PROGRAM

of the

First Joint Meeting

of the

CASCA and RASC

hosted by:

Saint Mary's University

& Halifax Centre, RASC

25-30 June,

1980

INDEX

SCHEDULE

All scientific sessions will be held in Theatre A of the Burke Education Building.

WEDNESDAY, June 25

09:00--	CASCA Council Meeting, Board Room of the McNally Building.
14:00--17:00	Registration, Loyola Building
19:00--20:00	Registration, Loyola Building
19:00--22:00	Reception hosted by Saint Mary's Univ. in the Art Gallery

THURSDAY, June 26

09:00--12:00	Registration, Burke Education Building
09:00--10:00	Session 1
10:30--12:00	Session 2
13:30--15:00	Session 3
14:00--17:00	Registration, Loyola Building
15:30--17:00	Session 4
20:00--	Discussion: "Canadian Participation in Starlab?", Theatre A

FRIDAY, June 27

09:00--10:00	Address of the retiring CASCA President, Carman Costain
10:30--12:00	Session 5

FRIDAY, June 27 (continued)

13:30--15:00 CASCA Business Meeting

14:00--17:00 Registration, Loyola Building

15:30--17:00 Session 6

15:30--17:30 RASC Council Meeting, L154, Loyola Building

19:00--21:00 Registration, Loyola Building

19:00--22:00 Reception hosted by Saint Mary's University in the Art Gallery

21:00--23:00 RASC Slide Show, Theatre A

21:00--24:00 Open House, Burke-Gaffney Observatory

SATURDAY, June 28

09:00--10:30 Registration, Burke Education Building

09:30--09:15 Statement of welcome by Kenneth Ozmon, President of Saint Mary's University

09:15--10:00 Session 7

10:30--11:30 Session 8

11:30--12:00 Group Photograph

12:00--13:30 Buffet Lunch, Residence Dining Room

19:30--22:00 Banquet Address of the retiring RASC President, John Percy--"In Praise of Smaller Telescopes"

SUNDAY, June 29

09:00--10:00 Session 11

10:30--12:00 Session 12

13:00--15:00 RASC General Assembly, Theatre A

15:15--16:00 RASC National Council, Theatre A

16:00--18:00 RASC Dinner, Armdale Yacht Club

22:00--22:30 RASC Display Awards, L162-163

PAPER SESSIONS

SESSION 1 Thursday, June 26, 9:00-10:00

A Study of Stellar Spectra with IUE, P. Delaney, University of Victoria.

The Sources of Heating in the Mantles of Early-Type Supergiants, A. B. Underhill, Goddard Space Flight Centre.

He λ10830 in Planetary Nebulae, J. N. Scrimger, Saint Mary's University.

Models of Cometary Comae, G. F. Mitchell and M. B. Swift, Saint Mary's University.

SESSION 2 Thursday, June 26, 10:30-12:00

Evidence for Diffusion of Relativistic Electrons in the Interstellar Medium of the Elliptical Galaxy NGC3862, J. P. Vallée, Queen's University.

Local Inhomogeneities in a Robertson-Walker Background, K. Lake, Queen's University.

Distance of Double Quasar 0957+561, Y. P. Varshni, University of Ottawa.

Combined Radio-Optical Observations of Active Solar Regions Associated with the S-Component of Solar Microwave Emission, V. Gaizauskas and K. F. Tapping, Herzberg Institute of Astrophysics.

Coronal Scattering of Satellite Radio Signals, H. M. Bradford, Canadian Coast Guard College, and D. Routledge, University of Alberta.

SESSION 3 Thursday, June 26, 13:30-15:00

Periodic Radio Emission from LSI+61°303, A. R. Taylor and P. C. Gregory, University of British Columbia.

Radio Superflares in R. S. Canum Venaticorum Binaries, P. A. Feldman, Herzberg Institute of Astrophysics.

Evolution of Low Mass, Distorted Stars in a Very Close Binary System with the Inclusion of Gravitational Radiation Losses, W. Y. Chau, Queen's University, C. Chiosi, Un. di Padava, K. L. Chan, Queen's University, and L. A. Nelson, Queen's University.

Perturbation of a Binary System with the Passage of Gravitational Waves, L. A. Nelson and W. Y. Chau, Queen's University.

