
CASSIOPEIA



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HELEN SAWYER HOGG DISTINGUISHED VISITORSHIP

Helen Sawyer Hogg (1905-1993) was one of Canada's most respected scientists. An internationally recognized astronomer, and a leading authority in the study of globular clusters, she was first and foremost a gifted and caring teacher. Indeed, until her death in January 1993, she was an active role model and visionary advocate for female scientists.

As a memorial tribute to this great scientist, the Faculty of Arts and Science and the Department of Astronomy at the University of Toronto announce the establishment of the Helen Sawyer Hogg Distinguished Visitorship. The Visitorship will bring a distinguished female scientist to the University on a regular basis to deliver both specialist and public lectures, and to interact with faculty members and graduate students in the astrophysical and related sciences. The Distinguished Visitor will also participate in the Faculty of Arts and Science's Women in Science Forum.

By providing both concentrated interaction with specialists and broader public education, the Distinguished

Visitor will continue Professor Hogg's tradition of encouraging a public understanding of the wonders of the universe while inspiring women to pursue scientific careers.

The Visitorship will take place a minimum of once every three years and annually if funds permit. Supporters of The Visitorship will be invited to attend public events.

In announcing The Visitorship, the University of Toronto invites contributions to assist in its establishment. Contributions by cheque may be made to the University of Toronto and mailed to The Chair, Department of Astronomy, University of Toronto, McLennan Labs, 60 St. George Street, Toronto, Ontario, M5S 1A7 (416) 978-3150.

The Helen Sawyer Hogg Distinguished Visitorship is an initiative of the Department of Astronomy and the David Dunlap Observatory in consultation with the Hogg family.

CFHT SCIENTIFIC ADVISORY COMMITTEE

Report on the May 1993 meeting

The 43rd meeting of the CFHT Scientific Advisory Committee was held in St Malo (France) May 12 through 14. Despite the attractions of the beauty of the Brittany coast, the excellent wines, and the superb seafood, the SAC was actually able to carry out some useful discussions. The major recommendations made both to the Board of Directors and to the CFHT Corporation are summarized in the following paragraphs.

1. Resolution Congratulating Guy Monnet

Since this was the final SAC meeting for the current director of CFHT, the SAC expressed thanks and congratulations to Dr. Guy Monnet for his outstanding work as Executive Director of CFHT during his mandate. He has contributed greatly in bringing the CFHT to the first rank among 4 meter class telescopes. SAC wishes him now as much success in his new endeavors as he encountered as CFHT Director.

2. Recommendation on Service Observing

SAC noted with interest and approval the recent experiments with service observing at CFHT. SAC recommends that such experiments continue and that an appendix be attached to Service Observing proposals at the time of their submission, providing a detailed preliminary list of all observations to be acquired. SAC also recommends that service observing requests be restricted to half nights or less.

3. Recommendation on Detector Information

CFHT has already in place an anonymous ftp account from which interested observers can access information about the detectors and their characteristics. SAC agrees that this is an excellent idea and encourages the Corporation to publicize its existence and to expand its use. This account should contain at a minimum current data on available detectors, the most current application form for CFH Telescope time, and observing manuals. All of this information should be in a format which can be down-loaded by potential applicants and easily printed.

4. Recommendation on Integral Field Spectroscopy

With the advent of the Adaptive Optics Bonnette in early 1996, the CFHT community will have available high resolution images (as small as 0.1") at the Cass focus of the telescope. At the moment, there is no spectroscopic instrument available to exploit these images, particularly for two-dimensional (Integral Field) spectroscopy. In order to fill this void, a French consortium has designed and is building a multi-purpose spectrograph called OASIS. There will be 6 modes of operation with this instrument: (1) an imaging mode (2) a long slit mode (3) a scanning Fabry-Perot mode (4) a TIGER mode (a micro-lens array to provide a two-dimensional capability) (5) an ARGUS mode (fiber optic bundle placed over an image and then passed to a

grism) and (6) a PYTHEAS mode (similar to TIGER mode except that a scanning Fabry-Perot is inserted before the lens array). The builders of this instrument have requested that it be given GUEST status at CFHT which means that it eventually becomes the responsibility of CFHT to maintain and support the instrument. SAC responded to this request by noting the importance of both long slit and Integral Field Spectroscopy behind the Adaptive Optics Bonnette. It viewed the development of the OASIS instrument as providing an important capability in this area.

Nevertheless, SAC is concerned about the complexity of the OASIS instrument. SAC views the implementation of imagery, long slit, ARGUS, and scanning Fabry-Perot modes as being of the highest priority. Concerns continue to be expressed regarding the maturity of the data reduction algorithms for TIGER and Pytheas. An additional point is that there is an overlap in the scientific capabilities of ARGUS and TIGER. Furthermore, SAC has doubts whether a strong scientific case for Pytheas as a general use instrument has been made.

In view of the compelling scientific case for a spectroscopic capability behind the Adaptive Optics Bonnette, SAC recommends that Guest Instrument status be granted solely for imagery, long-slit, ARGUS, and scanning Fabry-Perot modes of OASIS. SAC further recommends that TIGER and Pytheas modes be treated as visitor instruments (maintenance and support the responsibility of the builders), at least initially, until further experience is obtained with their operation.

Noting the fact that the Adaptive Optics Bonnette provides optimal performance in the J and H windows, SAC also recommends that the OASIS team investigate the possibility of using optical designs that can accommodate the entire 0.4-2.0 micron spectral range.

5. Infrared Spectroscopy

CFHT conducted a small survey inquiring as to the needs of the community for faint object spectroscopy in the 1-2 micron region. From this survey the following requirements for a low resolution spectrograph were found to be dominant. (1) direct imaging (for field identification and placing objects on slits), (2) tip/tilt stabilization for both imaging and spectroscopy, (3) long slit and multi-slit capability, (4) wide field ($0.3''/\text{pixel}$) and high resolution ($0.1''/\text{pixel}$) modes, and (5) resolving power in the range 500-2000. In response to this a DAO-Observatoire de Paris-Meudon consortium was established to build such an instrument. The design culminated in the OSIS project which will eventually replace the SIS part of MOS/SIS with a stabilized imaging spectrograph that will extend the spectral coverage out to 1.8 microns. The SAC commented as follows on this instrument.

