astronomique du Canada, Vol. 70, p. 138. Ceci est un rapport sur le progrès du projet tel qu'il est à l'automne 1976.

Le contrat pour la fourniture du télescope de l'observatoire a été alloué à la firme Perkin-Elmer, Division Boller and Chivens. L'échéancier prévoit la livraison du télescope de 1.6 mètre en octobre 1977. Le bureau de projet est établi au Service de l'Equipement de l'Université de Montréal où M. Claude Durand est en charge du dossier. Le contrat de gérance pour l'étude et la construction des infrastructures à ériger au mont Mégantic est pris en charge par la firme montréalaise Surveyer Nenninger et Chevenert. Les premiers travaux de construction concernent la route qui devra mener au sommet du mont Mégantic. On emprunte sur $1\frac{3}{4}$ mille une route existante menant à une altitude de 2,000 pieds à partir d'où on construit $3\frac{1}{2}$ milles de route pour atteindre le sommet à 3,700 pieds. A date (mi-septembre 1976), le déboisement est terminé et le terrassement du premier mille est complété. On prévoit qu'il sera possible avant novembre d'accéder au sommet en automobile. Les études architecturales du bâtiment du télescope et de l'édifice des services sont en cours sous la direction de Maître Victor Prus, et les négociations avec les manufacturiers amèneront la signature

d'un contrat pour la fourniture de la coupole en fin de septembre. La construction des bâtiments au site débutera au printemps. Le bâtiment du télescope devra être terminé en juillet 1977, l'installation de la coupole est prévue pour le mois d'août. Tous les travaux suivent encore, heureusement, l'échéancier qu'on en avait dressé il y a un an.

Du côté du personnel, de nouvelles figures ont fait apparition ou le feront très bientôt au département de physique de l'Université de Montréal. Dr Serge Demers a pris possession de son nouveau bureau au 1er juillet et Dr Anthony Moffat arrivera à Montréal en novembre. De plus, le Dr John Glaspey s'est joint au groupe comme astronome-ingénieur responsable des services techniques de l'observatoire. A l'Université Laval qui participe aussi au projet, le Dr Ermanno Borra est en poste depuis plus d'un an et on prévoit la venue d'un deuxième astronome d'ici peu. Toutes ces personnes sont impliquées tant dans la préparation des plans et devis pour l'infrastructure du télescope que dans la définition de l'instrumentation auxiliaire de l'observatoire et, bien sûr, dans la préparation de nouveaux cours d'astronomie qui se donneront tant à l'Université de Montréal qu'à l'Université Laval. Finalement, on prévoit qu'à chacune des deux universités un poste additionnel pour astronomes sera ouvert au printemps 1977.

La mise sur pied d'un nouvel observatoire et l'expansion de programmes d'enseignement et de recherche est un projet très enthousiasmant et très accaparant. Les individus qui y sont ici impliqués montrent un optimisme qui est bien justifié par les progrès à date. Il reste cependant que les étapes vraiment critiques sont encore à venir: construction, vérification, démarrage des recherches. C'est dans les deux années qui viennent que les réalisations concrètes s'accélèreront et qu'on pourra voir les résultats tangibles des efforts de tous les participants.

CANADIAN ASTRONOMICAL SOCIETY
SOCIÉTÉ CANADIENNE D'ASTRONOMIE

TREASURER'S REPORT FOR 1975

**A small change in the presentation of the 1975 Financial Statement compared with previous years is that for 1975 the Cassiopeia account has been included in the main Financial Statement rather than presented as a separate statement. Thus in 1974 the figure of $573.00 shown for Cassiopeia was merely the amount transferred from the Treasurer's account to the Editor's account, and the balance of $9045.01 at the end of 1974 did not include a small balance held by the Editor. The 1975 figure of $443.21 shows, however, the true cost of producing and mailing Cassiopeia, and the balances shown at the beginning and end of 1975 represent correctly the total financial holdings of the Society.

Attention was drawn in the Treasurer's Report for 1974 to the circumstance that at the end of that year 30 members were still owing their dues. During 1975, 22 of these members settled their account so that by September 30, only eight dues were still outstanding. However, by December 31 of 1975, no fewer than 59 members in a Society, which on that date numbered 176, had not renewed their dues. While the cost to the Society in lost interest by that date had amounted only to an estimated $24, it must be remarked that this cost is borne by those members who do remember to pay their dues on October 1.