SESSION 4 Thursday, June 26, 15:30-17:00

A Detailed Investigation of the R Association Containing the $1^{d}.95$ Cepheid SU Cassiopeiae, D. G. Turner and N. R. Evans, University of Toronto.

HR7308: A Unique Cepheid, J. R. Percy and N. R. Evans, University of Toronto.

UBV Photometry of the Highly Reddened Open Cluster, D. Forbes, University of Victoria.

HI in the Region Around the Reflection Nebula NGC 1579, P.E. Dewdney and R. S. Roger, Dominion Radio Astrophysical Observatory.

SESSION 5 Friday, June 27, 10:30-12:00

The Surface Brightness Profiles of Six Supergiant Galaxies, D. English and G. A. Welch, Saint Mary's University.

Ultraviolet Photometry of Spiral and Irregular Galaxies with the Orbiting Astronomical Observatory, G. A. Welch, Saint Mary's University.

Spectral Line Observations of the IC5146 Region, W. H. McCutcheon, University of British Columbia, R. S. Roger, Dominion Radio Astrophysical Observatory, and R. L. Dickman, Aerospace Coropration.

Warping of Galaxies, K. A. Papp and K. A. Innanen, York University.

A Driving Mechanism for Galactic Spirals, K. A. Innanen and K. A. Papp, York University.

SESSION 6 Friday, June 27, 15:30-17:00

Late papers

SESSION 7 Saturday, June 28, 9:15-10:00

Invited Paper, "Ninety Years of Variable Stars in Globular Clusters," Helen Hogg, David Dunlap Observatory.

The Variable Stars of the Globular Cluster NGC6284, C. M. Clement and T. R. Wells, University of Toronto.

Radio tel. in space } VLBA ?
linked to earth

using ref. sources in the field.

SESSION 8 Saturday, June 28, 10:30-11:30

Invited Paper, "The Canadian Very Long Baseline Array--A Proposal for a New National Astronomy Facility," Norman Broten, Herzberg Institute of Astrophysics.

Tom Legg

Castle Frederick Observatory: Location and Design, R. L. Bishop, Acadia University.

Review of "A Letter Concerning Earthquakes," J. E. Kennedy, University of Saskatchewan.

SESSION 9 Saturday, June 28, 13:30-15:00

Invited Paper, "Alii-nui, Kahunas and Menehunas on Mauna Kea, Hawaii--A Candid Glimpse of CFHT by Its Director-to-be," René Racine, Université de Montréal.

CCD Images Obtained With the Canada France Hawii Telescope, P. Hickons, J. R. Auman, G. G. Fahlman, T. K. Menon, G. A. H. Walker, R. Johnson and T. Lester, University of British Columbia.

A Planetarium for London, Ontario, P. Jedicke, London Regional Children's Museum.

Protective Filters for Solar Observation, R. Chou, University of Waterloo.

V = 14^m B-V = 2.0 D = 4 ± 1 kpc M_V = -7.
A = 8^m Stephenson catalogue 10,000 year old SN

SESSION 10 Saturday, June 28, 15:30-17:00

Invited Paper, "SS433-A New Stellar Phenomenon?", Ernest Seaquist, University of Toronto.

A SAAD System: Signal-Aquisition-Averaging-Display System, M. MacDonell, Saint Mary's University.

33 Tauri--A New Ellipsoidal Variable, D. P. Hube, University of Alberta.

An Amateur Observing Program in Southern Arizona, D. H. Levy, Kingston Centre, RASC.

SESSION 11 Sunday, June 29, 9:00-10:00

Making a Photographic Star Atlas With a 5.5" Schmidt Camera, D. Lemay, Centre de Québec, RASC

Gear Selection for Consideration with Gear Load Balancing for Astrophotography, M. P. Edwards, Halifax Centre, RASC

A Least Squares Determination of Cepheid Maxima, R. G. McCallum and J. M. Roney, Ottawa Centre, RASC

Navigation Versus Astronomy, R. Auclair, RASC

SESSION 12 Sunday, June 29, 10:30-12:00

A Union Catalogue of Antiguarian Astronomy Books, R. C. Brooks, Halifax Centre, RASC.

