Issue 03_Fall 2006

Coalition for Canadian Astronomy Newsletter

Representing Astronomy in Ottawa

On September 21, 2006, the Coalition for Canadian Astronomy, again, took their message to Ottawa. Pekka Sinervo, Coalition Co-Chair (Association of Canadian Universities for Research in Astronomy) and Dean of Arts and Science at the University of Toronto spoke to the House of Commons Standing Committee on Finance on behalf of the Coalition.

Their message: astronomy is a Canadian success story - scientifically, academically, and economically. To remain a world-leader in astronomy, Canada needs to continue investing in the Long Range Plans for Astronomy and Astrophysics, or LRP.

The Coalition strongly believes the Government must strategically invest in scientific research, to ensure Canada remains competitive in the global, knowledge-based economy.

"We believe that strategic scientific investment is as or more, important than investments in traditional manufacturing or resource industries," states Sinervo.

"This funding must be seen as an investment in Canada's economic future and a public good… just as vital to our economy as roads, ports or other infrastructure," he adds.

> "However you measure it – scientifically, academically, or economically – astronomy is a Canadian success story."

The Government faces pressure from many scientific interest groups to fund many different scientific priorities. However, astronomy is the only discipline that has a clear plan that brings together Canada's scientific, academic and industrial resources to achieve continued scientific excellence. The remaining elements of the LRP require another $235 million over seven years.

"Astronomy pays huge dividends to our economy, providing hundreds of jobs, several hundred million dollars in business revenue, and countless advances in technology and expertise that have propelled Canadian industry to world leadership in many diverse fields," explains Sinervo.

"However you measure it – scientifically, academically, or economically – astronomy is a Canadian success story."

Historically, Canada has received a two-to-one direct return, and as high as ten-to-one indirect return through spin-offs, for every dollar invested by the Federal Government in astronomy research. The knowledge gained supporting astronomy projects leads to new business opportunities in sectors far removed from astronomy.

These benefits to Canadian industry will continue only if we continue to have top-level astronomers in Canada. To that end, the Coalition's success has also generated an explosion of interest in astronomy at the university level with the creation of new astronomy departments, doubling the number of graduate and post-doctoral students.

As well, Astronomy has a disproportionate number of Canada Research Chairs, given its population of researchers. This has all occurred because of the support of the Federal Government.

Science has changed. Just like most other aspects of the economy and society, scientific pursuits are now international – and they are big, cost hundreds of millions of dollars, and take decades to complete. Canada's astronomy community has adapted to this changing reality. Unfortunately, Government funding mechanisms have not.

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PEKKA SINERVO, COALITION CO-CHAIR, SPEAKS TO THE HOUSE OF COMMONS STANDING COMMITTEE ON FINANCE.

SKA UPDATE

The international radio telescope for the 21st Century, The Square Kilometre Array (SKA), will probe the gaseous component of the early Universe. With its million square metres of radio-wave collecting area, SKA is 50 times more sensitive and 10,000 times faster, than any imaging radio telescope array ever built. SKA will be used extensively in planetary studies.

In the past six months, the NRC Herzberg Institute for Astrophyics and various ACURA members have focused on two areas of research: phased-array feeds and cost-effective reflector designs.

The International SKA Steering Committee is currently reviewing site proposals for Australia, China, Argentina and South Africa. Selection is based on which site has the ability to do the best science at an affordable cost.

"When it comes to Canada's exploration of space, astronomy's ongoing mission continues to give taxpayers a big bang for its buck."
Don Martin, National Post

REPRESENTING ASTRONOMY IN OTTAWA *continued from page 1*

"The Government needs to rethink its approach to scientific funding to ensure that those disciplines with a proven track record of success are given priority for project funding. Canada can be middle of the pack in several disciplines, or a world leader in a few. We believe the latter delivers more benefits to Canadian science and the economy," states Sinervo.

Let's ask a bigger question: why should astronomy funding be included in a Budget focused on Canada's place in a competitive world? The answers are clear.

"Investments in astronomy allow Canada to remain competitive through the development of new technology, the creation of a skilled workforce, and the emergence of a strong future generation of astronomers in our universities." explains Sinervo.