As predicted in the Treasurer's Report for 1974, attention to obtaining optimal interest rates has improved our interest income in 1975 compared with 1974 and previous years. For example interest income in 1975 was 6.9% of the beginning-of-the-year balance, compared with 4.6% in 1974.

Expenditure in 1975 was 48% of income, the highest proportion yet. While the expenses of bringing a visiting speaker and of publishing Cassiopeia were clearly major items, the increasing cost of postage and stationery is becoming apparent and will surely increase still further in 1976. Nevertheless the Society finished 1975 with $1754.59 more than it started the year with.

Respectfully submitted.

J.B. Tatum

J.B. Tatum
Treasurer
1976 June 17

CANADIAN ASTRONOMICAL SOCIETY
SOCIÉTÉ CANADIENNE D'ASTRONOMIE

FINANCIAL STATEMENT FOR THE CALENDAR YEAR 1975*

*(1975 figures are in the right hand columns. Comparable figures for 1974 are in italics in the left hand column.)

$ 6992.06	Balance at December 31 of previous year		$ 9234.54**
	INCOME		
3120.00	Membership dues	$2710.00	
0.00	Donations	5.00	
79.72	Interest on savings a/cs.	507.72	
240.57	Interest on term deposits	129.31	
0.39	Exchange on U.S. cheques, etc.	1.53	
3440.68			3353.56
10432.74			12588.10
	EXPENDITURE		
545.00	R.A.S.C. and C.A.P. reprints, page charges	362.80	
46.20	Postage	193.42	
68.39	Stationery, duplicating and office supplies	117.42	
573.00	Cassiopeia**	443.21	
0.00	Lecturers' expenses and honoraria	472.49	
5.14	Bank charges	1.43	
300.00	Travelling Fellowship	0.00	
0.00	Telephone	12.00	
1537.73	Total expenditure	1602.77	
150.00	Less uncleared cheques	3.80	
1387.73			1598.97
$ 9045.01	Balance at December 31		$10989.13
	Balance held as follows:		
	Bank of Montreal Chequing Savings Account		434.39
	Bank of Montreal True Savings Account		10202.29
	Cassiopeia Account		352.45
			$10989.13

** See note in Treasurer's Report.

J.B. Tatum
Treasurer
March 24, 1976

The above financial statement agrees with the receipts, bank books and other records submitted by the Treasurer and therefore is considered to be a true statement of the financial transactions of the Society in 1975.

March 29, 1976

K. O. Wright,
Auditor

Your Dues and Income Tax

As Treasurer, I am asked with remarkable frequency to send a receipt for dues "for income tax purposes", or else to date a receipt for some particular date "for income tax purposes".

The situation as regards receipts and income tax is as follows. When a member pays his dues, a date stamp marked "Paid" and signed by the Treasurer is stamped on the invoice and returned to the member. New members, who have not been sent an invoice, receive a printed receipt. The date on the date stamp or on the printed receipt is the date on which the Treasurer receives the dues. The Treasurer has no authority to alter this date.

Members may claim their CASCA dues as a deduction on their income tax if their membership in CASCA is a condition of their employment.

At present, CASCA is not registered as a charitable organization, and therefore donations are not tax deductible. If CASCA ever were to receive recognition as a charitable organization, donations over and above the regular membership dues would be tax deductible.

J. B. Tatum
Treasurer

The CAS and the PAC

The Canadian Astronomical Society and the Planetarium Association of Canada have initiated a formal relationship, intended to facilitate an exchange of information and to promote good relations between these two organizations. This agreement was formalized during the Penticton CAS meeting, and it provides for the exchange of newsletters, an exchange of corporate/institutional memberships, and official representation at meetings of each organization.

Mr. David A. Roger, President of P.A.C., attended the Penticton CAS meeting at Council's invitation, presenting a paper in the Education Session and discussing the CAS/PAC alliance with Council. In his paper, Mr. Rodger reviewed P.A.C.'s success in presenting astronomy to the public through Canadian planetariums and the media, and he made suggestions for more participation by professional astronomers. He also invited astronomers to participate in the 1977 P.A.C. Conference in Vancouver to discuss "Communicating Astronomy".

As a trial means of distribution, copies of P.A.C.'s publication North Star are available to CAS members by writing to me for a copy. Cassiopeia is similarly available to P.A.C. members.