Apollo Asteroids, C. Cunningham, Grand Valley Astronomers, RASC.

Transverse Doppler effect

Invited Abstract

Ninety Years of Variable Stars in Globular Clusters

Helen Sawyer Hogg
David Dunlap Observatory, University of Toronto

The discovery of a very bright variable star in Messier 3 in 1889 and two more such variables in Messier 5 in 1890 touched off further discovery and investigation of variable stars in globular clusters. The outburst of the nova in Messier 80 in 1860 had not stimulated a search for variable stars in these objects.

Nine decades later the brightness of the above mentioned stars is not so well known to observers as it should be, as shown by the unfortunate incident last year pertaining to Messier 3.

The research on variables in globular clusters consisted of discovery in as many clusters as possible, then period determination, and in recent decades, determination of period changes. The manner in which the changes of period fit in with current ideas of stellar evolution also receives attention. In the last few years X ray sources in globular clusters have added a new dimension to variability of stars in these objects.

This paper may be considered a supplement to my Presidential Address to CASCA in 1972 (J.R.A.S.C. 67, 8, 1973). Ninety years of investigation of variables in globular clusters will be given thirty minutes of consideration.

Contributed Abstracts

The Source of Heating in the Mantles of Early-Type Supergiants

Anne B. Underhill

Laboratory for Astronomy and Solar Physics

Goddard Space Flight Center, Greentelt, MD 20771

ABSTRACT

The winds from early-type supergiants are seen by means of the modifications which the outer layers of the stellar atmosphere, or mantle, impress on the ultraviolet spectra of the O and B type supergiants. It is inferred from the presence of higher ions than can be expected to be present according to the effective temperature of the star and from the rapid outflow of gas that non-radiative energy is deposited in the mantle. Although the effective temperatures of supergiants increase by less than a factor three from type B9/A0 ($T_{eff} \approx 10000$ K) to type O9/B0 ($T_{eff} \approx 26000$ K), the ions visible in the wind change from H^{+} and Mg^{+} at B9/A0 to C^{+3}, N^{+4} and O^{+5} at type O9/B0; the maximum velocity of outflow increases from about 250 km s^{-1} at B9/A0 to about 2500 km s^{-1} at O9/B0. It will be shown that this pattern of behaviour can be understood if the mantles of the early-type supergiants have an inhomogeneous structure like the structure of the mantle of the Sun, and if, as in the Sun, heating occurs as a result of interactions between an indigenous magnetic field and local differential velocities.

"A Study of Stellar Spectra with IUE"

by Paul Delaney, University of Victoria

In July 1979, 17 individual stellar spectra were obtained with the IUE satellite using its long wavelength camera in high dispension mode. The stars range in spectral type from B9 to M2 and in luminosity from type I to V. Comparisons of the various gross features of their spectra will be presented as well as some specific line identifications. In particular the possible presence of the 2 neutral boron resonance lines near 2500 λ will be discussed. Also the possibility of using the sharp emission features of the later spectral type stars along with well defined absorption features for radial velocity determinations will be investigated.

He λ10830 In Planetary Nebulae

J. Norman Scrimger
Department of Astronomy
Saint Mary's University

Absolute Paschen β fluxes for nine planetary nebulae have been determined. Relative photometry between Pβ and other near infrared lines (including He λ10830) has also been obtained. Two independent determinations of the absolute flux of Hβ can be made for each nebula using: a) hydrogen recombination theory and interstellar reddening evaluations; and b) relative photometry between Pβ and He λ10830 (here), and He λ10830 and Hβ (published). Comparison of the results of these two independent methods with previously obtained absolute Hβ fluxes points to several erroneous values of the published ratio of He λ10830/Hβ. This ratio determination is critical for studies of relative line strengths extended into the infrared, if such measurements are to be joined to a photometry system relative to Hβ.

MODELS OF COMETARY COMAE

George F. Mitchell and Michael B. Swift
Department of Astronomy
Saint Mary's University

By modeling the comae of comets it may be possible to deduce the composition of the unobservable cometary nucleus from observed coma abundances. As parent molecules evaporate from the nucleus and stream outward, they undergo photodissociation, photoionization, charge exchange reactions, and ion-molecule reactions. Starting with an assumed nuclear composition and using a comprehensive system of chemical reactions, we obtain abundances through the coma of 128 species. We will present results for a number of nuclear compositions. Model abundances of C_2, C_3, CN, CH, and NH_2, will be compared with observed abundances of these species.