Consistent with the needs of the community as expressed in the survey, SAC considers the OSIS project

to be an extremely interesting, viable project that would provide CFHT with unique high spatial resolution, multi-object spectroscopic capabilities. We encourage the OSIS team to proceed with this project and request that the following technical issues be addressed.

- (1) The spectral range should be limited to the upper limit of the H-band, around 1.8 microns. The added complexity and cost of cooling the slit-mask so as to get access to the K-band is not considered scientifically justifiable.
- (2) The issue of suitable coatings for the lenses and other optical options should be studied. We wish to stress that the use of the system in the B-band should not be seriously compromised. We recognize that minor sacrifices at certain wavelengths may be necessary to achieve the wider wavelength coverage.
- (3) It should be investigated whether the system will allow the use of infrared detector arrays of up to 1024x1024, 20 micron pixels format.

6. Recommendation on Long-term Strategy for Preserving CFHT Scientific Capabilities

The following SAC statement is in response to the request by the Board to examine potential ways of preserving the core scientific capabilities of CFHT in the event of significant budget cuts some time in the future. In particular, the Board suggested that perhaps operating CFHT at a single focus (to save manpower costs) might be an effective future strategy in an era of reduced budgets.

SAC emphasized, however, that CFHT will certainly provide unique capabilities in the fields of optical and near-infrared imaging and spectroscopy well into the era of a refurbished HST and the initial operation of 8-10 meter telescopes.

Restricting CFHT to only one focus is a radical and practically irreversible solution. If necessary, it should only be implemented after practical experience with the actual performance of the high image quality 8 m telescopes (VLT, Subaru, Gemini, etc.) is available for comparison with CFHT's capabilities. Substantial capital investments in new equipment will be necessary to equip this single focus with several optical and infrared instruments simultaneously. Only such an instrumental system would preserve the core scientific capabilities and could lead to a reduction in operating costs. Other options should be considered before closing down foci (e.g. block scheduling of instruments for extended periods of time, exchange of observing time with other institutions, etc.)

SAC proposes to address the scientific implications of all of these possibilities with the help of the Corporation. A study will be carried out on the financial gains to be arrived at from these different options.

As a final point of information for observers at CFHT, I mention below the current inventory of CCD chips available for use at CFHT. With the old PHOTOMETRICS controller CFHT has LICK2 uncoated, SAIC1 uncoated, RCA 2/4, and PHX1 coated. In December 1992 LICK1 died. LICK2 had a coating on it in order to enhance its blue response, but this was recently removed so that its flatfielding characteristics could be improved. This means that the response of LICK2 shortward of about 4000 Å is essentially zero. With the new generation of controllers (called Gen III) CFHT has available for use LORAL3 (2048 x 2048, thick, coated for blue sensitivity) which was loaned to CFHT by Gerry Luppino of the University of Hawaii. This arrangement with Luppino was arrived at after it was learned that the 2048 x 2048 devices being thinned

at Steward Observatory for CFHT were delayed. Some features, such as the hold and abort functions, of normal operation are not as yet available with this chip. The first thinned 2048 x 2048 chip received by CFHT from its collaboration with the University of Hawaii and Steward Observatory arrived damaged! It was repaired in Luppino's lab at UH. This chip, called LORAL4, was returned to Steward for additional testing and repairs. If these are successful it will be returned to Hawaii in early June for installation in a new dewar. CFHT is involved in one further wafer, and the hopes are that it will produce some usable chips. Observers planning to use any of these thinned chips should keep in mind that they are very likely to fringe quite badly. This may mean that it is possible they will not be usable for faint object spectroscopy with MOS.

HARVEY B. RICHER

REPORT TO CASCA COUNCIL ON JOURNALS PROJECT

Journal shipments continue at a slow but steady pace. The receipt of an earlier shipment to Peru having been confirmed, a second larger shipment has been sent. On the suggestion of S. van den Bergh, contact was made with the Gaza Library Project, who turned out to be eager to accept anything we could send. A pilot shipment was sent from Victoria, and a much larger one is in process from Toronto. On another suggestion from D.A. MacRae, I have established contact with INASP (International Network for the Availability of Scientific Publications). I believe that we can be probably more effective by linking up with a larger organization.

In recent years we have tended to discourage too many donations because of storage problems. The large shipments of this year have relieved that to some ex-

tent. However, we would like to suggest to CASCA members that they consider another way of giving suggested to us by INASP. Although some libraries do need old runs of journals, the crying need in most developing countries is for current journals. The ideal is a long back run with a commitment to provide current issues. Members could do this if they were willing to send the issues of a given journal received in each year at the end of the year. While I appreciate that there is a convenience in keeping one's personal copies of current journals, most of us work in institutions where we can easily consult library copies. Please consider making a commitment such as I have suggested. Although I have discontinued most of my journal subscriptions, I am offering my current copies of "The Observatory" to an Algerian astronomer.

A.H. BATTEN

NEW EDITOR FOR CASSIOPEIA

Jack Penfold has agreed to become the new editor for *Cassiopeia* beginning with the next issue. Please forward all submissions for the Autumnal Equinox issue directly to him.

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CITA ANNUAL REPORT 1992

Canadian Institute for Theoretical Astrophysics / Institut canadien d'astrophysique théorique

The following is an abbreviated version of the CITA Annual Report for 1992, prepared by Luc Binette and Arnold Boothroyd. Due to space constraints, we have not included a list of the publications from CITA in 1992, nor more than a very brief summary of the scientific activities at CITA in 1992. The full report is available on request (from citadmin@maia.utorp.bitnet).

Foreword

The Canadian Institute for Theoretical Astrophysics is a nationally supported research centre for studies in theoretical astronomy and related subjects, hosted by the University of Toronto. CITA has two primary missions: a Canadian one — to foster interaction within the Canadian theoretical astrophysics community, and also between theorists and observational astronomers — and an international one — to serve as a centre of excellence for theoretical studies in astrophysics. In this report, we review the main activities at CITA during 1992.