David L. DuPuy

NOTES FROM UNIVERSITIES

UNIVERSITY OF TORONTO

Visitors to the Observatory

Visitors who have recently given colloquia on Campus or at the Observatory include:

Prof. E.M. Purcell, Harvard, "Life at Low Reynolds Number".

Dr. N. Tariq, Waterloo, "An Exact Solution of the Einstein-Maxwell Equations".

Dr. Simon White, Cambridge, "Dynamical Evolution of Clusters of Galaxies".

Dr. P. Wesson, Queen's, "Self-Similar Cosmologies".

Dr. Theo Schmidt-Kahler, Ruhr University, Bonn, "The Structure of the Large Magellanic Cloud".

Dr. J.E. Hesser, Cerro Tololo Observatory, "Some New Inferences from Globular Cluster Observations".

Dr. Thomas Adams, University of Chicago, "Morphology of Seyfert Galaxies".

Dr. Larry Auer, Yale, "Proto-Stellar Masers".

Dr. John Lester, Harvard, "An Analysis of the Ultraviolet Spectrum of the Helium-rich Star HR 3089".

Dr. Barry Madore, Cambridge, "Cosmology Starts at Home".

Dr. C.V. Vishveschwara, University of Pittsburgh, "Cosmology and Geometry".

Tenth June Institute

A tenth anniversary of the June Institutes was held this year on June 8-11. Following a pattern which has evolved over the years, four distinguished astronomers gave mini-courses on four assorted topics - four lectures each. This year's selection of speakers and topics were

particularly well chosen and offered something for everyone's taste without being so highly specialized as to leave anyone floundering. Evidence of this was provided by the steadiness of the attendance which held up throughout all the lectures to the very end at something in the neighbourhood of 80-90, about 50 from out of town and 30+ locals.

The social functions were equally well attended: Peter and Liz Martin's welcome party, the Observatory visit and Open House of Don and Betty MacRae, GASA's party in the Physics Lounge and the dinner in Hart House.

Our thanks are owing to many persons of the Teaching and Support Staffs and Student Body, particularly John Percy, Esther Salve and Steve Shore and to the excellent speakers: Miroslav Plavec, Donald Lynden-Bell, James Gunn and Joseph Veverka - in order of their on-stage appearance each day.

As President John Evans said in his little speech of welcome, this format has many advantages over the large society meetings and international conferences.

Canadian Ambassador Visits Las Campanas

On May 7-8 His Excellency André Potvin, Canadian Ambassador to Chile, and Mme Potvin and two of their children visited Las Campanas, being guests of CARSO for a banquet on the 7th and overnight guests at Casa Canadiense. Receiving them were Canadians René Racine, Bob Garrison and Dot Fraquelli (observers on the 24-inch), former U. of T. graduate student Peter Jackson (observing on the CARSO 40-inch) as well as Dr. Art Vaughan and Robert Poindexter of CARSO. The Potvin family seemed to enjoy their visit and put our observers completely at ease with their informal friendliness.

Employed and Enrolled

The following students (3rd and 4th year, U. of T.) are employed as research assistants during the summer: Jeff Clayton, Henry Nienhuis, Richard McWatters, John Palimaka, Stephen Morris*(sic)*, Douglas Gies, Chris Rogers.

The following have been accepted as new graduate students: Joan Wrobel, Gerry Grieve, Chris McAlary, Donna Jean Zubrod, Robert Gauthier, Chris Smith, David Toms, Chris Vickers.

RASC Officers

Don Fernie has stepped down as National RASC President; he is succeeded by Alan Batten as President, and John Percy and Ian Halliday become First and Second Vice-Presidents respectively.

HSH Completes Book and Receives Honour

Helen Hogg's popular-style book on Astronomy, "The Stars Belong to Everyone", has been published by Doubleday Canada and is attracting much favourable comment . The book was launched on May 17 at a party given by Doubleday at the McLaughlin Planetarium and Simpsons downtown store sponsored an Autographing Party on June 5.

On May 29 McMaster University conferred on Helen the degree of Doctor of Science, honoris causa.

Tenured and Promoted

Tom Bolton and Peter Martin have both been granted tenure and promoted to Associate Professor as of July 1.

Observing

At Las Campanas: Dave Turner, Feb. 18 - Mar. 14; Tony Estevens Feb. 26 - Apr. 8; Shyam Jakate, Mar. 19 - Apr. 8; Bob Garrison, Apr. 30 - May 18; Dorothy Fraquelli, May 14 - 20, 28 - 31. Christine Clement, May 21 - June 8; Karl Kamper, June 14 - July 1.

