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CANADIAN ASTRONOMICAL SOCIETY
SOCIÉTÉ CANADIENNE D'ASTRONOMIE

GEMINI ANNOUNCEMENT FROM NRC

TO: Canadian Astronomers

For the past two years we have been pursuing the possibility of joining the United States and the United Kingdom in the construction and operation of two 8 m infrared telescopes on superb sites in Hawaii and Chile. These will be two of the ten or more 8 to 10 m telescopes that will be leading research facilities well into the next century. Consequently, at the General Meeting in June 1989, the Canadian Astronomical Society identified the collaboration with the U.S. and U.K. to build an 8 m telescope in each hemisphere as the top priority for a major new facility in astronomy.

The National Research Council of Canada, which has the Parliamentary mandate for government astronomical facilities, has been working with Canadian astronomers to develop the details of an appropriate international collaboration. At the same time, Dr. Gordon Walker of the University of British Columbia has prepared a proposal titled GEMINI - Twin 8 Metre Telescopes, which he submitted to NRC and the Natural Science and Engineering Research Council earlier this year.

To assess this proposal these agencies convened two committees. The first was an Astronomy Priorities and Planning Committee, chaired by Dr. Ian McDiarmid, to consider the effect of the estimated $2.8 M/yr Gemini operating costs on other astronomical activities for various budget projections. This committee produced a draft report which was discussed with the community at meetings in Montreal, Toronto and Vancouver on May 14-16.

The second Gemini Review Committee, chaired by Dr. William Wehlau, met on May 20 and 21 to assess the scientific merit of the proposal and the technical, financial and management issues.

There was concern in the community that the delayed schedules of these committees would preclude consideration of the Gemini proposal at the June meeting of the National Research Council. Consequently, NRC management arranged a presentation of the proposal, and the draft committee reports to the Assessment Committee of the National Research Council on June 3. The Council discussed the project the next day, and concluded that it could not support proceeding with the Gemini initiative with the existing budgetary levels available for astronomical activities in NRC.

The Council gave two reasons for this decision:

1. The difficulty of recommending expenditures of $60 M capital at a time when new initiatives must focus on urgent national priorities and on enhancing Canada's competitiveness, which we all recognize as a crucial national priority.
2. The need at this time to presume no growth in the annual astronomy budget, and hence the concern that the plans for the implementation of the facility would leave all activities marginal.

In summary, the Council sees no chance at present for a successful bid for such a large capital expenditure, and is concerned that a small perturbation in operating costs could put all our projects at risk because of the lack of flexibility. However, the Council said that it would be ready at its next meeting in September to reassess the case in light of the final reports if there are substantial changes to the financial considerations from those in the interim reports presented.

This decision is a serious disappointment and clearly will affect our hopes for the future, but I think we must recognize that it represents a fair assessment of the current situation in Canada from people who are much closer to the political realities than we.

Where do we go from here? The reports of the committees will be very useful and should be completed, particularly the parts relating to the case that Gemini is not approved. Since the CFHT will continue to be the key facility for Canadian optical astronomy, we shall do everything possible to make it even more effective. The Committees also identified the need for a plan for radio astronomy and the advantages of moving as much of HIA as possible to a single location near a university. NRC will continue to explore both these suggestions, though we shall need a radio astronomy plan before we can settle many of the details of relocation. Of course, in formulating a plan, the radio astronomers must give full consideration to the present views of the Council.

Donald C. Morton
Director General
Herzberg Institute of Astrophysics
National Research Council of Canada

10 June 1991

Note aux astronomes canadiens

Nous étudions depuis deux ans déjà la possibilité de joindre nos efforts à ceux des États-Unis et du Royaume-Uni pour la construction et l'exploitation de deux télescop es optiques/infrarouges de 8 m de diamètre sur de superbes sites à Hawaii et au Chili. Ils feront partie d'une série d'au moins dix autres télescopes de 8 à 10 m de diamètre qui resteront à l'avant-garde des moyens technologiques mis en oeuvre pour la recherche astronomique bien au delà de l'an 2000. En conséquence, lors de l'Assemblée générale de juin 1989, la Société canadienne d'astronomie est convenue que la collaboration avec les États-Unis et le Royaume-Uni à la construction d'un télescope de 8 m dans chaque hémisphère constituait la toute première priorité pour s'équiper de nouveaux moyens importants en astronomie.

Le Conseil national de recherches du Canada, qui a été officiellement mandaté par acte parlementaire de la gestion des moyens de recherche gouvernementaux en astronomie, travaille actuellement de concert avec les astronomes canadiens à la définition de ce que devrait être une collaboration internationale appropriée. De son côté, le Dr Gordon Walker, de l'Université de la Colombie-Britannique, avait préparé une proposition intitulée GEMINI - Twin 8 Metre Telescopes, qu'il a soumise à l'examen du CNRC et du Conseil de recherches en sciences naturelles et en génie au début de cette année.

Pour être en mesure d'évaluer cette proposition, les organismes concernés ont convoqué deux comités. Le premier est le comité des priorités et de la planification en astronomie, présidé par le Dr Ian McDiarmid. Ce comité a étudié l'incidence d'une dépense annuelle de quelque 2,8 millions de dollars en frais d'exploitation du Gemini sur les autres activités astronomiques en partant de diverses projections budgétaires. Le comité a remis un rapport pr/e'liminaire qui a été discuté avec la communauté astronomique lors de réunions tenues à Montréal, à Toronto et à Vancouver du 14 au 16 mai.

Le second comité d'étude du Gemini, présidé par le Dr William Wehlau, s'est réuni les 20 et 21 mai pour évaluer les mérites scientifiques de la proposition ainsi que les problèmes techniques financiers et de gestion qui lui sont liés.

La communauté astronomique s'était inquiétée de ce que des retards dans leséchéanciers de ces comités pourraient empêcher le Conseil national de recherches d'examiner la proposition GEMINI lors de la réunion de juin. La direction du CNRC s'est donc arrangée pour présenter la proposition et les rapports préliminaires des comités au Comité de l'évaluation du Conseil national de recherches le 3 juin. Le Conseil a débattu le projet le jour suivant et il a conclu qu'il ne pouvait appuyer la poursuite de l'initiative GEMINI avec les niveaux budgétaires actuellement consacrés aux activités astronomiques au CNRC.

Le Conseil a donné deux raisons pour cette décision:

1. La difficulté de recommander des dépenses de 60 millions de dollars en capital à un moment où les nouvelles initiatives doivent être axées sur des priorités nationales urgentes et sur le renforcement de la compétitivité du Canada, laquelle, nous lereconnaissons tous, constitue une priorité nationale cruciale.
2. La nécessité actuelle de ne pas envisager d'augmentation annuelle du budget de l'astronomie et, partant, la crainte que les plans de mise en oeuvre de l'installation ne relèguent toutes les autres activités au second plan.

En résumé, le Conseil n'entrevoit pas pour l'instant la possibilité qu'une démarche visant l'engagement d'un montant aussi élevé pour des dépenses d'immobilisations puisse être fructueuse et s'inquiéte du risque qu'une petite perturbation dans les coûts d'exploitation ne mette en danger tous nos projets parce que nous n'avons pas une latitude suffisante. Le Conseil a cependant déclaré qu'il serait prêt à réexaminer le dossier à sa prochaine réunion de septembre à la lumiére des rapports finaux à condition que la section couvrant les considérations financières dans les rapports intérimaires ait été substantiellement remaniée.

Cette décision nous décoit énormément et minera les espoirs que nous nourrissions pour l'avenir, mais je pense néanmoins que nous devons reconnaître qu'elle représente une évaluation équitable de la situation canadienne actuelle de la part de personnes qui sont beaucoup plus près que nous le sommes des réalités politiques.

Que faire maintenant? Les rapports des comités sont très utiles et doivent donc être achevés, en particulier les sections consacrées à l'argumentation aboutissant au rejet de GEMINI. Étant donné que le TCFH demeurera l'élément clé de l'astronomie optique canadienne, nous ne ménagerons aucun effort pour le rendre encore plus efficace. Les comités ont également souligné la nécessité d'avoir un plan pour la radioastronomie et les avantages qu'il y aurait à tranférer le maximum de ce qui constitue l'IHA sur un site unique proche d'une université. Le CNRC continuera à étudier ces deux suggestions, mais notons toutefois qu'il nous faudra un plan pour la radioastronomie avant de pouvoir régler la majeure partie des détails du transfert. Bien entendu, pour la formulation de ce plan, les radio astronomes devront prendre en compte la totalité des opinions actuelles du Conseil.

Donald C. Morton
Directeur général
Institut Herzberg d'astrophysique
Conseil national de recherches

10 June 1991

CFHT – SCIENTIFIC ADVISORY COUNCIL - May 1991
TCFH – CONSEIL SCIENTIFIQUE CONSULTATIF - mai 1991

The Scientific Advisory Council held its 39th meeting on May 13 and 14, 1991 at the Observatoire de Marseille, France. The SAC members present were Chantal BALKOWSKI (vice-chairman), Georges COMTE, David CRAMTPON, Paul FELENBOK, Klaus HODDAPP, Daniel NADEAU, Christopher PRITCHET, Daniel ROUAN and Jean-René ROY (chairman). George HERBIG was unable to attend this meeting. The Corporation was represented by its Executive Directors, GUY MONNET and John GLASPEY.

INTRODUCTION

This meeting marked an important milestone in the recent history of the CFHT. *The national agencies of Canada (NRC) and France (CNRS) have approved the funding of* $1.6M *for 3rd generation instruments aimed to support an ambitious program of new and improved imagery at CFHT.* This new instrumentation fund will be used to construct an infrared imaging facility, to initiate a MARK I adaptive optics system, and to improve the f/8 and f/36 Cassegrain upper ends. Also included in these plans, is the acquisition of an f/8 field corrector combined with an atmospheric dispersion compensator. There is no doubt that the successful completion of these projects will keep the CFHT at the forefront of astronomical research during the present decade. However, the fact that there will be no new positions at CFHT emphasizes the need for close collaboration by members of the three CFHT communities to insure the successful completion of the above projects.