Personnel Changes In 1992

Seven new staff joined CITA since the spring of 1992. Keith Ashman (Space Telescope Science Institute), Francis Bernardeau (Paris), Scott Grossman (University of Arizona), William Keogh (Toronto), Robert Nelson (Cornell), Michael Nowak (Stanford), and David Syer (Cambridge) were appointed research fellows. In addition, Lev Kofman returned to CITA as a research associate and CIAR scholar. They joined research associates Omer Blaes, Robert Malaney, and Larry Widrow and research fellows Arif Babul, Man Hoi Lee, Avery Meiksin, Prasenjit Saha, Glenn Starkman, Chris Thompson, John Wang, Rien van de Weygaert, and Lin Zuo.

Werner Israel (Alberta), Ray McLenaghan (Waterloo), and Peter Sutherland (McMaster) spent part of 1992 at CITA as Reinhardt Fellows.

A number of our research fellows have left during the past year. Luke Dones is now an assistant research astronomer at the University of California, Santa Cruz though he is spending most of his time at NASA/Ames. Michael Merrifield is a PDF at the University of Southampton. Steve Myers is a Millikan Postdoctoral Fellow at Caltech. Gerald Quinlan is a PDF at the University of California, Santa Cruz. Barbara Ryden has taken up a tenure-stream assistant professor position at Ohio State University. Finally, Gustavo Yepes is a PDF at the Universidad Autonoma de Madrid.

Faculty and research fellows have been involved in the supervision of eight graduate students from

the University of Toronto: S.-H. Kim, F. Rouleau, J. Stadel, P. Wiegert, and P. Zembrowski from Astronomy, W. Keogh from Chemistry, and P. Papadopoulos and G. Squires from Physics. Undergraduates D. Hogg (MIT), C. Shepherd (Toronto), and D. Parker (Toronto) also conducted research at CITA during 1992.

The research staff of CITA for the year 1992, along with their primary research interests, are listed below. (Notes: † has left CITA during 1992; ‡ joined CITA during 1992.)

CITA Faculty

- J. R. Bond, Professor (Ph.D. Caltech 1979) - *Cosmology — Very Early Universe, Evolution of Cosmic Structure, Dark Matter, Cosmic Background Radiation, Particle Theory*
- N. Kaiser, Professor (Ph.D. Cambridge, 1982) - *Cosmology, Early Universe, Large-Scale Structure, Galaxy Formation, Galaxy Clusters, Gravitational Lensing*
- P. G. Martin, Professor (Ph.D. Cambridge 1972) - *Interstellar and Circumstellar Dust, Interstellar Polarization, H₂, H II Regions, IR Cirrus, AGN, Chemical Abundances*
- S. Tremaine, Professor and Director (Ph.D. Princeton 1975) - *Galactic Structure, Stellar Dynamics, Solar System Formation and Dynamics, Comets*
- L. Binette, University Research Fellow (Ph.D. Australian National University 1983) - *Radiative Transfer, Diagnostics of Emitting-Line Plasma, Star Forming Regions, Active Galactic Nuclei*
- A. I. Boothroyd, University Research Fellow (Ph.D. Caltech 1987) - *Collisional Dissociation of H₂; Stellar Evolution: Lithium, Carbon Stars, Mass Loss, Solar Models and Neutrinos*

Research Associates 1992

- O. M. Blaes (Ph.D. Trieste 1986) - *Gamma-Ray Bursts, Neutron Stars, Accretion Disks, Gravitational Lensing*
- L. Kofman[†] (Ph.D. Tartu, 1983) - *Cosmology, Large Scale Structure, Early Universe*
- R. A. Malaney (Ph.D. St. Andrews 1986) - *Nuclear Astrophysics, Neutrino Astrophysics, Cosmology*
- L. M. Widrow (Ph.D. University of Chicago, 1988) - *Particle Astrophysics, Large Scale Structure, Neutrino Cosmology, Baryogenesis*

Postdoctoral Fellows 1992

- K. M. Ashman[‡] (Ph.D. Queen Mary College 1989) - *Formation and Evolution of Galaxies and Globular Clusters; Dark Matter*

- A. Babul (Ph.D. Princeton 1989) - *Physical Cosmology, Large-Scale Structure, Galaxy Formation, Galaxy Clusters*
- F. Bernardeau† (Ph.D. Paris 1992) - *Cosmology, Large-Scale Structure, Nonlinear Processes*
- L. Dones† (Ph.D. UC Berkeley 1987) - *Solar-System Dynamics, Planetary Rings, Light Scattering*
- S. A. Grossman† (Ph.D. Arizona 1992) - *Non-Local Convection: Convective Overshooting, Gravitational Lensing*
- W. J. Keogh† (Ph.D. Toronto 1992) - *Collisional Dissociation of H₂, Molecular Collision Dynamics, Potential Energy Surface Fitting*
- M. H. Lee (Ph.D. Princeton 1992) - *Gravitational Lensing, Stellar and Solar-System Dynamics*
- A. A. Meiksin (Ph.D. Berkeley 1988) - *Intergalactic Medium, Large-Scale Structure, Cooling Flows, Cosmology*
- M. R. Merrifield† (Ph.D. The ChairHarvard 1990) - *Dynamics of External Galaxies, Structure of the Milky Way, Gravitational Lensing*
- S. T. Myers† (Ph.D. Caltech 1990) - *Cosmology, Cosmic Microwave Background, Large-Scale Structure, Galaxy Formation, Millimeter-Wave Astronomy, Microwave Instrumentation*
- R. W. Nelson† (Ph.D. Cornell 1991) - *Compact Objects, X-ray Binaries, Plasma and Radiative Processes in Strong Magnetic Fields, Galactic Dynamics*
- M. A. Nowak† (Ph.D. Stanford 1992) - *Accretion onto Compact Objects and AGN, Studies of X-ray Timing Data, Black Hole QPO*
- G. D. Quinlan† (Ph.D. Cornell 1989) - *Stellar Dynamics, Solar-System Dynamics*
- B. S. Ryden† (Ph.D. Princeton 1987) - *Cosmology, Large Scale Structure, Galactic Structure*
- P. Saha (D.Phil. Oxford 1989) - *Galaxy and Solar System Dynamics*
- G. Starkman (Ph.D. Stanford 1988) - *Cosmology and Particle Astrophysics: Dark Matter, Large Scale Structure, Nucleosynthesis, Inflation, Electroweak Phase Transition, Topological Defects; Particle Physics: GUTs, SUSY, Fermion Masses*
- D. Syer† (Ph.D. Cambridge 1992) - *Stellar Dynamics; Dynamical Problems in Accretion Disk Theory*
- C. Thompson (Ph.D. Princeton 1988) - *Pulsars, Plasma Physics, Supernovae, Astrophysical Dynamics, Neutrino Astrophysics, Cosmic Gamma Ray Bursts, Cosmic Rays, Large Scale Structure, Microwave Background Radiation, Cosmic Strings*
- J. C. L. Wang (Ph.D. Cornell 1988) - *Gamma-Ray Bursts, Particle Acceleration, Radiative Transfer, Jets, Active Galaxies, Cosmology*