At Cerro Tololo: Sidney van den Bergh, Apr. 22 - May 8; Rene Racine, May 1 - 10.

At NRAO: Ernie Seaquist, Apr. 12 - 19.

At Steward: Jose Maza, Mar. 6 - 10; Peter Martin and Jose Maza, May 22 - 26.

Talks

Robert Roeder, U. of Windsor, Mar. 4, "Inhomogeneities in the Universe - Some Simple Models". John Percy, Appelwood Heights Sec. School, Mar. 3, "Astronomy in Canada"; Hamilton Centre RASC, Mar. 4, "Pulsating Stars". René Racine, U.'s of Alberta, Calgary, Lethbridge and Saskatchewan, Mar. 3 - 6, "Astrophysical Problems and Canadian Solutions". Sidney van den Bergh, Ohio State, Apr. 7 and 8, "Life in the Universe" and "Evolution and Clustering of Galaxies"; Cornell, Apr. 12 - 17, "The Radio Source Centaurus A", "Recent Observations of Cas A", "Evolution of Galaxies inside and outside of Clusters"; in La Serena, Chile, "The Post-eruptive Galaxy NGC 5128 = Centaurus A; at the Minkowski Memorial Symposium at Berkeley, May 18, "The Post-eruptive Galaxy NGC 5128 = Centaurus A".

Visitor

Dr. Andrew Odell of the University of Northern Iowa is spending six weeks collaborating with John Percy and Tom Bolton on topics of "Stellar Structure and Evolution".

Sabbatical Leave

Bob Garrison will be on Sabbatical Leave July 1976 - July 1977. Before the IAU he plans to spend a month in Poland using the Canadian Copernicus Spectrograph at Torun and giving lectures on Spectral Classification in Torun and Warsaw. From September through June "home base" will be Lick Observatory in Santa Cruz with excursions of a few weeks each to Vancouver, Berkeley, Hawaii and Chile. His main research project for the year will include accurate spectral classification of all stars brighter than 4.75 in both hemispheres, classification of integrated spectra of globular clusters on the Morgan system, and calibration of absolute magnitudes by the use of the I Sco, II Sco, α Per and Hyades main sequences.

Weddings

Former students Dave Hanes (Ph.D. 1976) and Roslyn Shemilt (M.Sc. 1974) will be married in Hamilton July 3 and will be taking up housekeeping in Cambridge where Dave is a P.D.F. Serge Pineault (Ph.D. 1975) also was married on June 12 in Paris.

Other Staff Notes

Sidney van den Bergh has been appointed to the Editorial Board of Astrophysical Letters. Jack Heard was in Victoria Mar. 24 to take part in the Ph.D. examination of Barrow Baldwin (who is now a PDF here and whose wife, Jane, is a summer assistant in our library). Don Fernie has accepted nomination to the Vice-Presidency of IAU Commission 27. Don MacRae attended the organization meeting of the 1976-1977 Board of Trustees of the Universities Space Research Association at the Langley Research Center in Virginia.

Saint Mary's University

Two new students have entered the M.Sc. program in astronomy: Darlene English (Saint Mary's) and Robert Bailey (Dalhousie). Returning student Hiro Funakawa worked with Vic Hughes at Queen's during the summer, and Doug Forbes (and DuPuy) obtained telescope time at Las Campanas.

George Mitchell has returned from his sabbatical year at the Hahn-Meitner-Institut für Kernforschung in Berlin. He and two theoretical chemists, Phil Kunst (Berlin) and Jack Ginzberg (Saint Mary's), made substantial progress with their research on interstellar molecule abundances.

Gary Welch and David DuPuy attended the CAS meeting in Penticton, each giving a paper in the Education Session.

The University of Western Ontario

John Landstreet and Mike Marlborough have been promoted to full professors.

The Maude Holt Kingston Gold Medal awarded to the top graduating student in the Honours Astronomy Program was won by Andrew Russell Taylor. Russ is working for John Landstreet this summer testing the image tube scanner, and developing data reduction programs for it, as well as doing some observing with it. Another member of the graduating class, Chris Essex is spending the summer working at the D.A.O. before commencing graduate work at Rice University in the fall.

Other students employed by faculty members this summer are Tanya Flemming, who is working for Amelia Wehlau and Doug Wade who is working for Bill Wehlau and Mike Marlborough. Graduate student Henry Leparskas is working at D.R.A.O. again this summer. John Conville is now working full-time for the department developing a data acquisition and instrument control system for use with a number of instruments.