The Plan will deliver economic returns to Canada and ensure a place in a competitive world. The Plan is clearly focused and well coordinated to further Canada's international competitiveness and expand our ability to adapt to rapid technological change.

These investments will also help Canadians acquire the skills this country needs to seize new market opportunities all around the world.

"Research, Development and innovation are at the heart of a competitive country and funding the LRP will ensure Canada continues in the right direction," concludes Sinervo.

HOW THE LRP IMPACTS B.C.

The Long Range Plan (LRP) has astronomical benefits for all of Canada – in education, industry and the advancement of astronomy research. Specifically, in British Columbia, the LRP benefits astronomers, both amateur and professional, two of its prestigious universities, and the local industry.

British Columbians make up a fifth of the Canadian Astronomical Society in Canada, with 102 members. The National Research Council's Herzberg Institute of Astrophysics, located in B.C., operates Canada's major observatories and other facilities at sites in Victoria and Penticton. The Institute actively collaborates with B.C.'s high-tech industry and provides training opportunities to university students.

Both the University of British Columbia and the University of Victoria are charter members of the Association of Canadian Universities for Research in Astronomy (ACURA). So far, the Federal Government's investments in the LRP have had a profound impact on these two universities.

Both universities have been able to attract graduate students, hire new professors and develop their astronomy programs. There are seventeen undergraduates, up from seven, working on significant research projects in both universities today. Since the LRP, the number of graduate students in astronomy has increased from 22 to 37. And, the number of post-doctoral fellowships has more than tripled from 3 to 10.

Funding of LRP projects has had a profound impact on B.C.'s economy. Overall, Canada receives at least a two-to-one direct return for every dollar invested in astronomy and spin-off return has been estimated as high as ten-to-one. Most of this economic activity takes place in British Columbia. Jobs have been created for British Columbians through the design, construction and operation of astronomical facilities and instruments.

Over 75 companies, such as Aardvark Resources, AMEC, High Density Design and Hoskin Scientific, throughout B.C. are winning contracts for components of astronomical instrumentation for various LRP projects. Many of these companies are now embarking on other, non-government contracts – which have stemmed from their expertise in astronomy related projects. An estimated $150 million in the past decade was earned from spin-off contracts.

For instance, the technology and expertise AMEC developed in its astronomy work has helped the company become a world leader in the design and construction of amusement park rides.

British Columbian scientists, engineers, universities and industry wish to be fully involved in the exciting LRP projects. They see this as crucial to maintaining the current expansion of astronomy in British Columbia, along with all the benefits that flow from it. Helping ensure British Columbia has the talent needed to stay at the forefront of the astronomy field, AMEC has supported and mentored one Master and three Doctorial students who are now working on top level telescope projects.

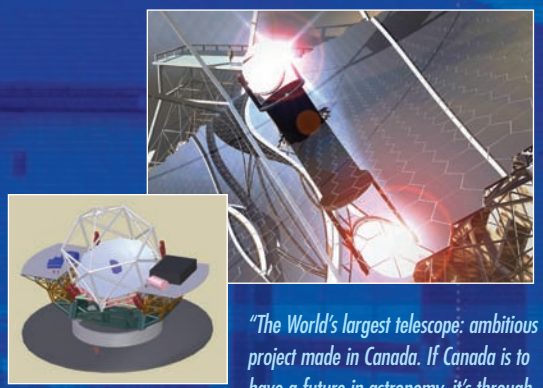
TMT UPDATE

In May, the Thirty-Metre Telescope, the world's next largest optical telescope, passed its conceptual design review with flying colours. A review panel evaluated all aspects of the project, including its optical design, the telescope structure and building, science instrumentation, site fronts and praised in particular the adaptive optics technology being planned for the giant telescope. In brief, the review praises the project, deeming it seamless - which is a real nod of approval to all those involved.

"The successful completion of our conceptual design review means that the TMT has a strong science vision, good technical requirements, a thoroughly reviewed design, and a powerful team to carry our work forward," stated Project Manager Gary Sanders.

The detailed design for the TMT developed by a U.S.-Canadian team is capable of delivering on the full promise of its enormous light-collecting area, according to the findings of an independent panel of experts. This means, astronomers can analyze the light from the first stars born after the Big Bang, directly observe the formation and evolution of galaxies, see planets around nearby stars, and make observations that test fundamental laws of physics, using TMT.