1 - REPORT ON SCIENTIFIC AND TECHNICAL ACTIVITIES

The executive directors, Guy MONNET and John GLASPEY, presented the observing statistics for the first semester of 1991, and gave a review of the activities for the past 6 months. The first semester of 1991 covers a total of 199 nights so as to include the July 11, 1991 solar eclipse because of the anticipated logistical problems. During 1991I, the telescope is scheduled for scientific use on 183 nights (92%) and for engineering on 16 nights (8%). This represents a significant decrease in engineering time compared to 1990II (14%). The time lost because of weather conditions, from January 1 to March 31, 1991, has decreased compared to the same period of 1990.

A technical progress report for 1991I was presented by the Associate Director, J. GLASPEY. The presentation included the preparations for the month of July shutdown (for work on dome, crane and shutter) and solar eclipse observation, mercury spill follow-up, and improved safety procedures; no new spot due to mercury has been detected on the primary mirror since last November. The telescope operating procedures have been changed to improve seeing. The Telescope Control System version IV project is progressing well. The large format LICK I CCD is in general use by observers. The readout time is presently 7.5 min, but the new generation III CCD controller project is progressing rapidly, and should reduce this time to less than one minute. In a collaborative effort between CFHT and the University of Hawaii, successful tests of a NICMOS infrared array for imaging Fourier Transform Spectroscopy have been performed.

The MOS/SIS project is optically and mechanically virtually complete, with the octagon and MOS now at DAO; meanwhile SIS is being tested at Meudon. Acceptance tests are being defined by CFHT and DAO. The present schedule is for MOS/SIS to arrive in Hawaii in January 1992.

Acceptance tests are also being defined by CFHT and DAO for the Coudé f/4 spectrograph. The detector environment is being assembled in Waimea, and the control electronics is progressing while the final cabling is being defined.

Several other projects have been completed. For example, The new UV optical module and UV blazed gratings of the Herzberg spectrograph have been successfuly commisioned. The installation of a variable astigmatism corrector in HR Cam has been a successful operation. The software has been improved: all instruments are now operating under X11 display, and the system for transmitting TV images over the network to Waimea has been installed and could lead to some form of remote (i.e. from Waimea) observing in the near future. A work station is now being installed at the summit and one will be available very soon at Hale Pohaku.

The total 1991II engineering time planned is 19 nights; this includes the 10 night shutdown scheduled in July 1991 for dome and shutter maintenance.

2 - POLICY CONCERNING COMMISSIONING RUNS FOR MOS/SIS AND COUDE f/4 SPECTROGRAPHS IN 1992

The construction and testing of the two second-generation spectrographs, MOS/SIS and Coudé f/4, are progressing in accordance with their planned schedules. Several components of the Coudé f/4 spectrograph have been completed, and assembly of some mechanical parts has started in Waimea. The MOS/SIS spectrograph is

optically and mechanically complete. The octagon and MOS are now at the Dominion Astrophysical Observatory (DAO) for a series of tests. The Corporation has completed the plans for commissioning and performance runs for both semesters to take place over the two semesters of 1992.

It is recalled that the P. I. for the Coudé f/4 spectrograph is John GLASPEY (CFHT) and that the Project Scientists are R. FERLET (IAP), D. F. GRAY (University of Western Ontario), and G. HERBIG (University of Hawaii). O. Le FEVRE (CFHT) is the P. I. for MOS/SIS, and the project scientists for the three CFHT communities are D. CRAMPTON (DAO), P. FELENBOK (Observatoire de Meudon) and A. STOCKTON (University of Hawaii). If you wish to have more technical details about these instruments or about their commissioning plans, contact any of the above people.

3 - IMPACT DES CCD GRAND FORMAT

L'arrivée du premier CCD grand format est un atout majeur pour l'avenir des observations au CFHT. Il est prévu que cet effort se poursuive par l'acquisition de nouveaux CCD grand format dans un avenir proche. Néanmoins, il est clair qu'ils posent actuellement des problèmes en ce qui concerne leur lecture d'une part, et d'autre part la transmission et l'archivage des images à Waimea soulève des problèmes. Les CCD grands formats et les nouveaux contrôleurs ouvrent la voie à de nouvelles procédures d'utilisation, en particulier celle de la lecture par dérive. Cette possibilité sera étudiée plus en détail lors de la réunion du CS C de Novembre 1991.

Le CSC souligne l'importance de l'archivage des données à un moment où de nouveaux instruments vont débiter une quantité importante de données (MOS/SIS, Coudé f/4 en particulier). Le CADC de DAO se propose de remplir cette tâche.

4 - PROGRAM OF IMPROVED AND NEW IMAGERY AT CFHT

Major efforts will be devoted to extend the optical and infrared imaging capabalities at CFHT in the coming years. The main directions of these efforts are described in the following items.

4.1 The CFHT INFRARED IMAGING FACILITY

The Infrared Working Group (IWG) was formed at the November 1990 SAC meeting to oversee various apsects of the design and acquisition of a facility infrared camera. SAC was most pleased to see that the project is progressing swiftly. The amount of $250,000, from the recently approved money for 3rd generation instruments, will fund all aspects of the camera's design, construction and testing. The plan endorsed by the IWG calls for two identical 1 - 2.5 μ camera-dewars to be built for insuring redundancy and simplification of summit operations. One camera would be dedicated to housing high resolution optics, while the other would house the wide field optics. Douglas SIMONS (CFHT) is the acting principal investigator for this project.

A NICMOS 3 (1 - 2.5 μ) 256 × 256 pixels array has been ordered from Rockwell, and delivery is expected before or around Spetember 1991. The revised camera plan includes the use of the new "Generation III" controllers being built to operate the 2K × 2K Lick series of CCDs. Having the same controller for handling CCDs and IR arrays, will greatly simplify summit operation, and insure the robustness of data acquisition for all imaging detectors.

The design of the camera incorporates a field lens, interchangeable cold stops, a pair of filter wheels, and a Cooke triplet in a cold tube assembly that can be removed easily from the camera's work surface. The optics will provide either 0.″2 or 0.″5 pixels at f/8 of CFHT.

The present schedule of operation calls for a camera that will be available to the CFHT community during the 2nd semester of 1992. The infrared camera CIRCUS of Meudon Observatory (cf. Daniel ROUAN) and MONICA of the University of Montreal (cf. Daniel NADEAU) are now available to astronomers of the three communities for use at CFHT. The greatest uncertainty in the present plan is Rockwell's ability to deliver a science-grade array on time. Fortunately, recent contacts with the company engineers (April 1991) indicate that the most serious problems in production have been solved. With incorporating the experience of University of Hawaii and IRTF, two leaders in infrared camera technology, the plans proposed by the Corporation are a careful and "no-risk" approach. The next generation of IR facility camera is likely to include several more innovative features.

4.2 ADAPTIVE OPTICS AT CFHT

Adaptive optics is a technique that should enable us to achieve diffraction-limit imaging from the ground in the near-infrared and certainly in the infrared domain. Improvements of image quality brought by an adaptive optics system in the visible range of wavelengths should also bring a real revolution in ground-based astronomical observations. The CFHT Corporation is now preparing to become a world leader in this venture.

4.2.1 COME-ON AND COME-ON PLUS

In November 1990, SAC heard a presentation by F. RODDIER on the development in adaptive optics at the University of Hawaii This time J.-G. Cuby of the Observatoire de Meudon presented the latest results from the experiment COME-ON and described the proposed COME-

ON PLUS being built for use on the European Southern Observatory (ESO) 3.6m within 1.5 year. Come-On Plus is an upgraded version of the current Come-On prototype, with 52 actuators on the deformable mirror and $\approx$ 50 Hz bandwidth, to be compared to the 19 actuators and 10 Hz bandwidth on Come-On.

Using a modal approach, Come-On Plus will allow *adaptive correction*, depending on reference brightness and angular distance from the observed object. Thus, low order correction will be done on faint references, but *high order correction will still be possible* on brighter sources. Based on technology evolution, it should also become possible to replace the current intensified detector, as a wavefront sensor detector, by a CCD, thus taking full advantage of the high quantum efficiency of the latter and increasing the limiting magnitude, from $\approx$ 15 to $\approx$ 18, thus opening adaptive optics applicability to the whole sky.

4.2.2 A CFHT ADAPTIVE OPTICS BONETTE.

The Adaptive Optics Project at CFHT has been funded by the national Agencies, NRC and CNRS, at the level of about $760K. It is expected to yield scientific results within 3 years from now. The recently formed Adaptive Optics Working Group met in April 1991 to discuss and review technical options. The results of these discussions are presented in *"An Adaptive Optics System for CFHT: A Progress Report"*, CFHT, May 1991. You may obtain a copy of this report by writing to the Director of CFHT, G. MONNET.

Following studies performed over recent years, we have a fair idea of the relative contribution of telescope optics, dome, and mirror "seeing", and free atmosphere to image degradation (cf. Racine 1991). **a)** Telescope optics contribute 0.″35 to image degradation. Low order static aberrations will be removed by the AO system. **b)** Contribution from dome and mirror seeing is estimated to be $\sim$ 0.″4, and with some effort could be reduced to 0.″2 (Racine 1991). **c)** Contribution of the free atmosphere varies between 0.″25 and 0.″50. Also the time evolution of the wavefront disturbances establishes the delay allowed between the actual recording of the wavefront and the application of corrections on the AO mirror.