Evidence for Diffusion of Relativistic Electrons in the Interstellar Medium of the Elliptical Galaxy NGC 3862,

J.P.Vallée, Queen's University at Kingston, Ont.

This intense X-ray (3U1144+19), radio (3C264), optical (NGC 3862) galaxy was observed in December 1979 at the Very Large Array in New Mexico, with high angular resolution at a wavelength of 20 cm.

The VLA data reveal four different structural components, from less than 0.2 arcsec (0.1 kpc) to more than 5 arcmin (200 kpc).

One of these four components covers much of the optical extent of the galaxy, and is interpreted here as the result of diffusive motions out of the nucleus of the galaxy in all directions.

Local Inhomogeneities in a Robertson-Walker Background

Kayll Lake

Queen's University at Kingston

A complete generalization of the "Swiss-Cheese"-type of locally inhomogeneous cosmologies is given. Neither the explicit form of the sperhically symmetric interior metric, nor the spatial curvature and equation of state of the Robertson-Walker background is restricted a priori. The history, mass, and mass growth rate of any timelike inhomogeneity is developed in terms of a single function characteristic of the inhomogeneity.

Subject Headings: cosmology - galaxies: formation

References: K. Lake, "Local Inhomogeneities in a Robertson-Walker Background. I. General Framework", Ap. J. 240, in press.

Distance of the Double Quasar 0957+561 by Y.P. Varshni, University of Ottawa

Walsh et al. (Nature, 279, 381, 1979) have discovered a double quasar 0957+561, which is of considerable interest. The red magnitudes of the two components, A and B, are identical, being 17, while the blue magnitudes are slightly different. The two components are separated by 5.7 arc sec. The emission spectra of both are extremely similar. Radio observations of 0957+561 have been carried out by Roberts et al. (Science, 205, 894, 1979; Bull. Am. Astron. Soc., 11, 620 (three abstracts, 1979), and by Pooley et al. (Nature, 280, 461, 1979). We have proposed a theory of quasars (Varshni, Bull. Am. Astron. Soc., 6, 213, 308, 1974; Astrophys. Space Sci., 37, L1, 1975; 46, 443, 1977; The Ta-You Wu Festschrift: Science of Matter, p. 285; Physics in Canada, 35, 11, 1979) based on sound physical principles and here we shall estimate the distance of 0957+561 on its basis. Both the components belong to the same group, namely 20, in our spectral classification of quasars (Astrophys. Space Sci., 43, 3, 1976). The most natural explanation of the existing observations is that 0957+561 is a binary star embedded in a nebulosity which gives rise to the common absorption lines. We shall draw upon the data for known binary stars for estimating the distance of 0957+561. From Eggen's compilation (Astron. J., 61, 405, 1956) we have selected such binaries which satisfy the following conditions: 1. Spectral types of both components are separately known. 2. Difference between the magnitudes is less than two. Twenty-nine binaries satisfying these conditions were found. In most cases, the spectral types of the two components are quite close; indeed, for seven of them, the spectral types are identical. The similarity with the case of 0957+561 is obvious. In Fig. 1 we show a histogram of ρ/π_t values for these binaries. It will be noticed that a great majority (75%) of the systems under consideration have ρ/π_t less than 500 arc sec pc. If we assume that 0957+561 falls in this class, its distance is estimated to be less than 100 pc. The largest value of ρ/π_t in our list is ∿1500 arc sec pc; corresponding to this value, the distance estimate for 0957+561 is 300 pc.