The Ivey Foundation has granted $30,000 towards the purchase of a Digicon detector and $20,000 has also been awarded from the Academic Development Fund for the same purpose.

Dave Gray's book, "The Observation and Analysis of Stellar Photospheres" has been published by John Wiley & Sons. The book is a first year graduate level textbook emphasizing the observational aspects of stellar atmospheres.

John Landstreet had an observing run in April at Mt. Wilson during which he studied variations in the magnetic fields of several magnetic stars and searched for magnetic fields in rapidly rotating main sequence and Be stars. Bill Wehlau and Chris McAlary had two weeks on the U. of T. 24-inch at Las Campanas doing photometry of white dwarfs, planetary nebulae and δ Scuti stars. They had good luck with the fall weather, getting 13½ out of 14 nights.

Bill Wehlau along with Eric Brannen and Zdenek Kucerovsky of the Physics Dept. attended a meeting on Infrared Heterodyne Detection Systems, held at York University in January. In February Bill was re-elected chairman of the Astronomy Discipline Group of ACAP at a meeting held in Toronto. During the same month he also attended meetings of the NRC Associate Committee on Astronomy and the National Committee of the IAU followed by a meeting of the Scientific Advisory Committee of the CFHT. He was re-elected vice-chairman of the SAC and attended another meeting in Hawaii in May, preceeded by meetings in Vancouver of the working groups on data acquisition and spectrographs.

Gilles, Francine and Marc Fontaine arrived at the end of June. Gilles is spending a year as a post-doc working with John Landstreet on photometry and spectroscopy of white dwarfs. The Fontaine family was increased by one more with the arrival September 15th of a baby girl.

Dave Gray, Bill and Amelia Wehlau, and grad student Herb Falk attended the June meeting of the CAS in Penticton. Dr. Gray presented a paper entitled "Differential Rotation in A Stars" and Amelia Wehlau gave one on "Red Variables in M22" which was co-authored by Helen Hogg of the U. of T. Mr. Falk presented a paper entitled "Proton-Proton Chain in Convective Cores" co-authored by Romas Mitalas.

While out west, Dave Gray visited the D.A.O. and gave a colloquium on "Analysis of Line Profiles for Turbulence and Rotational Broadening". He also spent some time at U.B.C. discussing photoelectric detectors for the CFHT.

Despite airline strikes, Bill Wehlau managed to attend the NRC Associate Committee meeting in Penticton followed by a Paris meeting of the CFHT Board of Directors which he attended as vice-chairman of the Scientific Advisory Committee.

Dave Gray, Mike Marlborough, Romas Mitalas, Bill and Amelia Wehlau attended the Grenoble meeting of the I.A.U. Dave gave an invited talk on "Fourier Analysis of Line Profiles for Turbulence and Rotation" at the Commission 36 meeting and attended I.A.U. Colloquium 40, "Astronomical Application of Image Detectors with Linear Response" held at Meudon after the General Assembly.

UNIVERSITIES continued on page 16

RESEARCH NEWS

HAVING FUN WITH A HELIOSTAT

J.B. Tatum
University of Victoria

A few years ago we installed a 200 mm heliostat on the roof of our science building. Although it seemed frightfully expensive at the time, we have in fact had a great deal of fun with it, some of which I shall write about in this article.

A heliostat consists of a plane mirror mounted on a polar axis, so that the mirror can be driven in hour angle or declination. In use, the normal to this mirror points half way between the Sun and the celestial pole and is driven in hour angle so that it always has the same hour angle as the Sun. Sunlight is reflected up towards the celestial pole, but, before it reaches it (after a couple of feet, in fact) it is intercepted by a fixed mirror, which can be arranged to reflect a stationary beam in either a horizontal or a vertical direction. No image is formed, unless you put a lens into the beam, but it is a great convenience for all sorts of purposes to have a fixed beam of sunlight.

Our heliostat came from Carson Astronomical Instruments, Inc. Originally in California, Carson seemed to disappear for a while, but the firm now has relocated at 120 Erbee N.E., Albuquerque, N.M. 87112. I do not know if they still make heliostats, but I can certainly say that the one we got was well made and has performed very well indeed. Any member seriously considering buying one might like to ask me about small details that I shan't have room to write about here.