Thanks to the Canada Foundation for Innovation (CFI), the National Research Council (NRC), the Natural Sciences and Engineering Research Council (NSERC), and the Governments of Canada, British Columbia, and Ontario, for helping to fund this significant project.



"The World's largest telescope: ambitious project made in Canada. If Canada is to have a future in astronomy, it's through projects like the Thirty-Metre Telescope."
The Hill Times

SPOTLIGHT ON THE UNIVERSITY OF CALGARY

The University of Calgary takes pride in being a research-intensive university; placing great emphasis on research bearing strong relevance to current scientific and societal interest.

Within the Astronomy and Astrophysics group, researchers at the University are leaders in their field. Some of the recent research activities include the International Galactic Plane Survey, the Atacama Large Millimeter Array, or ALMA, and the Square Kilometre Array.

The University is involved with the largest telescope ever to be built, otherwise known as the SKA. Its name – Square Kilometre Array, means just that. The SKA's total collecting area will be one square kilometer. The area is made up of tens of thousands of radio antennas distributed over an area that is thousands of kilometers across.

One hundred times bigger than the world's current best telescope, the SKA is being developed by an international consortium of 15 countries. As a partner in the SKA, the University of Calgary will assist in the technical development, scientific planning, and the international governance.

Dr. Russ Taylor, Professor at the University of Calgary, is the Canadian National Project Scientist for the SKA. His group at the University, the Radio Astronomy Laboratory, is working on research projects that are scientific pathfinders to the SKA. Dr. Taylor is also the founding executive secretary to the ISSC, and drafted the international Memorandum of Understanding to set it up in 2000. He also served as the founding chair of the International SKA Science Advisory Committee, to help set the scientific direction for the project and continues to serve as a member of the ISSC.

The SKA is governed by the International SKA Steering Committee, or ISSC, with representation from all 15 countries. Dr. Taylor is one of the two Canadian representatives on the ISSC – representing all Canadian Universities through the University of Calgary. The other Canadian representative is Peter Dewdney from the National Research Council, Herzberg Institute of Canada, or NRC, HIA.

The University of Calgary has partnered with the NRC on developing the SKA technology. The University's technology effort is lead by Professor Jim Haslett from the Department of Electrical and Computer Engineering. Haslett is working on developing new technology for radio signal amplifiers for the SKA. His research has produced the best low-noise amplifiers anywhere in the word – which is crucial for SKA, as the radio signals received from the universe are extremely weak and have to be amplified to produce measurable signals. Haslett is also an iCoRE/NSERC senior Industral Research Chair in Broad Band Wireless Radio Frequency Design.

The University of Calgary is also working with an international team on the ALMA project, working with centres at the National Radio Astronomy Observatory in Socorro, New Mexico and the European Southern Observatory in Garching, Germany to develop two types of software. The first type of software will allow astronomers to control the ALMA telescope and the other type is for astronomers to process their observations and turn them into scientific results.

PHOTO COURTESY OF RUSS TAYLOR, UNIVERSITY OF CALGARY.

The Federal Government's investments in the Long Range Plan have had a profound impact on the University of Calgary. The University attracts more graduate students, new professors, and has enhanced its astronomy program and department. Currently, there are three graduates and one postdoctoral graduate working on significant research projects related to the SKA. And, over the past three years the University of Calgary has hired three new faculty members in astronomy. Rene Plume,

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ACURA

The Association of Canadian Universities for Research in Astronomy, ACURA, is an organization made up of 21 Canadian universities dedicated to the advancement of research and teaching in astronomy and astrophysics in Canada. It assists in coordinating large-scale national initiatives of its member institutions, advocates for the priorities of the LRP for astronomy, and is a liaison between Canadian member universities and international partners in international and world observatories.

"Canadians are masters of the universe" Macleans

JWST UPDATE

The James Webb Telescope (JWST), from its vantage point in deep space over a million and a half kilometers from Earth, will peer back into the time when new stars and galaxies first began to develop. With its infrared instruments it will also be able to penetrate clouds of obscuring interstellar dust to probe the conditions in which stars are born and the development of possible extra solar planetary systems.