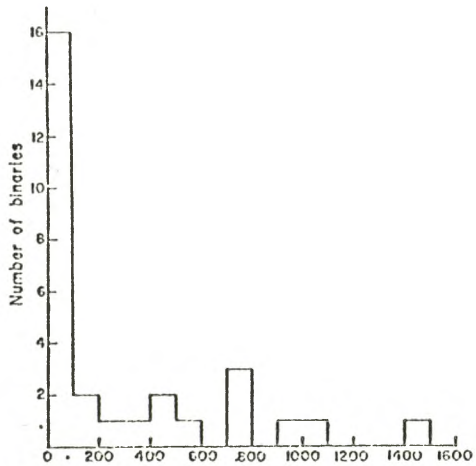

Fig. 1

COMBINED RADIO-OPTICAL OBSERVATIONS OF ACTIVE SOLAR REGIONS ASSOCIATED WITH THE S-COMPONENT OF SOLAR MICROWAVE EMISSION

V. GAIZAUSKAS and K.F. TAPPING

Herzberg Institute of Astrophysics

Ottawa, Ontario

In a collaborative study between the Algonquin Radio Observatory and the Ottawa River Solar Observatory, the signal strengths of individual sources of the S-component are measured at a wavelength of 2.8 cm and the peaks of microwave emission are associated with specific optical features in Hα filtergrams. The objective of this study is to examine the generally-accepted hypothesis that the S-component is emitted by thermal electrons in intense magnetic fields overlying sunspot umbrae where the optical thickness for microwaves is greatly enhanced by gyro-resonant absorption. We find cases where emission peaks over plages rather than over adjacent sunspot umbrae. Regions containing sunspots of apparently similar sizes and field strengths may differ substantially in their output of microwaves. Other sources are too bright to be accounted for by emission from thermal electrons. We suggest that non-thermal mechanisms make a significant contribution to the steady component of the microwave emission from some solar regions.

Coronal Scattering of Satellite Radio Signals

by Henry M. Bradford
Canadian Coast Guard College, Sydney, N.S.
and David Routledge
University of Alberta, Edmonton, Alberta.

The angular broadening and spectral broadening of satellite radio signals, close to the times of occultation by the solar corona, provide information about the inhomogeneity of the corona close to the sun. The results of observations of Voyager 2, Helios 1 and 2 at 2.3 GHz in the fall of 1979 will be discussed. These observations agree roughly with extrapolations of other observations made near the solar maximum, and are consistent with a scattering explanation for apparent discrepancies in ground based observations of the radial heights of solar "plasma frequency" radio bursts.

PERIODIC RADIO EMISSION FROM LSI+61°303

A.R. Taylor and P.C. Gregory
Dept. of Physics, University of British Columbia
Vancouver, B.C. V6T 1W5

The highly variable radio source GT0236+610, associated with the emission line star LSI+61°303 and a soft x-ray source, has been found to exhibit periodic radio emission at centimeter wavelengths with a period of 26.45 ± 0.05 days. The optical and radio properties of this source are remarkably similar to those of Circinus X-1. Circinus X-1, and possibly SS433, are the only other known X-ray binaries with an established radio period. This argues that LSI+61°303 belongs to the same class of object as Cir X-1 and may be a massive primary undergoing mass transfer to a neutron star or black hole companion.

Radio Superflares in RS Canum Venaticorum Binaries,
P.A. FELDMAN, Herzberg Institute of Astrophysics, N.R.C., of Canada, Ottawa - For more than three years all accessible RS CVn and similar binaries have been observed on a regular basis with the 46-m telescope of the Algonquin Radio Observatory at a wavelength of 2.8 cm. Large radio flares, with peak radio luminosities~10^3 Lu (1 Lu $\equiv 10^{15}$ erg s^{-1} Hz^{-1}) have been found on a number of occasions from HR 1099, AR Lac, SZ Psc, UX Ari, HR 5110, and II Peg (HD224085), all of which show evidence of extremely active chromospheres. These superflares, some 10^5 times more energetic than any from our Sun, can be attributed to nonthermal gyrosynchrotron emission from a radiating volume whose characteristic dimension is comparable with the binary star separation. A simple model of magnetic-field annihilation occurring in flux tubes of stellar dimensions is able to explain the observed properties of the radio superflares within the context of what is known about the coronae and chromospheres of these stars from X-ray, UV, and optical observations.