- R. van de Weygaert (Ph.D. Leiden 1991) - *Cosmology, Large-Scale Structure*
- G. Yepes† (Ph.D. Univ. Autónoma Madrid 1989) - *Cosmology, Large-Scale Structure, Galaxy Formation, Clusters of Galaxies*
- L. Zuo (Ph.D. Caltech 1992) - *QSO Absorption Line Systems, Intergalactic Ionizing Background*

Although the bulk of the support for CITA's research staff comes from our NSERC Collaborative Special Program grant and from research grants to individual faculty members, our research fellows successfully attracted substantial support from other sources including 2 NSERC Postdoctoral Fellowships (Lee and Quinlan), 2 NSERC International Fellowships (Meiksin and van de Weygaert), 2 NSERC University Research Fellowships (Binette and Boothroyd), a NATO/British SERC Fellowship (Ashman), NASA (Dones), the Spanish Ministry of Education (Yepes), and the Canadian Institute for Advanced Research (Kofman).

National Fellows 1992

A program started in 1988 solicits nominations from universities across Canada for "CITA National Fellows". These are research fellows who are jointly supported by CITA and the nominating university; although they work primarily at the nominating university, visits to CITA and collaboration with CITA staff are encouraged. CITA Council awards these fellowships using the same selection criteria as those for CITA research fellowships. The National Fellows in 1992 were:

- A. Barvinsky (Ph.D. Moscow State University), held at the University of Alberta (1991-1993)
- G. Hayward (Ph.D. University of Alberta), held at Dalhousie University and the University of Alberta (1992-1994)
- M. Morris (Ph.D. Caltech 1988), held at the University of Waterloo (1990-1992)
- T. Zannias (Ph.D. University of Alberta 1985), held at Queen's University (1992-1994)

CITA Visitors

CITA has a vigorous visitors program bringing a number of Astronomy and Physics faculty members from other Canadian universities and from abroad for both extended stays and shorter visits.

Visitors to CITA in 1992 included:

- T. Beers, Michigan State University
- J. Binney, Oxford University
- C. Bird, Michigan State University
- A. Blanchard, Observatoire de Meudon
- M. Butler, Queen's University
- G. Byrd, University of Alabama
- E. Chaisson, Tufts University
- E. Chatzichristou, Leiden Observatory
- H. Couchman, University of Western Ontario

- R. Davis, University of Pennsylvania
- C. Deliyannis, University of Hawaii
- D. Earn, Institute of Astronomy, Cambridge
- G. Efstathiou, Oxford University
- C. Evans, University of North Carolina
- H. Feldman, University of Michigan
- M. Fich, University of Waterloo
- M. Fukugita, Yukawa Institute, Kyoto University
- G. Guzzo, Osservatorio Astronomico di Brera
- M. van Haarlem, Leiden Observatory
- F. Hammer, Meudon
- R. den Hartog, Leiden Observatory
- T. Herbst, Max-Planck, Heidelberg
- L. Hernquist, University of California, Santa Cruz
- J. Hutchings, Dominion Astrophysical Observatory
- V. Icke, Leiden Observatory
- W. Israel, University of Alberta
- E. van Kampen, Leiden Observatory
- P. Kroupa, Institute of Astronomy, Cambridge
- K. Kuijken, Center for Astrophysics
- P. Kumar, High Altitude Observatory, Boulder
- S. Kwok, University of Calgary
- D. Leahy, University of Calgary
- H. M. Lee, Pusan National University
- P. Leonard, Los Alamos National Lab
- A. Loeb, Institute for Advanced Study, Princeton
- R. Lovelace, Cornell University
- R. McLenaghan, University of Waterloo
- M. Mandy, Dalhousie University
- G. Matthews, Lawrence Livermore Laboratory
- D. Merritt, Rutgers University
- J. Monaghan, Monash University
- N. Murray, Caltech
- Y. Ng, Leiden Observatory
- V. Petrosian, Stanford University
- F. Pijpers, Queen Mary College
- P. Pinto, Center for Astrophysics
- N. Prantzos, Institut d'Astrophysique, Paris
- C. Pritchett, University of Victoria
- T. Quinn, Oxford University
- D. Richstone, University of Michigan
- D. Richardson, Institute of Astronomy, Cambridge
- M. Romanova, Cornell University
- M. Ruderman, Columbia University
- D. Schade, Institute of Astronomy
- D. Schramm, University of Chicago
- F. Summers, U.C. Berkeley
- P. Sutherland, McMaster University
- P. Thomas, University of Sussex
- J. Tohline, Louisiana State University
- P. Tribble, Institute of Astronomy, Cambridge
- M. Turner, University of Chicago
- M. Villar, ESO, ST-ECF, Garching
- R. Webster, University of Melbourne
- M. West, Leiden Observatory
- T. Williams, Rutgers University
- S. Zepf, University of Durham

CIAR and CITA

The Canadian Institute for Advanced Research (CIAR) and CITA: CIAR supports a number of Programs chosen for their high intellectual promise and interdisciplinary character. The CIAR Cosmology Program has nodes at UBC (Director and Fellow Bill Unruh, Fellow Ian Affleck), the University of Alberta (Fellows Werner Israel and Don Page) and at CITA, where Dick Bond and Nick Kaiser are CIAR Fellows. The CIAR also collaborated with CITA in 1992 to help support research associate and CIAR Scholar Lev Kofman. The intellectual interaction between CIAR Fellows and other CITA visitors and researchers, and the administrative cooperation between CITA and CIAR in attracting excellent cosmologists, continues to make Toronto and Canada a lively place for research in theoretical cosmology.