The specifications as put forward by the Adaptive Optics Working Group are as follows:

1. Adaptive corrections will provide images with a Strehl angle $\leq$ 0.″2 (median value) from a wavelength of 0.5 to 2.5 μ with at least 60% average sky coverage.
2. The AO system will allow efficient (i.e. bandwidth $\geq$ 50Hz) adaptive tip-tilt corrections from 0.4 to 2.5 μ over 85% of the sky while providing active higher order corrections.
3. The AO should allow use of theobject as reference source.
4. The AO should be easily removable from the beam for direct focus use.
5. Optical transmission (excluding beamsplitters) should be at minimum 70% from 0.4 to 2.5 μ with a mean of $\geq$ 75%.
6. The AO system should be evolutive and modular, and must provide a reliable and "transparent" user's interface.

Furthermore SAC considers as top priority the further specification that the AO bonette *be able to feed full-sized instruments* such as spectrographs. SAC also urges the Corporation and the AO Working Group to set as a more ambitious target for the size of the corrected field: the AO should provide *a non-vignetted field as large as 4 arcmin*. It is realized that the atmosphere will only allow correction yielding a Strehl angle of $\sim$ 0.″2 over the central arcmin field, but the remaining outer field (4 arcmin) should at least have correction for static (telescope) aberrations. Finally, because of the great scientific interest of heavily obscured sources in the interstellar medium, SAC emphasizes the need of second wavefront sensors able to operate in the near IR. It is obvious that the astronomers from the three communities should collaborate to bring this project to successful completion in a timely fashion.

4.3 IMPROVEMENT ON THE f/8 UPPER END AND ADC+CORRECTOR

The f/8 focus is one of the most important *foci* of the 3.6m telescope, and its relative use is due to increase during the decade. Unfortunately, the f/8 focus drive system has had a history of slow starts, difficulty in returning to a desired focus, and suffers from image motion. The problems arise from wear, and unwanted differential motions. Various solutions are being explored to correct these problems. Design work on a modified drive system is being done. The upper end would need to be out of service for about three weeks to implement the planned changes.

A final set of optical spectifications for the f/8 Cassegrain *corrector* and *atmospheric dispersion compensator* was presented and approved by SAC. The proposed unit would have 10 optical surfaces (with all air-glass interfaces being AR coated) with less than about 1% loss per surface. The diameter of the unvignetted field at the focal plane would be 20 arcmin (166 mm). The unit is intended for use primarily with the MOS/SIS spectrograph and direct imaging requiring large field. The wavelength spectral coverage is 0.34 to 1.1 μ. The field corrector and the ADC are to be designed and used as a unit. It will not be possible to use either separately. The instruments will be attached to the bonette, and will be operated as part of the upgraded bonette control.

4.4 THE f/36 UPPER END

The f/36 infrared upper end needs a major overhaul, since its role in infrared investigations may become of great im-

portance. The Corporation is completing detailed studies of the probable use of the unit and is exploring various designs.

5 - CHFT: HORIZON YEAR 2000

It is one of SAC's main responsibility to plan for the long-term scientific future of CFHT. Fortunately, the present context in our communities is most favorable for this long range planning. However only a rough outline is presented in the following text. Further discussions will indeed require close interaction with our three communities.

5.1 EXPLORING OPTIONS FOR 4th GENERATION INSTRUMENTATION

Because of the long delay between the conception of new instruments, approval and funding, and the completion of all building phases, SAC has started planning for the possible instruments of the next generation. This exercise is justified in order to insure the planning of the 3rd CFHT Users' Meeting of May 1992, where some specific propositions will be presented for discussion.

Two types of instruments, which would require funding **beyond 1993**, are being explored: **1)** A large *mosaic of multiple 2K × 2K CCDs*, the smallest size considered would be 2 × 2 (*i.e.* 4 chips), plus full hardware and software integration of data acquisition and preprocessing. **2)** Various options of *infrared spectrographs*, either using gratings, Fabry-Perot or Michelson interferometers. These issues will be discussed in more detail at the November 1991 SAC meeting, and at the 3rd CFHT Users Meeting in Victoria in May 1992. It should be remembered that any new instrument proposal will have to examine very closely the available manpower at the Corporation, and de-commissioning of some instruments may be necessary.

5.2 THE ROLE OF CFHT IN THE 1990-2000 PERIOD

Several aspects of the long-term operation of CFHT were considered. Most of the discussions centered on a more optimized scheduling of the telescope. Again the need to minimize changes of instruments and the possible use of MOS/SIS as a universal instrument "work horse" were emphasized. It is also hoped that the percentage of visitor's instrument use will decrease with the arrival of MOS/SIS. However SAC considers that fewer instruments is not necessarily a guarantee of better quality or more innovative science. Nonetheless, an effort should be made to concentrate the instruments for operation at very few *foci*.

With the arrival of large 8 m to 10 m telescopes, the vocation of CFHT should shift to more specialized and long-term projects. One can envisage the very large telescope operating as multi-purpose instruments, with very little time for "special" projects. This evolution would lead to an increased pressure on more "innovative" or "block" scheduling of 4-m class telescopes such as the CFHT. Implementation of remote and/or service observing at CFHT will rapidly become desirable.

It is clear that the CFHT Corporation has gained, over several years, a large expertise in the operation of a large multinational optical telescope on Mauna Kea. The CFHT staff has also acquired a strong leadership in developping and using forefront astronomical instrumentation for imagery and spectroscopy optimized for the unique conditions of the Mauna Kea site. Considering the challenging perspectives opened by the coming of very large optical and infrared telescopes on Mauna Kea, SAC has made the following recommendation to the Board of Directors of CFHT: *SAC considers that the coordinated operation of a large 8-meter telescope and of a smaller 3.6-meter telescope would provide an extremely powerful way to carry out astronomical investigations in a most unique way. In the context of the possible participation of Canada in the Gemini Project, SAC draws the attention of the Agencies to the interesting possibilities arising from the probable involvement of the CFHT Corporation with the Gemini Project. Such involvement could take, for example, the shape of sharing the headquarters, the resources, part of the staff and the operations at the summit of Mauna Kea.*

6 - TROISIEME REUNION DES UTILISATEURS DU CFHT

La dernière réunion de utilisateurs du CFHT s'est tenue à l'Observatoire de Meudon, Paris, en mai 1989. La prochaine réunion des utilisateurs du CFHT aura lieu à Victoria, au Canada, au mois de mai 1992. Les détails de l'organisation de la réunion et son contenu seront précisés lors de la réunion du CSC de novembre 1991. Un des points qui devra être abordé concerne l'avenir du CFHT à l'horizon an 2000. Un nombre limité de participants sera déterminé (environ 20 chercheurs pour le Canada) pour chacun des pays partenaires du TCFH. Si vous êtes intéressé à faire une présentation et à participer à cette importante réunion, contactez J.-R. Roy à l'Université Laval (e-mail: 1150005@LAVALVX1) ou C. Pritchet à l'Université de Victoria (e-mail: pritchet@orca.phys.uvic.ca). Nous ferons appel à certains d'entre vous pour des conférences invitées.

Dates for the 40th meeting of SAC have been set as October 31 and November 1, 1991.

JEAN RENÉ ROY

IMPORTANT NOTICE CONCERNING CFHT PROPOSALS

(Seven copies now required)

DEADLINES: One original + SIX copies must be received at HIA in Ottawa by Sept 1 for the first semester of the following year and by Mar 1 for the second semester. E-mail and/or Faxed versions will not be allowed. Proposals received on or after these dates will be returned (allow at least one day for internal NRC mail).

PROPOSAL LENGTH: The scientific justification MUST NOT exceed two pages. An additional (i.e., third) optional page may be added for diagrams and/or references. Standard sized type MUST be used, i.e., lower case letters should be at least 2 mm high (12 point type, 6 lines per inch). THE TOTAL LENGTH OF THE PROPOSAL MUST NOT EXCEED 8 PAGES (including instrument requirements and supplies needed).

David Crampton, Chairperson CTAC
(crampton@dao.nrc.ca)
604 363 0010, fax: 604 363 0045

JSSA NOTES

The Joint Subcommittee for Space Astronomy provides advice and recommendations to the Canadian Space Agency regarding Canadian participation in Space Astronomy missions. The JSSA reports to both the CASCA board, who approves its membership, and to the NRC Advisory Board on Astronomy (ABA). It also serves as the advisory committee for the CADC.

The current JSSA members are: Greg Fahlman (UBC, chairman), Gordon Walker (UBC), Denis Leahy (UCal), Sun Kwok (UCal), Nancy Evans (ISTS), Francois Wesemael (UdeMontreal) and Tom Bolton (UToronto).

Through the CSA, Canada is participating in four space missions: (1) LYMAN/FUSE, a far ultra-violet spectroscopic mission. John Hutchings (DAO) is the Candadian project scientist. This mission is being supported primarily at the DAO and ISTS. (2) Radio Astron, a Soviet led VLBI mission. Canadian support is centered at the DRAO (Peter Dewdney), ISTS (Wayne Cannon) and at the University of Calgary (Russ Taylor). (3) EUVITA, an extreme UV imaging experiment on the Soviet Spectrum x-gamma spacecraft. Denis Leahy (U. of Calgary) is leading Canadian activities. (4) At its most recent meeting (Feb 15/16), JSSA recommended CSA support for a limited participation in the Soviet Spectrum UV (SUVT) project as proposed by Slavek Rucinski (ISTS). Further information on these missions can be obtained by contacting the associated people named above.

CSA support is restricted generally to project funding of hardware components and to flight operations. Its funds should be spent in Canada, with the goal of assisting the development of Canadian industry. The CSA does not directly fund scientific research. This fact is a source of some confusion (the CSA is not a mini-NASA) and frustration. The JSSA will continue to seek to convince the CSA that their 'hardware only' policy should be modified. In the meantime, however, we (as a community) should be prepared to take advantage of the opportunities afforded by the present policies.