Evolution of Low Mass, Distorted Stars in a Very Close Binary System with the Inclusion of Gravitational Radiation Losses. W.Y. Chau*, C. Chiosi†, K.L. Chan* and L.A. Nelson*. The formulation of Chan and Chau (Ap. J. 233, 950, 1979) for incorporating rotational and tidal distortions into stellar structure calculations has been applied to the study of the evolution of Pop. I low mass distorted stars in a very close binary system up to the point when mass loss sets in. Computations have been carried out both with and without the inclusion of gravitational radiation. The general effect of distortion is a slow down of evolution. Gravitational radiation, on the other hand, can exert an additional influence on the system besides the commonly known one of reducing the orbital separation (which by itself, of course, affects the evolutionary state of the star at the onset of mass loss). It turns out that with the inclusion of distortion it can also affect the evolution of the star in a very direct way since the distortion parameters themselves depend on the ratio of the stellar radius to the orbital separation.

*Physics Department, Queen's University at Kingston, Ontario, Canada.
†Instituto di Astronomia, Universita di Padova, Padova, Italy.

Perturbation of a Binary System with the Passage of Gravitational Waves. L.A. Nelson and W.Y. Chau, Physics Dept., Queen's University at Kingston, Ontario. The perturbed orbital equations governing the behaviour of a non-relativistic, elliptical, gravitationally bound two-body system with the impinging of weak, monochromatic plane waves at oblique incidence are presented. In particular, explicit expressions for the components of the perturbing force in terms of the appropriate Euler angles are given. Results will be presented for the special case of normal incidence and small eccentricity when analytical solutions can be obtained, and also for the general case of large eccentricity and different states of polarization for which extensive numerical analysis has been carried out. The occurrence of resonances and the polarization dependence will be discussed, as well as the implications for doppler tracking of spacecrafts as a means for detecting gravitational waves.

A Detailed Investigation of the R Association Containing the $1^d.95$ Cepheid SU Cassiopeiae

David G. Turner and Nancy Remage Evans
David Dunlap Observatory, University of Toronto

We have obtained new photometric and spectroscopic observations for stars lying in the immediate vicinity of the $1^d.95$ Cepheid SU Cas and also lying in reflection nebulae to the south, in order to investigate the reality of the SU Cas R association studied previously by Racine (1968). On the basis of new and existing data on radial velocities, proper motions, and absolute magnitudes (derived from Balmer line strengths) for likely association members, we find strong evidence for a physical relationship between the stars illuminating reflection nebulosity in this region. This confirms the visually-apparent relationship between the dust complexes located south and east of SU Cas. Membership of SU Cas in this association is indicated by its similarity in (i) radial velocity, (ii) proper motion, (iii) reddening, and (iv) evolutionary status to other association stars, and more emphatically by the fact that it illuminates a portion of the same dust cloud illuminated by two other association members. Its derived luminosity as an association member is in excellent agreement with the value expected from van den Bergh's (1977) revised formulation of the period-luminosity relation. This argues that SU Cas is pulsating in the fundamental mode, and contradicts recent suggestions that this Cepheid is an overtone pulsator.

HR 7308: A UNIQUE CEPHEID

John R. Percy*

and

Nancy Remage Evans

David Dunlap Observatory
University of Toronto
Toronto, Canada M5S 1A7

The variability of HR 7308 (HD 180583, F6I-IIb, m_V = 5.93) was discovered by Breger (1969, Ap.J. Suppl. 19, 79), and was studied in more detail by Percy, Baskerville and Trevorrow (1979, P.A.S.P. 91, 368) and by Burki and Mayor (1980, I.A.U. Inf. Bull. on Var. Stars #1728). We have obtained further photometric and spectroscopic observations of HR 7308 in 1979 and 1980.

In most respects, HR 7308 is a typical small-amplitude classical Cepheid: it shows light, colour and radial velocity variations, with correct relative amplitudes and phases, with a period of 1.49107^d. Although this period is very short, the star lies within the Cepheid instability strip and conforms to the period-luminosity relation. It appears to have normal metal abundance.

During 1978 and early 1979, the visual light amplitude of HR 7308 decreased gradually from $0^m.28$ to $0^m.05$, and remained near that level through late 1979. Such behaviour is unprecedented in a classical Cepheid, and may be due to the fact that HR 7308 lies on the extreme red edge of the Cepheid instability strip. [Supported by Natural Sciences and Engineering Research Council of Canada.]