Facilities

CITA occupies the entire 12th floor of the McLennan Physical Laboratories at the downtown campus of the University of Toronto. We continue to own a three-eighths share (the remainder being divided between Astronomy and Physics) of a Silicon Graphics 4D/280 (8 processors, 256 Mb), where most of our computationally-intensive jobs are run. The 4D/280 is supplemented with a network of 17 diskless Sun 3/50 workstations, eight Sun Sparcstations, and ten Silicon Graphics Personal IRISes. The IRISes are used to support research activity demanding 3-D scientific visualization. The disk capacity available to the network currently exceeds 12 Gb.

We recently used money from an NSERC equipment grant to purchase two Digital Equipment Alpha AXP systems, which will become CITA's primary resource for large computations. The combined computational power of these two systems (a 32 Mb 3000/400S and a 256 Mb 3000/500S) is expected to exceed that of the entire 4D/280. The configuration will provide us with one system for large-memory jobs, and another one for jobs with more modest memory requirements. The 500S will eventually support 1 Gb of memory.

We are also planning to phase out our Sun3s over the next year or two, replacing them with Sparcstations and X terminals.

CITA Council

CITA is both an Institute within the School of Graduate Studies of the University of Toronto, and a non-profit corporation (CITA, Inc.). Relations between the two CITAs are governed by a Letter of Agreement between CITA Inc. and the University of Toronto that was signed in late 1989. The CITA Council consists of seven members, five selected from the CITA Inc. membership in co-operation with the Canadian Astronomical Society (of which they must also be members),

and two *ex officio*: the Director of CITA and the Dean of the School of Graduate Studies of the University of Toronto or his designate. Richard Henriksen (Queen's University) finished his term on the council in March 1992.

Members of CITA Council for the second half of 1992 were:

- Dave Hartwick, University of Victoria
- Kim Innanen, York University
- Rika Maniates, Assistant Dean, School of Graduate Studies, University of Toronto
- Lorne Nelson, Bishop's University
- Peter Sutherland, McMaster University, Chair
- Scott Tremaine, CITA, Director
- Don Vandenberg, University of Victoria

Conferences Supported by CITA

CITA supports scientific workshops and meetings in Canada on subjects of interest to theoretical astrophysics. Meetings supported by CITA in 1992 were:

- "Black Holes, White Holes, and Wormholes", May 20-23, Banff, organizer D. Page (University of Alberta).
- "Astronomical Infrared Spectroscopy", June 16-19, Calgary, organizer S. Kwok (University of Calgary).
- "New Perspectives on Stellar Pulsation and Pulsating Variable Stars", July 15-18, Victoria, organizer D. Welch (McMaster University).
- "Summer School on the Interstellar Medium", August, Penticton, organizer C. Rogers (DRAO).

Scientific Accomplishments 1992

Research at CITA covers a broad range of fields in astrophysical theory. Here, we give a brief overview of the research activities in 1992. Research in gravitation and particle theory included work on the possibility of gravitational neutrino oscillations in the sun, spinors in general relativity, and patterns in the quark and lepton mass/mixing matrices. Research topics in cosmology ranged from the early Universe, microwave background radiation, large scale structure, gravitational lensing, and clusters and galaxies. Studies of the early Universe dealt with inflation, dark matter (warm and cold+hot), primordial nucleosynthesis, stellar and primordial Be and B, cosmic ray spectra, the electroweak phase transition, and Nambu-Goldstone bosons. Research on the cosmic background radiation included analysis and interpretation of COBE, MIT balloon, and South Pole data as well as the possibility that the COBE's anisotropy signal might include a contribution from gravitational waves. Research in large scale structure dealt with statistical studies of the morphology of large scale structure, biasing, spherical

collapse, techniques for doing dark matter simulations, the shape of the primordial spectrum in light of the COBE results, voids, filaments, and clusters, and implications of the APM survey. Research in the field of gravitational lensing included work of the problem of lensing by several lenses, lensing of gamma ray bursts by dark matter clumps, using the gravitational distortions of the images of galaxies to map out the matter distribution, and the validity of Huygen's principle in an inhomogeneous universe. In the area of clusters and galaxy formation, CITA members have studied faint blue galaxies, starburst dwarf galaxies, globular clusters (metallicity, dynamics, formation), cluster formation in light of COBE, a smooth particle hydrodynamics code, velocity fields in clusters, substructure in clusters, and clusters in models with both cold and hot dark matter.

CITA members also worked on active galactic nuclei, as well as the intergalactic and interstellar mediums. In particular, they studied the baryon fraction in the IGM, evolution of the IGM, Ly α lines, the effects of dust on the Balmer and Lyman decrements of the Narrow Line Regions of AGN, Ly α clouds, QSO's (UV background from, absorption line systems, distribution of), the role of turbulence in black hole accretion disks, collisional excitation and dissociation of H₂ colliding with H₂, H₄, and the potential energy surface of He - H₂, extinction of light by irregularly shaped particles, and the size distribution of interstellar particles.

Several CITA members worked in the fields of galactic and stellar dynamics including studies of dark matter in spiral galaxies, dense clusters of compact stars, the distribution of atomic hydrogen in the Milky Way, the dynamics of disk galaxies, the interaction of galactic warps with the surrounding dark matter halo, the kinematics of elliptical galaxies, numerical methods in N-body codes, and the ellipticity of the Milky Way.