Price? Well, in 1971 a basic 6-inch heliostat, which delivered a horizontal beam and had pyrex $\lambda/2$ optics was quoted at $2370.00, and I am sure you could do a great deal with such an instrument. We spoiled ourselves, however, and got an 8-inch heliostat, delivering a vertical beam (very convenient) and cervit $\lambda/20$ optics. We also got a remote control console which allows us to set R.A. and Dec. from the laboratory below, as well as a remotely-operated weatherproof shelter. We had to make a hole in the ceiling of our laboratory, with a $\lambda/20$ quartz window in the ceiling, and a large variable-aperture iris diaphragm. Also a third mirror in the laboratory which allows us to redirect the vertical beam as a horizontal beam in any direction we choose. By the time we had all of this, we were talking about $13,000 (1972.0) or so.

In many ways the nicest thing is the number three mirror. This is mounted on a laboratory bench. The sunlight comes vertically down from the number two mirror on the heliostat on the roof above, and encounters the third mirror, which directs the light to any one of four directions in the laboratory, where various experiments are set up. We rarely have all experiments going at once, but, for the purpose of this article, we'll imagine they are all set up.

If we direct the beam to the west, it goes through a refracting telescope which produces, by eyepiece projection, a large image of the Sun, just for the pleasure of seeing it. Depending on the eyepiece used, we have had sunspots an inch or more in diameter.

In the south, we have a similar telescope, which projects an image of the Sun on to a phototransistor connected to a pen recorder. If we switch off the heliostat drive and allow the Sun to drift across the phototransistor we can get a good measurement of the limb darkening. We can use coloured filters to see how it varies with wavelength. A little thought shows that we don't have to worry about vignetting problems.

Solar limb darkening is supposed to follow a law approximately like

$$I(\theta) = I(0)[1 - u(1 - \cos\theta)]$$

so that, in principle, u can be determined from

$$u = [I(\text{centre}) - I(\text{limb})]/I(\text{centre}) \quad .$$

In practice, however, scattered light near the limb makes it difficult to measure $I(\text{limb})$ with any pretence of accuracy. The limb darkening coefficient is much easier to find by plotting $I(\theta)$ against $\cos\theta$.

The system needs to be calibrated, of course. One way is to make use of crossed polaroids, the transmitted intensity of which is alleged to vary as $\cos^2\alpha$, where α is the angle between the optic axes of the two polaroids. Alternatively, one can use a set of neutral density filters. A very useful set (I think they are rhodium-on-quartz) of a dozen two-inch square filters, varying in transmittivity from 1% to 97%, is available from Jose Hamburger, 528 Huron Street, Toronto M5R 2R7. The trade name for these filters is "Balzers", and the set costs $165.00.

If we turn the third mirror so that the sunlight is directed to the north, we find a fixed, horizontally-mounted 1882 Alvan Clark 4-inch refracting telescope. Inside the telescope is a tunable Hα filter with a 0.05 nm bandwidth. You can sit down in a comfortable chair, and the eyepiece is then conveniently at eye level, so you can look through the telescope and see the Sun in Hα , prominences, filaments, flocculi and all. The filter is a polarizing interference filter, and it is surrounded by an electrically heated oven, which fits neatly inside the telescope tube. A rheostat enables you to change the oven temperature; this presumably changes the spacing between the various interference elements, and allows you to change the transmitted wavelength from the core to the wings of Hα . The filter, called Skyspear, is available from Carson. Depending on precise specifications the price can be anything up to $4000.

Our filter is just 2 inches in diameter, so if we put it in front of the telescope object glass, we lose resolution. If we put the filter inside the telescope, a short way in front of the focal plane, we are using the full telescope aperture, but of course converging light is then going through the interference filter. We are now designing a collimating system so that we can get the best of both worlds.

It is a simple matter to attach a 35 mm camera to the end of the telescope and photograph prominences. Eyepiece projection photography gives a better scale for detail than prime focus photography, and the experts seem to like Kodak SO-392 or SO-410 emulsion.

At nighttime, we can remove the filter and look at the Moon through the telescope without leaving the warm laboratory. Since the heliostat is all remotely controlled, there is no need to climb on to the cold roof. I have sat in my laboratory watching migrating birds flying across the face of the Moon, while my colleagues have believed that I was industriously working at spectroscopy after hours.

We can also see stars and set up exercises for double star measurements, merely using the heliostat to bring starlight into the fixed telescope. The heliostat drive speed can be varied from the laboratory so that we can get a sidereal rate.