Funded by the American, European, and Canadian space agencies (NASA, ESA, and the CSA) and set to be launched in 2013, the telescope will be used by a large international astronomical community. Canada's role is to provide a major hardware package – the Fine Guidance Sensor (FGS) with its Tunable Filter Camera.

The Canadian-built FGS instrument will provide high precision imaging of stars to enable accurate positioning and tracking for the whole observatory. The Tunable Filter Camera is a unique scientific instrument to complement the three other instruments being developed by NASA and ESA. It provides wide-field imaging capability within the infrared range 1.6 to 4.9 micrometers, using the tunable filter to isolate narrow wavebands chosen to highlight particular astrophysical diagnostics.

"CANADIAN ASTRONOMERS PRODUCE SOME OF THE BEST ASTROPHYSICAL SCIENCE ON THE PLANET" Macleans

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The Coalition for Canadian Astronomy, formed in 2000, was created to secure new money from the Federal Government to fund the LRP for Astronomy and Astrophysics. Made up of astronomers – both amateur and professional – universities and various industry members; the Coalition is an umbrella-like organization that encompasses all non-governmental major players in Canadian astronomy.

Edited by Lucy Meffe

ALL ABOUT ALMA

Sitting over 5000 metres above sea level on a plateau in Chile's Atacama Desert is the site for the Atacama Large Millimeter Array (ALMA) – a collection of up to sixty-four, 12-metre antennas that will be dispersed throughout the site to collect millimeter wavelength light from our universe.

ALMA is the world's largest ground-based astronomy project and will create a new standard for radio astronomy observatories. The telescope is expected to revolutionize modern astronomy, detecting the earliest, most distant galaxies, while taking a closer look into star and planet formation in our own Galaxy.

ALMA began as an equal partnership between North America and Europe, with participation from Chile. In 2006 Japan joined, bringing new technologies and adding antennas to the project. Canada's commitment, as part of the North American partnership, is US$20 million to the total cost of about US$800 million for the ALMA project. Canada's main contributions are largely technological in nature along with scientific expertise.

The largest component of the telescope, the antennas, have already been designed and evaluated at the ALMA test facility in New Mexico. The contracts to build the antennas have been completed and the first antennas will arrive at the Atacama site in 2007, with the rest delivered about one per month, finishing in 2012.

There has been steady progress at the Chilean plateau site. The infrastructure required for such a large project is being completed, including roads, laboratories, and dormitories to house scientists and workers. Over the last year, the ALMA project successfully passed a series of management and cost reviews.

Canada's largest contribution to ALMA's construction is the design, development, and construction of the "Band 3" receiver cartridges, operating at 3 millimetres. These receivers, one per antenna, will detect the weak signals from space, amplify them, and convert them into measurable quantities that are then compared between antennas in order to image the sky. The "Band 3" cartridges, designed and developed by the HIA, are the most sensitive receivers built at this frequency, meeting and sometimes exceeding ALMA's demanding specifications.

Canadians also contribute to ALMA's software, from facilitating communication between subsystems to software programs for astronomers to create images using ALMA's retrieved data. Both McMaster University and The University of Calgary participate in this effort.

Astronomers are preparing now for the ALMA revolution. In August 2006 HIA hosted an extremely successful Submillimetre Observing Techniques Summer School for Canadian graduate students, preparing them for the ALMA era. In November 2006 the ALMA partnership is holding an international science meeting in Madrid, Spain. Here, the main scientific drivers behind ALMA will be presented and discussed: the formation and evolution of galaxies, the physics and chemistry of the interstellar medium, and the processes of star and planet formation. Many Canadian astronomers will partake in this important event.

Artist's rendition of the Atacama Large Millimeter Array (ALMA) radio telescope. Image courtesy of NRAO/AUI.

ALMA is moving forward fast and "first light" is be expected in 2010, at which time sixteen antennas will be available for early science. The full array is expected to be complete and functioning in 2012.

SPOTLIGHT ON UNIVERSITY OF CALGARY *continued from page 3*

who is prominently involved in the ALMA project; Jo-Anne Brown, a member of the radio astronomy group and working on SKA science; and Rachid Ouyed, a theoretical and computational astronomer working on many theoretical projects that underpin both.

"WHEN IT COMES TO ASTRONOMY, CANADA IS THE WORLD'S BRIGHTEST STAR." Don Martin, National Post