Finally, there has been considerable work at CITA in the study of stars, compact objects, and the solar system. In particular, CITA members have investigated the fate of old, 'dead', neutron stars, accretion onto neutron stars, particle acceleration from nonlinear, relativistic Alfvén waves, nucleosynthesis in asymptotic giant branch stars, the evolution of the Sun until the white dwarf stage, Boltzmann transport of fluid 'blobs', mixing-length convection, cyclotron line radiative transfer in cool magnetic atmospheres, Roche lobe overflow from a Jupiter-like planet, binary pulsars, dynamo action in young convective neutron stars, the possibility that neutron stars with supercritical magnetic fields might be responsible for gamma-ray bursts, cyclotron lines in gamma-ray bursts, the Balbus-Hawley instability in partially ionized accretion disks, the formation of planets, evolution of test-particle orbits in the solar system, the Jovian satellites, and Oort-type comet clouds around other stars.

Arnold Boothroyd
Larry Widrow

CANADIAN ASTRONOMY PUBLICATIONS
March 6 to June 8, 1993

If you have a preprint or other Canadian publication, we would like to include it in this list. Please send a copy (or a photocopy of the title page) to:

Canadian Astronomy Publications List
Astronomy Library
University of Toronto
Room 1306
60 St. George Street
Toronto, Ontario
M5S 1A7

A. PREPRINTS OF RESEARCH PAPERS

The following is a list of preprints written by Canadian astronomers and received at the Astronomy library within the dates given above. The preprints are arranged in alphabetical order according to the surname of the first listed author. Originating institution and date of receipt at the library are given.

- Aaquist, O.B., *Detailed radio morphology of the compact nebula K3-35*. College of New Caledonia, Prince George BC, 5-May-1993.
- Bell, M.B., Avery, L.W., Watson, J.K.G., *A spectral line survey of W51 from 17.6 GHz to 22.0 GHz*. JCMT/Ottawa Gp., 3-May-1993.
- Bernardeau, F., *The nonlinear evolution of rare events*. Canadian Institute for Theoretical Astrophysics, 10-May-1993.
- Borra, E.F., *On the correction of the aberrations of a liquid mirror telescope observing at large zenith angles*. Université Laval, 18-May-1993.
- Borra, E.F., Content, R., Girard, L., *Optical shop tests of a f/1.2 2.5-meter diameter liquid mirror*. Université Laval, 18-May-1993.
- Branch, D., van den Bergh, S., *Spectroscopic differences between supernovae of type 1A in early-type and in late-type galaxies*. Dominion Astrophysical Observatory, 12-Apr-1993.
- Chen, K., Leonard, P.J.T., *Does the coalescence of white dwarfs produce millisecond pulsars in globular clusters?*. Los Alamos Ntl. Lab., 31-Mar-1993.
- Clement, C.M., Ferance, S., Simon, N.R., *The RR Lyrae variables in the globular cluster M68*. David Dunlap Observatory, University of Toronto, 23-Mar-1993.
- Delisle, S., Hardy, E., *Comparison of the metallicity gradients of a bulge and a giant elliptical*. Obs. Mont Mégantic, 10-May-1993.
- Eales, S.A., Hill, G.J., Rawlings, S., *A Ly alpha survey of a possible Zeldovich pancake*. David Dunlap Observatory, University of Toronto, 21-Apr-1993.
- Epstein, R.I., Leonard, P.J.T., et al, *Gamma ray bursts in active galactic nuclei*. Los Alamos Ntl. Lab., 6-May-1993.
- Evans, N.R., Butler, J., *The companion of the 18d classical cepheid YZ Car*. Institute for Space and Terrestrial Sciences, York University, 31-Mar-1993.
- Evans, N.R., Welch, D.L., et al, *The orbit and companion of the cepheid S Sge: a probable triple system*. Institute for Space and Terrestrial Sciences, York University, 11-Mar-1993.
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- Fernie, J.D., Seager, S., *V441 Herculis and V814 Herculis in 1991 and 1992*. David Dunlap Observatory, University of Toronto, 21-Apr-1993.
- Hardy, E., Beauchamp, D., Suntzeff, N.B., *Two dwarf galaxies of the local group: Fornax and the SMC. Implications for stellar and chemical evolution*. Obs. Mont Mégantic, 10-May-1993.
- Hickson, P., Gibson, B.K., Hogg, D.W., *Large astronomical liquid mirrors*. University of British Columbia, 17-Mar-1993.
- Hill, R.J., Madore, B.F., Freedman, W.L., *The initial mass function for massive stars in the Magellanic Clouds. II. Interstellar reddening towards 14 OB associations*. IPAC, 18-Mar-1993.
- Hill, R.J., Madore, B.F., Freedman, W.L., *The initial mass function for massive stars in the Magellanic Clouds. I. UVB photometry and CM diagrams for 14 OB associations*. IPAC, 18-Mar-1993.