The room below the heliostat is a spectrographic research laboratory, and it so happened (!) that, by directing the sunlight to the east with the #3 mirror, the light goes straight into the slit of our spectrograph, which gives a

dispersion of 5×10^6; that is, a reciprocal dispersion of 0.2 nm/mm. Here the possibilities for student experimentation are boundless. We get them to calibrate the plate for wavelength and intensity and then microphotometer the plate and measure the equivalent widths of the sodium D lines, but I'm sure there are more imaginative exercises than that.

No lens is necessary between heliostat and spectrograph and no solar image is formed. However, if we do mount a telescope on the optic axis of the spectrograph, we can project, with the eyepiece, a huge image of a sunspot, focussed on the spectrograph slit, so that spot spectra can be obtained.

Another possibility, which I hope to try soon, is to mount the object glass (no eyepiece) of the 4-inch refractor on the axis of the spectrograph and focus a star on the slit. As yet, I have no idea what exposure I need to get a 0.2 nm/mm spectrum of Sirius with a 4-inch telescope, but I intend to try.

A further interesting use was suggested by a member of our Biology Department, who was interested in using our fixed vertical beam of sunlight for making measurements of the growth of plants and of bacterial cultures!

Aligning the polar axis was a slight problem, but the method finally adopted was interesting. We simply measure the rate at which the Sun drifts out of the field because of incorrect alignment of the polar axis. It is true that this drift might also be partly caused by an incorrect drive speed, but I managed to sort out the spherical trigonometry involved and devised a method by which it was possible to deduce, from the observed drift rate, the azimuth and altitude of the polar axis and the drive speed of the heliostat. I hope to publish a technical article on that somewhere.

In any case, our heliostat has already given us lots of enjoyment, and we hope to have yet more in the years to come.

Continued from page 12 (University of Western Ontario):

A grant has been received from the Academic Development Fund for the purchase of a fast scanning interferometer and negotiations are in progress to let a contract.

The image tube scanner is now in operation and it was used over the summer at the 82-inch coudé camera focus to obtain a series of observations of Hα and Hβ profiles of Oe and Be stars. The scanner is presently being adapted for use with the Cassegrain spectrograph for both spectrophotometry and spectropolarimetry.

Sidney van den Bergh Discovers new SN Remnant

On plates obtained in May at the prime focus of the 4-m telescope of CTIO, Sidney van den Bergh has discovered delicate whisps of filamentary nebulosity about 10' NW of the centre of the radio position of the Lupus supernova of 1006 AD. (The object, which reached V = -8, was the brightest supernova of recorded history.) Red and blue plates show that the nebulosity is equally bright in Hα and [OIII]. The overall length of the system of filaments, which lie entirely within the radio remnant, is about 9'. The thickness of the filaments ranges from about 1" to 8". The morphology of the filaments is intermediate between that of S147 and SN1572 (Tycho).

Spectrograph of 74-inch to be Modified

The grating spectrograph of the DDO 74-inch telescope which has been in service since 1964 is about to undergo its first major modifications. The changes which have been proposed by Tom Bolton and Jack Heard in consultation with Harvey Richardson of the DAO include the following:

(a) Replacement of the 40 A/mm dispersion (which has never been satisfactory) by a suitable new grating and the present F/5 camera folded so as to provide an external focus for an image tube.

(b) Replacement of the present conventional slit-head by Richardson image-slicers.

(c) Duplication of the image-slicer and the inverted-cassegrain collimator to provide high-reflectance coatings for the blue (to 5000 A) and the red (5000 A - 11000 A) regions.

(d) Eventual fitting of an image tube to the lower-dispersion system mentioned in (a).

The new components which are being manufactured in Toronto and Victoria are well underway.

IR Studies by Airborne Telescope

Bob McLaren of DDO has been collaborating with Professor Charles Townes and his students at the University of California at Berkeley in making spectroscopic observations in the far-infrared region of the spectrum at wavelengths around 100 microns. They are using NASA's G.P. Kuiper Airborne Observatory - a 36-inch telescope which operates at stratospheric altitudes from a large jet aircraft. The group is particularly interested in studying far-infrared emission lines from HII regions. So far this year, they have had two observing sessions, each consisting of two eight-hour flights. Some of the objects which have been studied are M42, M17, M8, and W3. Bob reports that one good thing about observing from an altitude of 41,000 feet is that the weather is always clear.