* who will present the paper

UBV Photometry of the Highly Reddened Open Cluster Berkeley 87

Doug Forbes
Department of Physics and Astronomy
University of Victoria
Victoria, B.C.

Abstract

The young open cluster Berkeley 87, with earliest spectral type O8 V, is of particular interest because of the possible membership of the unusual Wolf-Rayet-like star Stephenson #3, whose spectrum (WC) shows the O VI doublet λλ 3811,3834 strongly in emission, and the very red star BD +37°3903 (= BC Cyg; B3.5 Ia). UBV photoelectric and photographic observations to V = 14.5 of 24 probable cluster members are used to derive a mean colour excess E(B-V) = 1.60 ± 0.15, with several stars in the northeastern portion of the cluster being more highly reddened. Zero-Age Main Sequence fitting gives a distance of 1.2 ± 0.2 kpc, putting Be 87 on the near side of the Cyg OB 1 association, along with NGC 6913.

Stephenson #3, a probable cluster member, is found to have $M_V = -2.4$ - rather underluminous for a "classical" WR star, but more nearly of the same luminosity as the WR-like planetary nuclei.

BD +37°3903, although located in the outer regions of the cluster, does appear to be a member, with a resulting M_V of -6.5, in good agreement with the results of Stothers (1972) for other M Ia supergiants.

Further photoelectric photometry and MK spectroscopy of suspected cluster members is planned in order to confirm the photometric results, and to examine the unusual spectrum of Stephenson #3.

THE SURFACE BRIGHTNESS PROFILES OF SIX SUPERGIANT GALAXIES

Darlene English*

and

Gary A. Welch
Department of Astronomy
Saint Mary's University
Halifax, N. S.

Six supergiant galaxies in Abell clusters have been studied to investigate possible similarities in surface brightness profiles. All but one of the cD galaxies fit the $r^{-1.6}$ relation for surface brightness versus radius suggested by Bahcall. The exception, the cD galaxy in Abell 401, has a surface brightness which falls off more slowly with radius than do those of the other cD galaxies. In addition, one of the "elliptical" galaxies used to check reduction procedures is better fit by the $r^{-1.6}$ relation than by the standard $r^{-\frac{1}{4}}$ de Vaucouleurs law.

These findings, especially that the field ellipical seems to possess a cD-like halo, may imply the existence of more than one cD formation mechanism, or that the shape of the cD halo may be altered after formation.

* Present address: Department of Physics
University of Victoria
Victoria, B. C.

ULTRAVIOLET PHOTOMETRY OF SPIRAL AND IRREGULAR GALAXIES WITH THE ORBITING ASTRONOMICAL OBSERVATORY

Gary A. Welch
Department of Astronomy
Saint Mary's University
Halifax, Nova Scotia.

The Wisconsin Experiment on board OAO-2 has observed forty spiral and irregular galaxies. The medium broadband photometry covers the wavelength baseline 1550-4520 Å, and refers to the light contained within a 10 arcminute diameter aperture centered on the galaxy. It has been transformed to the OAO system of absolute fluxes.

A brief summary of internal errors and a comparison with other photometry will be presented. The absolute energy curves of the various morphological types will then be discussed. Because the photometry refers to the integrated light it will permit an assessment of the contribution of normal galaxies to the cosmic ultraviolet background radiation.

SPECTRAL LINE OBSERVATIONS OF THE IC5146 REGION

W.H. McCutcheon

Dept. of Physics, University of B.C.

R.S. Roger

Dominion Radio Astrophysical Observatory

R.L. Dickman

Aerospace Corporation

CO observations in 3 isotopic lines have been made of the dark cloud region around the young stellar cluster IC5146. The elongated complex of dark clouds to the west of the IC5146 nebula shows a uniform velocity gradient of 0.26 kms^{-1} pc^{-1} over an angular extent of at least one degree. This gradient continues across the associated H II region and is opposite in sign to that obtained from optical velocities of the H II region.

The mass of H_2, concentrated into 3 hot spots around the H II region is estimated to be several hundred solar masses. The CS line has been detected in one hot spot, indicating a dense core of molecular hydrogen. Searches for water vapour masers and an infrared source at 3.5 μm yielded negative results.