- Iverson, R.J., et al, *A multi-frequency study of symbiotic stars - III. Simultaneous ultraviolet and optical observations of AX Persei*. David Dunlap Observatory, University of Toronto, 22-Apr-1993.
- Iverson, R.J., Munari, U., Marang, F., *On the symbiotic star V919 Sagittarii*. David Dunlap Observatory, University of Toronto, 10-May-1993.
- Kaiser, N., Malaney, R.S., Starkman, G.D., *Neutrino-lasing in the early universe*. Canadian Institute for Theoretical Astrophysics, 16-Mar-1993.
- Kaluzny, J., Rucinski, S.M., *Discovery of 17 variable stars in the old open cluster NGC 6791*. Institute for Space and Terrestrial Sciences, York University, 19-Mar-1993.
- Kaspi, V.M., et al, *A young, glitching pulsar near the direction of W28*. Princeton, 8-Jun-1993.
- Larson, A.M., et al, *A low-amplitude periodicity in the radial velocity and chromospheric emission of beta geminorum*. University of Victoria, 19-Apr-1993.
- Lee, M.G., Madore, B.F., *BVRI CCD photometry of the resolved galaxy NGC 1560*. IRAS, 2-Apr-1993.
- Li, J.G., Seaquist, E.R., Sage, L.J., *Molecular gas in the early-type starburst galaxy NGC 3928*. David Dunlap Observatory, University of Toronto, 6-May-1993.
- Matthews, J.M., *Seismology of pulsating Ap stars: results from the past decade, prospects for the next*. Obs. Mont Megantic, 10-May-1993.
- Matthews, J.M., *Observing the eigenmodes of delta Scuti and ro Ap stars*. Obs. Mont Megantic, 10-May-1993.
- Moffat, J.W., *Do black holes exist?*. Phys/U of T, 31-Mar-1993.
- Murowinski, R., et al, *A simple and low-cost infrared imager for the Dominion Astrophysical Observatory*. Dominion Astrophysical Observatory, 19-May-1993.
- Nowak, M.A., *A kinematic model for black hole X-ray power spectra*. Canadian Institute for Theoretical Astrophysics, 4-Jun-1993.
- Nowak, M.A., Wagoner, R.V., *Turbulent generation of trapped oscillations in black hole accretion disks*. Canadian Institute for Theoretical Astrophysics, 4-Jun-1993.
- Ozard, S., Morbey, C., *The application of artificial neural networks for telescope guidance: a feasibility study for Lyman FUSE*. Dominion Astrophysical Observatory, 12-Apr-1993.
- Piche, F., *A near-infrared survey of the star-forming region NGC 2264 (PhD thesis abstract, PASP, vol. 105, p. 324, 1993)*. University of Washington, 15-Apr-1993.
- Roger, R.S., Leahy, D.A., *HI photodissociation zones around two HII regions in Auriga, Sh 217 and Sh 219*. Dominion Radio Astrophysical Observatory, 17-May-1993.
- Rucinski, S.M., Lu, W.-X., Shi, J., *Spectral-line broadening functions of W Uma-type binaries. III. W. UMa*. Institute for Space and Terrestrial Sciences, York University, 14-Apr-1993.
- Rucinski, S.M., *A simple description of light curves of W UMa systems*. Institute for Space and Terrestrial Sciences, York University, 14-Apr-1993.
- Saha, P., Tremaine, S., *The orbits of the retrograde Jovian satellites*. Canadian Institute for Theoretical Astrophysics, 4-Jun-1993.
- Simon, N.R., Clement, C.M., *A provisional RR Lyrae distance scale*. David Dunlap Observatory, University of Toronto, 23-Mar-1993.
- Tremaine, S., Dones, L., *On the statistical distribution of massive impactors*. Canadian Institute for Theoretical Astrophysics, 16-Mar-1993.
- Turbide, L., Moffat, A.F.J., *Remote young stellar groups and the rotation of the outer galactic disk*. Obs. Mont Megantic, 10-May-1993.
- van den Bergh, S., *A list of supernova discovered between 1989 January 1 and 1993 April 1*. Dominion Astrophysical Observatory, 19-May-1993.
- van den Bergh, S., *A catalog of recent supernovae*. Dominion Astrophysical Observatory, 19-May-1993.
- van den Bergh, S., *Supernova rates*. Dominion Astrophysical Observatory, 12-Apr-1993.
- van de Weygaert, R., *Fragmenting the universe IV. The clustering properties of Voronoi foams*. Canadian Institute for Theoretical Astrophysics, 19-Apr-1993.
- Widrow, L.M., Kaiser, N., *Using the Schrodinger equation to simulate collisionless matter*. Canadian Institute for Theoretical Astrophysics, 4-Jun-1993.
- Wilson, W.J.F., Milone, E.F., Fry, D.J.I., *Studies of large amplitude delta Scuti variables: I. A case study of EH Librae*. University of Calgary, 22-Apr-1993.
- Yee, H.K.C., Ellingson, E., *Quasars and AGN in rich environments III. The rapid evolution of AGN activity in rich clusters*. David Dunlap Observatory, University of Toronto, 22-Mar-1993.
- Young, A.T., Milone, E.F., Stagg, C.R., *On improving IR photometric passbands*. University of Calgary, 12-May-1993.
- Zepf, S.E., Ashman, K.M., *Globular cluster systems formed in galaxy mergers*. Canadian Institute for Theoretical Astrophysics, 3-May-1993.

Zuo, L., *A semi-analytic method for calculating D [subscript A] evolution*. Canadian Institute for Theoretical Astrophysics, 26-Apr-1993.

Zuo, L., Phinney, E.S., *Absorption by discrete intergalactic clouds - theory and some applications*. Canadian Institute for Theoretical Astrophysics, 26-Apr-1993.

CASCA FINANCIAL STATEMENTS

March 31, 1993

AUDITORS' REPORT

To the Members
of
CANADIAN ASTRONOMICAL SOCIETY

We have audited the balance sheet of the Canadian Astronomical Society as at March 31, 1993, and the statement of income for the year then ended. These financial statements are the responsibility of the management. Our responsibility is to express an opinion on these financial statements.

Except as explained in the following paragraph, we conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatements. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management as well as evaluating the overall financial statement presentation.

In common with many non profit organizations, the organization derives revenue from membership fees, the completeness of which is not susceptible of satisfactory audit verification. Accordingly, our verification of these revenues was limited to the amounts recorded in the records of the organization and we were not able to determine whether any adjustments might be necessary to membership fee revenue, excess of revenues over expense, assets and operating surplus.

In our opinion, except for the effect of adjustments, if any, which we might have determined to be necessary had we been able to satisfy ourselves concerning the completeness of the membership fees referred to in the preceding paragraph, these financial statements present fairly, in all material respects, the financial position of the Canadian Astronomical Society as at March 31, 1993, and the results of its operations for the year then ended in accordance with generally accepted accounting principles.