The program outlined above is clearly limited in scope and surely does not cover the range of interests within Canadian astronomy. Space missions are very expensive and complex activities; we have a small budget to work with and a limited technical infrastructure to support developmental work. Nevertheless, we can do some things, including some new things.

The JSSA is currently wrestling with the issue of how to best identify opportunities and assess space astronomy proposals from within our community. Comments on this issue would be very welcome. However, we are open to receive submissions on possible projects and ideas; proposals involving potential collaborations with American, European, and Japanese groups would be of particular interest.

For more information, please contact the chairman or any other JSSA member.

GREG FAHLMAN
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CITA ANNUAL REPORT 1990

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

The following is an abbreviated version of the CITA Annual Report for 1990, prepared by Luc Binette and Arnold Boothroyd. Due to space constraints, we have not included a list of the publications from CITA in 1990, nor more than a very brief summary of the scientific activities at CITA in 1990. The full report is available on request (from `bond@cita.utoronto.ca` or from `citadmin@maia.utordop.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; the other is 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 1990.

Personnel Changes in 1990

In July, J. Richard Bond became Acting Director at CITA for a one year term while Scott Tremaine enjoys a well deserved sabbatical leave, six months of which are being spent at Caltech.

Since April 1990, CITA has a Computing Systems Manager in the person of Mark Bartelt, who previously worked at the Toronto Hospital for Sick Children as well as at Caltech.

Six new staff and two long-term visitors joined CITA's research team since the Spring of 1990. Larry Widrow (Harvard) was appointed as a research associate. Michael Merrifield (Harvard), Steve Myers (Caltech), Barbara Ryden (Harvard), and John Wang (Chicago) were appointed as postdoctoral research fellows. Gustavo Yepes (Univ. Autónoma, Madrid) came to CITA as a research fellow with funding from Spain. Anatoly Klypin (Moscow) and Lev Kofman (Tartu) are long-term visitors to CITA. They joined research associate Omer Blaes, and research fellows Matt Choptuik, Luke Dones, Hume Feldman, Konrad Kuijken, William Latter, Gerald Quinlan, Alex Raga, Peter Tribble, and Michael West.

Six research fellows left during the year. Varun Sahni has taken up a faculty position at the newly created Inter-University Centre for Astronomy and Astrophysics located in Poona near Bombay. Peter Barnes won a postdoctoral fellowship at the Center for Astrophysics (Harvard). Josh Barnes is in a tenure stream Assistant Professor position at the University of Hawaii. Paul Brown joined the Department of Physiology and Environmental Science of the University of Nottingham. Albert Stebbins left his CIAR Scholar position at CITA in January 1991 to take up a tenure track Associate Scientist position at Fermilab. Jean-François Sygnet returned to his permanent position at the Institut d'Astrophysique de Paris.

In 1990, Scott Tremaine received the Carlyle S. Beals Award of the Canadian Astronomical Society "in recognition of outstanding achievement in research". He was also awarded the Rutherford Medal in Physics of the Royal Society of Canada.

Hume Feldman was selected as one of ten participants for the Soviet-American Workshop for Young Investigators in Cosmology. The program entails alternate three week research meetings in the USSR and the USA.

Konrad Kuijken (Belgium) became the first Jeffrey Bishop Fellow at CITA. This fellowship was instituted in honour of Jeffrey L. Bishop who died in 1988 (the funds are provided by a bequest from his family). Jeff was one of the first research fellows hired in the newly created CITA in 1985.

Alex Raga (Argentina) and Peter Tribble (England) both won an NSERC International Fellowship, a new Canadian scholarship program for foreign postdoctoral applicants.

Faculty and research fellows have been involved in the supervision of seven graduate students from the University of Toronto: S.-H. Kim, D. Millar, F. Rouleau and D. Schwartz from Astronomy, W. Keogh and M. Mandy from Chemistry, and P. Papadopoulos from Physics. Five summer students conducted research at CITA in the summer of 1990: M. Rajagopal (Queen's), M. Lister (U. of T.), D. Hogg (MIT), A. Ferguson (U. of T.) and I. Walker (U. of T.).

The research staff of CITA for the year 1990, along with their primary research interests, are listed below.

CITA Faculty

- J. R. Bond, Professor, *Acting Director until July 1991* (Ph.D. Caltech 1979) - *Cosmology — Very Early Universe, Evolution of Cosmic Structure, Dark Matter, Cosmic Background Radiation, Particle Theory*
- N. Kaiser, Assoc. Professor (Ph.D. Cambridge 1982) - *Cosmology, Galaxy Formation, Large-scale Structure, Galaxy Formation*
- P. G. Martin, Professor (Ph.D. Cambridge 1972) - *Interstellar Dust, Interstellar Polarization, H_2, H II Regions, Seyfert Galaxies*

- S. Tremaine, Professor, *Director* (Ph.D. Princeton 1975) - *Galactic Structure, Stellar Dynamics, Solar System Dynamics, Comets*
- L. Binette, University Research Fellow (Ph.D. Australian National University 1983) - *Radiative Transfer, Diagnostics of Emission-Line Plasma, Star Forming Regions, Active Galactic Nuclei*
- A. I. Boothroyd, University Research Fellow (Ph.D. Caltech 1987) - *Collisional Dissociation of H_2, Stellar Evolution: Carbon Stars, Mass Loss, Solar Models*
- R. L. Webster, University Research Fellow (Ph.D. Cambridge 1985) - *Gravitational Lensing, Rich Clusters of Galaxies, Comet Searches*

Research Fellows 1990

- J. Barnes†, (Ph.D. UC Berkeley 1984) - *Models of Interacting Galaxies, Dynamics of Compact Groups and Clusters, Galaxy Formation and Cosmology*
- P. Barnes†, (Ph.D. Illinois 1988) - *Interstellar Medium, Star Formation, Radiative Transfer*
- O. M. Blaes, (Ph.D. Trieste 1986) - *Gamma-Ray Bursts, Neutron Stars, Accretion Disks, Molecular Cloud Dynamics*
- P. D. Brown†, (Ph.D. Manchester 1988) - *Interstellar Chemistry, Dense Clouds, Grain Mantles*
- M. W. Choptuik, (Ph.D. UBC 1986) - *Numerical Relativity, Computational Physics*
- L. Dones, (Ph.D. UC Berkeley 1987) - *Solar System, Dynamics, Planetary Rings*
- H. A. Feldman, (Ph.D. Stony-Brook 1989) - *Cosmology, Very Early Universe, Inflation, Cosmological Perturbations, Late Time Phase Transitions, Structure Formation*
- A. Klypin‡, (Ph.D. Moscow 1980) - *Cosmology, Large-scale Structure, Microwave Background Radiation*
- L. Kofman‡, (Ph.D. Tartu Observatory 1983) - *Large-scale Structure, Early Universe, Inflation*
- K. Kuijken, (Ph.D. Cambridge 1988) - *Galactic Structure, Dynamics, Dark Matter*
- W. B. Latter, (Ph.D. Arizona 1989) - *Astrochemistry, Interstellar Medium, Mass Loss Processes, Planetary Nebulae, Magnetic White Dwarfs*
- M. R. Merrifield‡, (Ph.D. Harvard 1990) - *Stellar Dynamics, Structure and Evolution of Clusters of Galaxies*
- S. T. Myers‡, (Ph.D. Caltech 1990) - *Cosmology, Microwave Background Radiation, Large-scale Structure, Active Galactic Nuclei*
- G. D. Quinlan, (Ph.D. Cornell 1989) - *Stellar Dynamics, Solar-System Dynamics*
- A. C. Raga, (Ph.D. University of Washington 1985) - *Astrophysical Hydrodynamics, Young Stars, Stellar Outflows, Pulsating Stellar Atmospheres*
- B. S. Ryden‡, (Ph.D. Princeton 1987) - *Large-scale Structure, Galaxy Formation and Dynamics*
- V. Sahni†, (Ph.D. Moscow State 1985) - *Large-scale Structure, Early Universe, Inflation, Cosmic Strings*
- A. Stebbins†, (Ph.D. Berkeley 1986) - *Cosmology, Large-scale Structure, Microwave Background Radiation, Cosmic Strings*
- J.-F. Sygnet†, (Thèses Paris 1983 and 1989) - *Galactic Structure, Stellar Dynamics*
- P. C. Tribble, (D.Phil. Oxford 1989) - *Clusters of Galaxies, Cooling Flows, Magnetic Fields, Extragalactic Radio Sources*
- G. Yepes‡, (Ph.D. Univ. Autónoma Madrid 1989) - *Cosmology, Large-scale Structure, Clusters of Galaxies*
- J. C. L. Wang‡, (Ph.D. Cornell 1988) - *High Energy Astrophysics, Radiative Transfer, Compact Objects, Accretion Disks, Jets*
- M. West, (Ph.D. Yale 1987) - *Clusters of Galaxies, Large-scale Structure, Cosmology, Galaxy Formation*
- L. M. Widrow‡, (Ph.D. University of Chicago 1988) - *The Early Universe: Inflation, Baryogenesis, Topological Defects*

† *Has left CITA since June 1990*
‡ *Joined CITA since June 1990*

Of the research fellows, six were supported by a Special National Program Grant awarded by NSERC, four by operating grants to individual faculty members, three were partially supported by the SNP grant and by individual operating grants, one by internal University of Toronto funds (Connaught grant), one by a NATO fellowship (P. Brown), one by the Spanish Ministry of Education (G. Yepes), one by an NSERC postdoctoral fellowship (G. Quinlan) and two by NSERC International Fellowships (A. Raga and P. Tribble). J.-F. Sygnet was supported by the Conseil National de la Recherche Scientifique (France) and Albert Stebbins was partially supported by the Canadian Institute for Advanced Research.

National Fellows 1990

A program started three years ago 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. Five awards were held in 1990 (or part of the year) by:

- Jean-Pierre Arcoragi (Ph.D. Université de Montréal 1986), fellowship held at the Université de Montréal.

- Salman Habib (Ph.D. Maryland 1987), fellowship held at the University of British Columbia.
- Michael Morris (Ph.D. Caltech 1988), fellowship held at the University of Waterloo.
- Kevin Volk (Ph.D. University of Calgary 1986), fellowship held at the University of Calgary.
- L. B. F. M. Waters (Ph.D. University of Utrecht 1987), fellowship held at the University of Western Ontario.

CITA Visitors

CITA also 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.

With funding provided by the Reinhardt Fund of the University of Toronto Astronomy Department, the Reinhardt Fellowship program provides relief from teaching duties to encourage long-term visits by Canadian theorists to CITA. A Reinhardt Fellowship has been awarded to Werner Israel who will be visiting CITA in the second half of 1991. In 1990 the Reinhardt visitors were:

- Ralph Pudritz (McMaster)
- Mike Fich (Waterloo)

We have also solicited proposals for collaborative programs between CITA and other universities. Examples of such programs include shared support for sabbatical visitors to Canada or support to gather a "critical mass" of researchers to work on a problem of interest to CITA.

Visitors to CITA included:

- P. Amendt, Lawrence Livermore National Lab, Livermore
- K. H. Böhm, University of Washington, Seattle
- F. Bouchet, Institut d'Astrophysique de Paris
- J. Cantó, UNAM, México
- C. Chang, University of Western Ontario
- W. Chau, University of Hong Kong
- S. Cole, UC at Berkeley
- R. Corrigan, Institute of Astronomy, Cambridge, UK
- P. d'Alessio, UNAM, México
- M. Drinkwater, Université Laval, Québec
- D. Earn, University of Cambridge, UK
- R. Ellis, University of Durham
- M. Fitchett, University of Durham
- M. Franx, Center for Astrophysics, Cambridge, MA
- G. A. Fuller, Centre for Astrophysics, Cambridge, MA
- J. R. Gott, Princeton University
- S. Habib, University of British Columbia, Vancouver
- A. Hamilton, JILA, Boulder
- A. Hassam, University of Maryland
- P. Hewett, Institute of Astronomy, Cambridge, UK
- J. Huchra, Center for Astrophysics, Cambridge, MA
- S. Kwok, University of Calgary
- J. Lattanzio, IGPP, Livermore
- I. Lawrie, Leeds University
- D. Leahy, University of Calgary
- S. Lizano, UNAM, México
- P. Lubin, UC at Santa Barbara
- P. Madau, Space Telescope Science Institute, Baltimore
- R. Malaney, LLNL, Livermore
- R. McCray, University of Colorado, Boulder
- G. Moriarty-Schievan, Queen's University, Kingston
- A. Noriega-Crespo, University of Washington, Seattle
- T. Morikawa, University of British Columbia, Vancouver
- D. Page, University of Alberta, Edmonton
- L. Parker, University of Wisconsin, Madison
- J. Peacock, Royal Observatory, Edinburgh
- G. Pearce, Oxford University
- T. Quinn, Oxford University
- H. Reeves, CENS, Saclay
- M. Rozyczka, Warsaw University Observatory
- P. Saha, Rutgers University, Piscataway
- D. Salopek, Fermilab, Chicago
- C. Sarazin, University of Virginia
- F. Shu, UC at Berkeley
- D. Spergel, Princeton
- P. Thomas, University of Sussex, Brighton
- Z. Tsvetanov, University of Maryland
- S. van den Bergh, DAO, Victoria
- R. van de Weygaert, Leiden University
- T. Vaschaspati, Tufts University, Medford
- S. Veeraraghavan, Center for Astrophysics, Cambridge, MA
- K. Volk, University of Calgary
- R. Waters, University of Western Ontario
- D. Whittet, Lancashire Polytechnic
- S. Willner, Smithsonian Astrophysical Observatory
- A. Wolfe, UC at San Diego
- R. Wyse, Johns Hopkins University, Baltimore
- A. Zdziarski, Space Telescope Science Institute, Baltimore
- W. Zheng, University of Alabama, Tuscaloosa

CIAR and CITA

The Canadian Institute for Advanced Research (CIAR) supports a select set of programs chosen for their high intellectual promise. One of these was in Cosmology, and CITA was chosen to be one of the three nodes, the others being UBC and the University of Alberta. The CIAR continued to support Dick Bond and Nick Kaiser as CIAR Fellows and Albert Stebbins as a CIAR Scholar. It also collaborated with CITA in bringing John Peacock to visit in the summer and in supporting the Workshops on Quantum Cosmology and Exotic Ideas for Cosmic Structure Formation held at UBC in May.

Facilities

CITA occupies the entire 12th floor of the McLennan Physical Laboratories at the downtown campus of the University of Toronto, having converted the remaining space to new offices last summer. In 1990, we further expanded our network of UNIX workstations. We now have 19 diskless Sun 3/50 computers, networked with a Silicon Graphics 4D/280 (8 processors, 256MB). Three Sun Sparcstations, which provide substantially more desktop computing power than the Sun 3/50s, have been acquired. We have a three-eighths share of the 4D/280 (the remainder is divided between Astronomy and Physics); it was recently upgraded from a 4-processor/64MB 4D/240, thus considerably expanding our computing power over that available in 1989. The number of Personal Iris (4D/20 and 4D/25) workstations have been expanded to eight, so that research activity demanding 3–D scientific visualization can be supported. The disk capacity available to the network now exceeds 7 GB. Except for the shared 4D/280, CITA computing is now quite independent of the former consortium.

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. George Mitchell (St. Mary's University) and Don Vandenberg (University of Victoria) finished their term on the council in March 1990.

Members of CITA Council for 1990 were:

- Richard Henriksen, Queen's University, Chair
- Kim Innanen, York University
- Werner Israel, University of Alberta
- Sun Kwok, University of Calgary
- Peter Sutherland, McMaster University
- Paul Gooch, Assistant Dean, School of Graduate Studies, University of Toronto
- J. Richard Bond, CITA, Acting Director

Conferences Supported by CITA

CITA supports scientific workshops and meetings in Canada on subjects of interest to theoretical astrophysics. Partial or full sponsorship is always given serious consideration when a request is made directly to CITA. Meetings supported by CITA in 1990 were:

- *Workshop on "Quantum Cosmology"*, May 11-12 1990, held at UBC, Vancouver. Organizers: R. Laflamme (UBC) and W. Unruh (UBC). Co-sponsored by CIAR and CITA.
- *Workshop on "Inflation and Exotic Cosmic Structure Formation"*, May 13-14 1990, held at UBC, Vancouver. Organizers: H. Feldman (CITA), A. Stebbins (CITA) and V. Sahni (CITA). Co-sponsored by CIAR and CITA.
- *Conference on "Gravitation"*, August 12-25 1990, held in Banff. Organizers: R. Mann (Waterloo) and P. Wesson (Waterloo). Sponsored by AECL, CITA and several universities.

Scientific Accomplishments 1990

Research at CITA covers a broad range of fields in astrophysical theory. In 1990 the areas of study included: general relativity (numerical black hole formation); cosmology (inflation, dark matter, cosmic strings, large-scale structure, microwave background anisotropies, gravitational lensing); intergalactic and interstellar medium (cooling flows, magnetic fields, dust physics, molecular cloud chemistry, star-forming regions, jets and outflows); dynamics (galactic disk/dark matter halo interactions, distribution functions); stellar physics (neutron stars and γ-ray bursts, carbon stars, planetary nebulae, pulsation); solar system astrophysics (planetary rings, planetary accretion, orbit evolution).

We had another very active year in research and publication at CITA. Our 1990 Annual Report, covering the period Jan. 1 - Dec. 31, 1990, lists 136 papers published by CITA personnel during the year in all of the areas listed above. Some highlights follow (a more detailed description may be found in the CITA annual report).

Choptuik surveyed the parameter space of collapsing, spherically symmetric configurations of scalar radiation, finding interesting non-linear phenomena suggesting true critical behavior in the model.

Bond and collaborators used microwave background data of Lubin and Meinhold to largely rule out a large class of theories of structure formation and to show that the next round of experiments should confirm or deny the basic CDM picture. Bond and Salopek developed stochastic methods for calculating nonlinear fluctuation evolution in inflation models. Feldman, Sahni and Stebbins constructed a "loitering universe" in which large amplitude inhomogeneities grow while producing little anisotropy in the microwave background radiation. Feldman and collaborators showed that chaotic inflation is an attractor in initial condition space. Using observations of

galaxy clustering and the microwave background radiation to constrain cosmological theories of the growth of structure in the Universe, Kaiser and collaborators found strong evidence for large scale power in excess over the CDM model predictions. Kaiser and Peacock showed that small scale clustering would contaminate the ability of pencil beam redshift surveys to search for large scale power and questioned whether the apparent periodicity seen in such surveys was physically meaningful. Seven of 96 fields observed by Myers and collaborators showed possible fluctuations in the microwave background radiation, but four of these seven have been found to contain nonthermal radio sources; observations continue. Myers, Stebbins, and collaborator are testing statistical tools to allow constraints on cosmic string models to be derived from microwave anisotropy experiments; these constraints may possibly be stringent enough to rule out string seeding of large scale structures. Stebbins and collaborator showed that an extremely early generation of stars could have kept the universe ionized throughout most of its history, while not distorting the microwave background at levels detectable by the COBE satellite. From the distribution and properties of quasars and radio galaxies, West has found intriguing, though very tentative, suggestions of the existence of large-scale (tens of Mpc) filamentary structures at redshifts as great as $z = 1$ or 2. Widrow and collaborators showed that a baryon-neutral universe with exotic (undetected) antibaryon dark matter restricted the antibaryon mass to lie between 39 and 50 MeV.