TORONTO, Ontario
May 6, 1993

Tinkham & Associates
CHARTERED ACCOUNTANTS

**CANADIAN ASTRONOMICAL SOCIETY
BALANCE SHEET
AS AT MARCH 31, 1993**

	1993	1992
A S S E T S		
CURRENT		
Cash	\$ 19,844	\$ 22,117
Investments	27,200	26,200
Interest receivable	<u>848</u>	<u>-</u>
	<u>47,892</u>	<u>48,317</u>
OTHER		
Due from trust	<u>4,060</u>	<u>-</u>
	<u>\$ 51,952</u>	<u>\$ 48,317</u>

LIABILITIES and OPERATING SURPLUS

CURRENT		
Accounts payable	\$ <u>300</u>	\$ <u>-</u>
OPERATING SURPLUS	<u>51,652</u>	<u>48,317</u>
	<u>\$ 51,952</u>	<u>\$ 48,317</u>

On behalf of the Board:

Accounting policies - Note 1

Christine McClement Board Member

L. G. Hogg Board Member

**CANADIAN ASTRONOMICAL SOCIETY
STATEMENT OF INCOME
FOR THE YEAR ENDED MARCH 31, 1993**

	1993	1992
REVENUE		
Membership fees	\$ 12,153	\$ 11,919
Interest income	3,448	3,430
Miscellaneous revenue	<u>112</u>	<u>2,088</u>
	<u>15,713</u>	<u>17,437</u>
EXPENSE		
Lecture and awards		
Hogg lecture	616	300
Petrie lecture	-	1,592
Beals award	1,583	-
Plaskett award	1,328	662
Small grants	<u>-</u>	<u>1,500</u>
	<u>3,527</u>	<u>4,054</u>
Office and General		
Astronomical Society of the Pacific	631	1,003
Newsletter	4,182	4,392
Office-treasurer	670	343
Office-secretary	1,752	2,699
Office-president	-	21
Shipments to Third World	1,253	289
Professional	300	-
General	<u>63</u>	<u>30</u>
	<u>8,851</u>	<u>8,777</u>
	<u>12,378</u>	<u>12,831</u>
EXCESS OF REVENUE OVER EXPENSE FOR THE YEAR	3,335	4,606
OPERATING SURPLUS, April 1	<u>48,319</u>	<u>43,713</u>
OPERATING SURPLUS, March 31	<u>\$ 51,654</u>	<u>\$ 48,319</u>

**CANADIAN ASTRONOMICAL SOCIETY
NOTES TO FINANCIAL STATEMENTS
MARCH 31, 1993**

NOTE 1 SIGNIFICANT ACCOUNTING POLICIES

(a) Revenue and expense recognition

Membership fees and contributions are recorded when received.

NOTE 2 ORGANIZATION

The Canadian Astronomical Society is a non-profit organization incorporated without share capital for the purpose of promoting public awareness of science in Canada.

NOTE 3 STATEMENT OF CHANGE IN FINANCIAL POSITION

A statement of changes in financial position has not been provided because all the information is available to management and the statement will not add meaningful information to these financial statements.

NOTE 4 COMPARATIVE FIGURES

The comparative figures are unaudited.

CASCATRUST FINANCIAL STATEMENTS
March 31, 1993

AUDITORS' REPORT

To the Trustees
of
CASCATRUST

We have audited the balance sheet of the Cascatrust as at March 31, 1993, and the statement of income for the year then ended. These financial statements are the responsibility of the management. Our responsibility is to express an opinion on these financial statements.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatements. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management as well as evaluating the overall financial statement presentation.

In our opinion, these financial statements present fairly, in all material respects, the financial position of the Cascatrust as at March 31, 1993, and the results of its operations for the year then ended in accordance with generally accepted accounting principles.

TORONTO, Ontario
May 6, 1993

Tinkham & Associates
CHARTERED ACCOUNTANTS

**CASCATRUST
BALANCE SHEET
AS AT MARCH 31, 1993**

1993

A S S E T S

CURRENT

Cash	\$ 3,220
Investments	1,000
Interest receivable	<u>36</u>
	<u>4,256</u>

LONG TERM

Restricted funds (Note 1)	<u>100</u>
	<u>\$ 4,356</u>

LIABILITIES and OPERATING SURPLUS

CURRENT

Accounts payable	\$ <u>200</u>
------------------	---------------

OTHER

Due to related company	<u>4,060</u>
	<u>4,260</u>

OPERATING SURPLUS

	<u>96</u>
	<u>\$ 4,356</u>

On behalf of the Trustees:

Christine McClement Trustee

Donald A. ... Trustee

**CASCATRUST
STATEMENT OF INCOME
FOR THE YEAR ENDED MARCH 31, 1993**

	1993
REVENUE	
Donations	\$ 100
Interest income	46
Royalties	<u>1,224</u>
	<u>1,370</u>
EXPENSE	
Bank charges	14
Professional	<u>1,260</u>
	<u>1,274</u>
EXCESS OF REVENUE OVER EXPENSE FOR THE YEAR	96
OPERATING SURPLUS, Opening	<u>-</u>
OPERATING SURPLUS, March 31	<u><u>\$ 96</u></u>

**CASCATRUST
NOTES TO FINANCIAL STATEMENTS
MARCH 31, 1993**

NOTE 1 RESTRICTED FUNDS

A gift of \$100 is restricted for a period of ten years commencing in 1993.

NOTE 2 ORGANIZATION

The Cascatrust is a charitable trust without share capital constituted for the purpose of advancement of education in astronomy and is a registered charity for income tax purposes.

NOTE 3 STATEMENT OF CHANGE IN FINANCIAL POSITION

A statement of changes in financial position has not been provided because all the information is available to management and the statement will not add meaningful information to these financial statements.

NOTE 4 COMPARATIVE FIGURES

The Trust commenced operations in 1993.

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Second Vice-President
Secretary
Treasurer
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Past President

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Education
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Optical and Infrared Astronomy
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R. Jarrell, York U.
D. Welch, McMaster U.
R. Taylor, U. of Calgary
D. Leahy, U. of Calgary
S. van den Bergh, D.A.O.

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