Kaiser calculated the coherent stretching of distant galaxy images due to the tidal field of density fluctuations; detection should be feasible over a range of scales, providing a direct probe of the density fluctuations. Kaiser and Tribble showed that in a strongly evolving universe (such as CDM) the distribution of lensing objects would be expected to lie at lower redshifts than the observed distribution, which is consistent with less evolution. Webster and collaborators analysed the light curve of the gravitationally lensed quasar 2237+0305, calculating a robust upper limit on the size of the continuum-emitting region; obtaining statistical properties of the microlenses will require sampling the light-curve over a period of many decades.

Tribble showed that drag forces are important for the evolution of overdense blobs of gas in the intracluster medium (and in cooling flows); magnetic fields inevitably dominate the late evolution of such blobs. Tribble and collaborators detected excess Rotation Measure in radio polarization for lines of sight passing near cluster centres, consistent with intracluster magnetic fields of 1 μG with reversals on 10 kpc scales. Wang and collaborators developed a theory for electromagnetic or Poynting flux jets arising from thin viscous and resistive magnetized accretion disks, a possible mechanism for one-sided jets in AGNs.

Boothroyd, Martin, Keogh, and collaborators are in the process of obtaining an accurate *ab initio* potential energy surface for H_4, necessary to calculate cross sections for excitation and dissociation of H_2 colliding with H_2 in molecular clouds; an improved H_3 surface has also been obtained. Martin and collaborators have obtained rate constants for *all* collisional transitions of H_2 colliding with H atoms. From laboratory data, Martin and Rouleau extracted spectral constants for amorphous carbon over a wide spectral range, and found that shape and clustering effects on the infrared absorptivity of small particles are very pronounced. Martin and collaborators found that helium is less abundant in the Orion Nebula than previously thought, when dust processes are incorporated in photoionization models. Fich and collaborator found nitrogen abundances in eighteen H II regions at the outer edge of the galaxy high enough to be consistent with no abundance gradient at all, contrary to the prevailing theory. Latter showed that mass-losing asymptotic giant branch stars could be the primary source of interstellar polycyclic aromatic hydrocarbons (PAHs), but only if PAHs are not well mixed into the interstellar medium.

Blaes and collaborator are studying linear and nonlinear evolution of MHD waves in a clumpy, weakly ionized medium, with the aim of understanding whether small scale wave power excited by molecular outflows can be transferred to large scales, providing dynamical support of molecular clouds. Raga, Binette, and collaborators developed models for steady, nonadiabatic jet flows (including nonequilibrium ionization and radiative cooling) which approximately match the excitation and kinematics of observed stellar jets, though some unresolved problems remain. They also developed quasi-analytic models for jets from time-dependent sources, and used these to show that the source of HH 46/47 has had two ejection episodes in the past, separated by about 5000 years. Kim and Raga showed that time variations in a stellar wind collimated by nonadiabatic de Laval nozzles can be amplified by a factor of five, although short period (< 50 year) variations are filtered out. Raga showed that the size of predicted offsets between Hα and [S II] 6717+6731 emission favors the "internal working surface" model of knots in stellar jets over the "crossing shock" model. He also showed that new theoretical jet models (less than $\sim$ 10% ionized) imply mass and momentum rates more than two orders of magnitude larger than previously accepted values, removing the stellar jet/molecular outflow momentum discrepancy.

Fich and Tremaine reviewed estimates of the mass of the galaxy, finding that models of the galaxy with a "min-

imal (35 kpc) halo" cannot explain dynamics of the Local Group; models with extended halos (in which the mass of the galaxy is ill-defined) appear to be consistent with observations, though there are few realistic numerical models. Kuijken analyzed the kinematics of K dwarfs, and found that there is no evidence for a dark matter component of the galactic disk. He also showed that models of galaxies with warped disks (that do not lie in a plane of symmetry of their massive dark halos) fit observations of M 33 and NGC 2841 surprisingly well. Merrifield explored the limits of the amount of information that can be extracted from kinematic observations of gravitating systems (the deprojection problem). Yepes and collaborator computed numerical models of cluster dynamics, which will be used to estimate the dynamical state of rich clusters of galaxies from observations of luminosity segregation and velocity dispersion profiles.

Blaes and collaborators modelled accretion from the interstellar medium onto neutron stars and the subsequent build-up of an unstable density inversion, whose overturn could produce a γ-ray burst; however, simulations of neutron star orbits in the galaxy showed that many more neutron stars would be required than are implied by the current radio pulsar birthrate. Wang and collaborators developed a cyclotron scattering model for the formation of low energy ($\sim$ tens of keV) absorption-like features seen in $\sim$ 20% of "classical" γ-ray burst spectra. Stellar models of Boothroyd and collaborator demonstrated that asymptotic giant branch stars of $\sim 6\ M_\odot$ experience nuclear burning in the convective envelope sufficient to deplete the surface carbon (in spite of dredge-up) and to enhance the surface ^{7}Li abundance via the ^{7}Be transport mechanism, consistent with observations of very luminous Li-rich S stars in the Magellanic Clouds. Latter and collaborators are studying the time-dependent chemical evolution of planetary nebulae, comparing a complex chemical and molecular emission model with their observations.

Dones showed that tidal disruption of a comet by a giant planet creates rings at least as well as tidal disruption of a moon, but neither is able to provide a re-supply mechanism on the 10^8 year ring evolution timescale that is suggested by recent theoretical arguments. Dones and collaborators demonstrated that the difference in impact velocities of late-accreting cometary volatiles could explain the dense atmosphere of Titan compared to the absence of atmospheres of Ganymede and Callisto. Dones and Tremaine showed that planetary bodies accreting from a disk of small bodies could spin either prograde or retrograde, depending on the planet's gravity and the small body velocity dispersion relative to the shear of the disk. Quinlan, Tremaine, and collaborators developed symmetric multistep methods for numerical integration of planetary orbits, where the energy error remains approximately constant and the longitude error grows only linearly with time; these were used to perform a 3 Myr integration of the orbits of the nine planets, which were found to be regular rather than chaotic on this timescale. They also showed that innacuracies in the predicted longitude of Neptune are a consequence of Neptune's long orbital period, and provide no evidence for the existence of a tenth planet or a belt of cometary matter. Sygnet and Tremaine found the projected growth of Earth orbital debris to be large (resulting in a very hostile near-Earth environment over the next few decades), but did not encounter catastrophic exponential growth (due to collisions: the "Kessler syndrome") in the cases they examined.

LUC BINETTE
ARNOLD BOOTHROYD

CASCA JOURNALS PROGRAM

Paul Delaney has replaced Dieter Brueckner in working on this programme with the undersigned. Progress has been very slow, mainly because demand from potential recipients is not very high. We are, however, in the middle of preparing a large shipment to Peru. We are particularly pleased to do this as it supports one of the IAU Visiting Lecturer Programmes, the aim of which is to get astronomical work started in countries in which there is none. CASCA members may recall that Peru bacame one of the first Associate Members of the IAU at the last General Assembly in Baltimore.

Mailing costs continue to increase, and must be the principal charge on any financing the Society gives to this programme. The cost of shipments to Peru is now an appreciable fraction of the cost of the journals themselves. Members who do not have journals to give the programme might like to consider making donations to the Society ear-marked for this particular purpose.

A.H.BATTEN

NEWS FROM THE UNIVERSITY OF VICTORIA

This year an unusually large number of our graduate students have completed their degrees. Ben Dorman and David Schade have obtained Ph.D.'s, supervised by Don VandenBerg and David Hartwick respectively. Ben's thesis was entitled "A Study of the Structure, Evolution and Observation of Horizontal Branch Stars", and David's was "A Faint Spectroscopic Quasar Survey". In addition, Anne-Marie Monteith (supervised by Don VandenBerg and Robert McClure) and Joanne Rosvick and Meng Lu (both supervised by Colin Scarfe) have completed M.Sc.'s. Their thesis titles were, respectively, "The Ages of the Old Open Clusters NGC 188, NGC 6791, Melotte 66 and NGC 2204", "A Study of Two Spectroscopic Binary Systems", and "Photometric and Spectroscopic Studies of Four Binaries: SU Cep, VZ Cep, TY Del and AW Lac". We are all delighted that, in this first year of Governor-General's Medal awards to Ph.D. recipients, the winner of the Medal for this University is Ben Dorman.

Don VandenBerg is approaching the end of the tenure of his Steacie Fellowship, and recently returned from six months away in the sunny climes of Australia, visiting his old haunts at Mt. Stromlo Observatory, Canberra. His absence was well timed to avoid one of Victoria's coldest, wettest winters of recent years!

Maintaining the Australian connection, we have had in residence for almost a year, as a PDF, Sean Ryan (actually a New Zealander), who recently completed his Ph.D. at Mt. Stromlo. Alas by the time this appears in Cassiopeia he will have departed for a new position in Texas, where his "digger" hat may come in more useful as a sun-shade than it has in Victoria!

Stephenson Yang, formerly of UBC, has been with us a couple of years now, and he and Alan Irwin are continuing to collaborate with Gordon Walker, over there on "the Continent", on the HF precise radial velocity program, despite the departure of Bruce Campbell.

We now have a Photometrics CCD installed on our 0.5m telescope, and Russell Robb almost has the combination operating in fully automatic mode, as he had the photometer that previously detected photons from that telescope. A few more bugs to remove, and we'll be able to obtain observations while sleeping once again!

John Climenhaga still visits the group at frequent intervals, but now that he no longer occupies the post of Treasurer to the Society, he is not obliged to come in almost daily, as he did then. However we welcome his cheery smile and wise counsel whenever he does come in, even if it's only to check that Jeremy Tatum and David Balam are keeping track of the asteroid that bears his name as well as those that carry their own!

COLIN SCARFE

ANNOUNCING AN ON-LINE ABSTRACTING SERVICE FOR EXTRAGALACTIC DISSERTATIONS

The *NASA/IPAC Extragalactic Database* = **NED** is contining to explore new means of providing rapid access to extragalactic data for the astronomical community. This announcement is both to inform the community of a new addition to **NED**, and to solicit submissions from astronomy departments and their recent graduates.

The primary aim of the **NED** is to make available an up-to-date and useful research tool for extragalactic astronomers by increasing information flow, data access and communication within the discipline. As part of this mandate the **NED** is now in the process of placing *an on-line thesis abstracts for recent doctoral dissertations on extragalactic topics.* As soon as an extragalactic thesis has been accepted in partial fulfilment of the doctoral degree at your Institution, the **NED** will be pleased to accept the abstract for immediate on-line publication. Electronic submission, by the Department or the author can be made over the network to the following e-mail address: **barry@ipac.caltech.edu**. Alternatively hardcopy versions may be sent to either **Barry F. Madore or George Helou at IPAC 100-22, Caltech, Pasadena, CA 91125 USA.**

We hope that this new service will prove to be useful to established research astronomers and graduate students alike. Additional information on **NED** can be obtained on **INTERNET** using the command **telnet ipac.caltech.edu** or via **SPAN** using **set host IPAC** (absolute address 5.857). At the **login:** prompt simply type **NED**. The system is self-explanatory from there on.

This work is being carried out at the Infrared Processing and Analysis Center which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration (Astrophysics Division, Science Operations Branch).

BARRY F. MADORE
barry@ipac.caltech.edu

CANADIAN ASTRONOMICAL SOCIETY
SOCIETE CANADIENNE D'ASTRONOMIE
INC. 1983

Financial Statement as of March 31, 1991
(giving details since the March 31, 1990 statement)

(1989–90)		(1990–91)
36242.33	**Balance on March 31, 1990**	**38875.25**
	INCOME	
10716.89	Membership dues	11045.53
485.76	Bank Interest (CIBC)	–
1081.87	Bank Interest (Canada Trust)	1803.29
481.00	GIC Interest (Petrie fund)	555.94
925.00	GIC Interest (General funds)	537.50
1025.00	GIC Interest (Beals fund)	1100.00
	Contributions toward shipping journals abroad	
100.00	–from RASC Toronto Centre	–
–	–from International Atomic Enery Corp.	444.30
–	Contribution from Spar Aerospace for bursaries	500.00
–	Government of Canada for 'Status' report	2055.68
14815.52	**TOTAL INCOME**	**18042.24**
	EXPENDITURES	
2400.00	Cassiopeia	1812.48
1629.06	Secretary – postage, copying, printing constitution,	
–	membership directory, status report, etc.	4843.66
392.15	Treasurer – postage, copying, etc.	319.20
1354.00	Travel – Board Members (Treas. to CASCA 1989 meeting)	–
30.00	Receiver General	30.00
476.00	ASP – Universe in classroom ($400.00 US)	–
1200.00	Small Grants	1500.00
1380.80	Petrie Lecture	–
762.00	Petrie Lecture (publication charges)	–
1442.45	Hogg Lecture (costs shared equally with RASC)	508.29
313.50	Hogg Lecture (publication charges shared with RASC)	855.50
–	Beals Award	1000.00
	Plaskett Medal	
–	–publication charges (shared with RASC)	450.00
–	–recipient's travel	532.81
186.50	–recipient's travel (costs shared with RASC)	–
44.24	Bank charges	–
546.90	Shipment of books to Egypt and Nigeria	852.94
25.00	Legal fees	–
–	York University for Spar bursaries	500.00
12182.60	**TOTAL EXPENDITURES**	**13204.88**
38875.25	**Balance on March 31, 1991**	**43712.61**

Balance Held as Follows
at Canada Trust, 2972 Bloor St. W
Toronto, Ontario.

Chequing Savings account #326 506616	23512.61
GIC (#326 2031550)	5000.00
GIC (#326 2031239 – Petrie Fund)	5200.00
GIC (#326 2067039 – Beals Fund)	10000.00
	43712.61

Christine M Clement
C. M. Clement, Treasurer

April 2, 1990
Date

I have examined the books, receipts, and other documentation provided by the Treasurer and I am satisfied that this Financial Statement is a true and correct statement of the financial affairs of the Society from April 1, 1990 to March 31, 1991.

Harvey R. Evans
N. R. Evans, Auditor

Apr. 2, 1990
Date

CANADIAN ASTRONOMY PUBLICATIONS
March 13 to June 21, 1991

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
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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.

Arcoragi, J.-P., et al., *Fragmentation of elongated cylindrical clouds II. Polytropic clouds.* Obs. Mont Megantic, 18-June-1991.

Barnbaum, C., Likkel, L., et al., *Carbon stars associated with oxygen-rich circumstellar envelopes: EU Andromedae, BM Geminorum and V778 Cygni .* UCLA/Dominion Radio Astrophysical Observatory, 16-Apr-1991.

Bastien, P., *Polarization of light and models of the circumstellar environment of young stellar objects.* Obs. Mont Megantic, 18-June-1991.

Bianchi, L., Hutchings, J.B., Massey, P., *Stellar winds and UV extinction of OB stars in M33 and M31.* Dominion Astrophysical Observatory, 7-May-1991.

Bietenholz, M.F., Kronberg, P.P., Hogg, D.E., Wilson, A.S., *The expansion of the Crab Nebula.* University of Maryland/University of Toronto, 9-Apr-1991.

Bietenholz, M.F., Frail, D.A., Hankins, T.H., *Does the Vela pulsar have "wisps"?.* NRAO/David Dunlap Observatory, University of Toronto, 5-June-1991.

Binette, L., Magris, G., Bruzual, G., *The effect of internal dust on the Ly alpha/H beta ratio.* Canadian Institute for Theoretical Astrophysics, 7-June-1991.

Blaes, O., Rajagopal, M., *The statistics of slow interstellar accretion onto neutron stars.* Canadian Institute for Theoretical Astrophysics, 21-May-1991.

Bolte, M., *Photometric binary stars in Praesepe and the search for globular cluster binaries.* Dominion Astrophysical Observatory, 22-Apr-1991.

Bond, J.R., *Summary of after the first three minutes.* Canadian Institute for Theoretical Astrophysics, 30-May-1991.

Bond, J.R., Efstathiou, G., *The formation of cosmic structure with a 17 keV neutrino.* Canadian Institute for Theoretical Astrophysics, 30-May-1991.

Bond, J.R., Myers, S.T., *Background radiation inhomogeneities from gas processes.* Canadian Institute for Theoretical Astrophysics, 30-May-1991.

Borra, E.F., Content, R., *Lunar liquid mirror telescopes.* Université Laval, 26-Mar-1991.

Borra, E.F., et al., *Liquid mirrors: optical shop tests and contributions to the technology.* Université Laval, 12-Jun-1991.

Carr, B.J., Bond, J.R., Hogan, C.J., *Cosmological implications of COBE.* Canadian Institute for Theoretical Astrophysics, 30-May-1991.

Cote, S., Carignan, C., Sancisi, R., *A dark halo dominated galaxy: NGC 5585.* Obs. Mont Megantic, 18-June-1991.

Cowley, A.P., et al, *Discovery of a long-term periodic variation in LMC X-C.* Dominion Astrophysical Observatory, 4-June-1991.

Davidge, T.J., Simons, D.A., *JHK photometry of bright giants in M69.* Canada-France-Hawaii Telescope, 25-Mar-1991.

Davidge, T.J., Boeshaar, P.C., *The near-infrared spectrum of the suspected brown dwarf binary system Gliese 473.* Canada-France-Hawaii Telescope, 10-Apr-1991.

Davidge, T.J., *JHK imaging of a field in Baade's window.* Canada-France-Hawaii Telescope, 7-May-1991.

Davidge, T.J., *The extended spectrum of NGC 5846.* Canada-France-Hawaii Telescope, 7-May-1991.

Davidge, T.J., *Absorption line gradients in the compact elliptical galaxies NGC4478, NGC4486B, and NGC5846A.* Canada-France-Hawaii Telescope, 11-June-1991.

Demers, S., Irwin, M.J., *Catalogue of blue stars between the Magellanic Clouds.* Obs. Mont Megantic, 8-May-1991.

Dougherty, S.M., Taylor, A.R., Waters, L.B.F.M., *Radio variability of Be stars.* University of Calgary, 12-Jun-1991.

Ellingson, E., Green, R.F., Yee, H.K.C., *Clusters of galaxies associated with quasars, II. Galaxy cluster dynamics.* Dominion Astrophysical Observatory, 7-May-1991.

Evans, N.R., Ferro, A.A., Udalska, J., *The luminosity of the cepheid BP Cir.* Institute for Space and Terrestrial Sciences, York University, 17-Apr-1991.

Evans, N.R., *The luminosity of the double mode cepheid Y Car.* Institute for Space and Terrestrial Sciences, York University, 31-May-1991.

Feldman, H.A., Raga, A.C., *Simulated images of stellar jets.* Canadian Institute for Theoretical Astrophysics, 30-May-1991.

Fernie, J.D., *R CrB and delta CrB in 1990.* David Dunlap Observatory, University of Toronto, 22-May-1991.

Fernie, J.D., *V441 Herculis and V814 Herculis in 1990.* David Dunlap Observatory, University of Toronto, 31-May-1991.

Fich, M., Hodge, P., *Continuum emission at 1mm from the elliptical galaxy NGC 205.* Canadian Institute for Theoretical Astrophysics, 26-Apr-1991.

Frail, D.A., et al., *HI absorption measurements toward 15 pulsars and the radial distribution of diffuse ionized gas in the galaxy.* NRAO/David Dunlap Observatory, University of Toronto, 5-June-1991.

Frail, D.A., Hjellming, R.M., *The distance and total column density to the periodic radio star LSI+61 303.* NRAO, 14-Mar-1991.

Gibson, B.K., *Liquid mirror telescopes: history.* University of British Columbia, 17-May-1991.

Gibson, B.K., Hickson, P., *Outline of a liquid mirror telescope QSO survey.* University of British Columbia, 12-Jun-1991.

Gray, D.F., Johanson, H.L., *Precise measurement of stellar temperatures using line-depth ratios.* University of Western Ontario, 10-Apr-1991.

Gulliver, A.F., Adelman, S.J., Cowley, C.R., Fletcher, J.M., *Metallic line profiles of the AOV star Vega.* Dominion Astrophysical Observatory, 4-June-1991.

Hasegawa, T.I., Rogers, C., Hayashi, S.S., *Observations of HCO+ in B335.* Dominion Radio Astrophysical Observatory, 4-Apr-1991.

Higgs, L.A., van der Werf, P.P., *Radio sources in a field centred on BG 2107+49.* Dominion Radio Astrophysical Observatory, 4-Apr-1991.

Hutchings, J.B., Neff, S.G., *Optical imaging of the low redshift superluminous QSO 1821+643.* Dominion Astrophysical Observatory, 22-Apr-1991.

Hutchings, J.B., et al., *First results from the GHRS: UV spectra of a starburst knot in NGC 1068.* Dominion Astrophysical Observatory, 7-May-1991.

Kaiser, N., et al., *The large-scale distribution of IRAS galaxies and the predicted peculiar velocity field.* Canadian Institute for Theoretical Astrophysics, 17-May-1991.

Kaiser, N., *Weak gravitational lensing of distant galaxies.* Canadian Institute for Theoretical Astrophysics, 17-May-1991.

Kim, K.-T., Tribble, P.C., Kronberg, P.P., *Detection of excess rotation measure due to intracluster magnetic fields in clusters of galaxies.* Canadian Institute for Theoretical Astrophysics, 3-Apr-1991.

Kofman, L., Raga, A.C., *Modelling structures of knots in jet flows with Burgers' equation.* Canadian Institute for Theoretical Astrophysics, 26-Apr-1991.

Latter, W.B., *Large molecule production by mass-losing carbon stars: the primary source of interstellar PAHs?.* Canadian Institute for Theoretical Astrophysics, 15-Mar-1991.

Lemelin, G., Lessard, R.A., Borra, E.F., *An investigation of holographic correctors for astronomical telescopes.* Université Laval, 26-Mar-1991.

Madore, B.F., Freedman, W.L., *The cepheid distance scale.* IRAS, 18-June-1991.

McClure, R.D., Arnaud, J., Fletcher, J.M., Nieto, J.-L., Racine, R., *A measurement of isoplanatism with HRCam at the CFHT.* Dominion Astrophysical Observatory, 22-Apr-1991.

Merrifield, M.R., *Modelling edge-on elliptical galaxies: are two integrals enough?.* Canadian Institute for Theoretical Astrophysics, 21-May-1991.

Nadeau, D., Yee, H.K.C., et al., *Infrared and visible photometry of the gravitational lens system 2237+030.* Obs. Mont Megantic, 8-May-1991.

Nadeau, D., Riopel, M., Geballe, T.R., *The extinction to the H2 line emission in the DR 21 outflow source.* Obs. Mont Megantic, 8-May-1991.

Nemec, A.F.L., Nemec, J., *On the validity of Davies' test for periodicity* . University of British Columbia, 17-May-1991.

Normandeau, M., Joncas, G., Green, D.A., *The DRAO galactic-plane survey, III: Field at l=85.* Obs. Mont Megantic, 18-June-1991.

Pierce, M.J., *The luminosity-line-width relations and the value of Ho.* Dominion Astrophysical Observatory, 7-May-1991.

Pudritz, R.E., Pelletier, G., Gomez de Castro, A.I., *The physics of disk winds.* Canadian Institute for Theoretical Astrophysics, 31-May-1991.

Racine, R., *Fifth image and photometric variability in 2237+0305 ("Einstein cross").* Université de Montréal, 9-May-1991.

Racine, R., Salmon, D., Cowley, D., Sovka, J., *Mirror, dome and natural seeing at CFHT.* Canada-France-Hawaii Telescope, 11-June-1991.

Raga, A.C., Binette, L., *Models of spatially resolved recombination regions in H-H objects.* Canadian Institute for Theoretical Astrophysics, 16-Apr-1991.

Rawlings, S., Eales, S., Lacy, M., *Near-IR spectrophotometry of eight 3CR radiogalaxies: the first detections of [OIII]500.7 and [SIII]953.2 emission lines in galaxies with z>1.* Cambridge U/University of Toronto, 14-May-1991.

Rosvick, J.M., Scarfe, C.D., *An investigation of the spectroscopic-visual triple system 20 Leonis.* University of Victoria, 8-May-1991.

Rosvick, J.M., Scarfe, C.D., *Radial velocities of the composite spectrum binary alpha Equulei.* University of Victoria, 8-May-1991.

Roy, J.-R., Aube, M., McCall, M.L., Dufour, R.J., *The origin of broad emission lines in the extragalactic giant HII region NGC 2363.* Université Laval, 8-May-1991.

Seaquist, E.R., Odegard, N., *A synchrotron halo around M82.* David Dunlap Observatory, University of Toronto , 4-Apr-1991.

Seaquist, E.R., *Summary lecture: workshop on the interpretation of modern synthesis observations of spiral galaxies.* David Dunlap Observatory, University of Toronto, 4-Apr-1991.

Seaquist, E.R., *A lower limit on the distance to the young planetary nebula Vy 2-2 by expansion paralax.* David Dunlap Observatory, University of Toronto, 4-Apr-1991.

Shore, Steven N., Bolton, C.T., et al., *First results from the GHRS: low-velocity narrow absorption components in the ultraviolet resonance lines of the O7.5 III star xi Persei.* GSFC/David Dunlap Observatory, University of Toronto, 17-Apr-1991.

Solf, J., Raga, A.C., Bohm, K.H., Noriega-Crespo, A., *HH 1: H alpha and [S II] spectroscopy with two-dimensional spatial resolution.* Canadian Institute for Theoretical Astrophysics, 25-Mar-1991.

Stetson, P.B., *Early-type high-velocity stars in the solar neighborhood. IV. Four-color and Hbeta photometry.* Dominion Astrophysical Observatory, 4-June-1991.

Strassmeier, K.G., Rice, J.B., Wehlau, W.H., et al., *Doppler imaging of high-latitude spot activity on HD 26337.* University of Brandon/University of Western Ontario, 15-Apr-1991.

Taylor, A.R., Gregory, P.C., Duric, N., Tsutsumi, *A new galactic source with a radio jet, GT 2318+620.* University of Calgary, 4-June-1991.

van den Bergh, S., *The stellar population of M33.* Dominion Astrophysical Observatory, 4-June-1991.

van de Rydt, F., Demers, S., Kunkel, W.E., *Phoenix an intermediate dwarf galaxy in the Local Group.* Obs. Mont Megantic, 8-May-1991.

Verge, M.-P., Borra, E.F., *Liquid GRIN mirrors: a detailed analysis.* Université Laval, 26-Mar-1991.

Wang, J.C.L., Sulkanen, M.E., Lovelace, R.V.E., *Intrinsically asymmetric astrophysical jets.* Canadian Institute for Theoretical Astrophysics, 7-June-1991.

Wang, J.C.L., Sulkanen, M.E., Lovelace, R.V.E., *Intrinsically asymmetric jets: energetic and dynamical implications for AGN.* Canadian Institute for Theoretical Astrophysics, 7-June-1991.

West, M.J., *Superclustering at high redshifts.* Canadian Institute for Theoretical Astrophysics, 24-Apr-1991.

Witt, A.N., Rogers, C., *CCD surface photometry of IC 2220.* Dominion Radio Astrophysical Observatory, 4-Apr-1991.

Woodsworth, A.W., Murowinski, R., Kwok, S., Chan, S.J., *CO observations of bright carbon stars at 230 GHz.* Dominion Astrophysical Observatory, 22-Apr-1991.

Woodsworth, A.W., *Database services at the Canadian Astronomy Data Centre .* Dominion Astrophysical Observatory, 7-May-1991.

B. OTHER PUBLICATIONS

Helen Sawyer Hogg: a lifetime of stargazing / Michael Webb. Toronto : Copp Clark Pitman, 1991

History of free fall / Stillman Drake. Toronto : Wall & Thompson, 1989

Physical cosmology and philosophy / edited by John Leslie. New York : Macmillan, 1990

EDITORIAL NOTES

We are indebted to Colin Scarfe for catching this quote, which appeared on page 1985 of volume 100 of the *Astronomical Journal*, December 1985:

> The dataset was a product of a long-term observing program directed by J.F. Heard at the Dominion Astrophysical Observatory (University of Victoria).... Fortunately, C.T. Bolton of David Dunlap Observatory was able to find the original data sheets....

* * *

The minutes of CASCA's Annual General Meeting held at York University, June 1991, will appear in the next issue of *Cassiopeia.*

Cassiopeia Editor: J.D. Fernie

Assistant Editor: Brian Beattie

E-Mail: fernie@centaur.astro.utoronto.ca
beattie@cygnus.astro.utoronto.ca

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