There is a large cloud of atomic hydrogen associated with this region and this has a mass at least as great as the molecular hydrogen in the vicinity of the H II region. The ionized region is on the near side of the HI and is moving away from it. The CO hot spots undoubtedly result from the H II region - molecular cloud interaction and may be precursors of star formation although the heating mechanism is uncertain.

HI IN THE REGION AROUND THE REFLECTION NEBULA NGC 1579

The reflection nebula NGC 1579 is illuminated by the highly obscured emission-line star Lk Hα 101. New aperture synthesis observations at 21 cm (resolution 2' x 3.5' by 0.67 km s^{-1} in radial velocity) show a continuum source of 176 mJy centered on the star and $\sim 50\ M_\odot$ of atomic hydrogen in a cloud $\sim$3.5 pc across at the assumed distance of 800 pc. The highest column densities of HI are just to the west of the star with the greatest extension of low-brightness emission to the N-W. There is a lacuna near the position of the star extending northward. The gas is distributed over radial velocities -4 to 6 km s^{-1} (lsr) with an absorption component on most profiles near 0 km s^{-1}. The absorption, of approximately unity optical depth, may be due to a cool HI shell on the near side of the associated dark cloud.

A comparison with $^{12}C^{16}O$ spectra measured with similar resolution at 18 points on the nebula (Knapp et al. 1976) shows that the CO profiles have a width about half that of the corresponding HI profiles ($\sim$ 8 km s^{-1}). This indicates that the CO and HI are not coexistent on a scale of about .2 pc. The CO also shows a distinct absorption component near 0 km s^{-1}.

P.E. Dewdney & R.S. Roger
Dominion Radio Astrophysical Observatory
Herzberg Institute of Astrophysics
National Research Council Canada
P.O. Box 248
Penticton, B.C. V2A 6K3
CANADA

Warping of Galaxies, K.A. Papp and K.A. Innanen, Department of Physics, York University. Treating galaxies as classical bodies moving in a noninertial frame, we show that warping of otherwise flat galaxies comes about as a natural consequence of inertial forces: The Coriolis force in particular. The anti-symmetry and degree of warping along with the fact that many bent galaxies have no nearby companions with which to interact tidally are readily explained by assuming modest orbital velocities and the presence of nearly spherical halos. To apply the results to our galaxy and M31 requires the two systems to have a combined mass of $\sim 10^{12}$ $M_{\odot}$. The direction and magnitude of the Galaxy-M31 angular momentum can be estimated. Numerous other results follow from this work including distortion of local velocity ellipsoids and outer rotation curves of galaxies as well as a simple explanation for the support of massive molecular clouds against gravitational collapse. The latter topics are briefly outlined.

This research has been sponsored by NSERC (Canada).

A Driving Mechanism for Galactic Spirals, K. A. Innanen and K.A. Papp, Physics Dept., York University. The major obstacle to the acceptance of the spiral density wave theory of Lindblad, Lin and Shu has been the absence of a convincing, large-scale driving force or instability (Toomre, 1977). We propose that this missing primum mobile is just the antisymmetric warp induced in most flattened galaxies as described in the preceding paper of Papp and Innanen. To illustrate the bending mechanism in a simple mechanical way, we demonstrate the motion of a group of small beads attached by equal strings to a small disk whose axis is rotated by a variable speed motor. When the motor is moved suitably in a curved path, the antisymmetric appearance of the warp is clearly evident. This periodic, antisymmetric oscillation produced as the gas and stars of the outer disk "pass through the warp" appears to be a natural, global way of exciting the inward moving, trailing waves required to drive the two-armed density wave in the inner parts. The ensuing spiral structure has a wide latitude to develop the Hubble Sa to Sc sequence, as well as barred spirals, depending on the inclination of the galaxy's rotation vector to its orbital revolution vector and whether or not the rotation is direct or retrograde. No spiral structure is expected when this inclination is zero. This research has been supported by NSERC (Canada).

Toomre, A., 1977, Ann. Rev. Astron. Astrophys. 15, 437

The Variable Stars of the Globular Cluster NGC 6284 by

Christine M. Clement and Thomas R. Wells, David Dunlap Observatory, University of Toronto.

Our investigation is based on 92 photographs taken with the University of Toronto 24-inch telescope at the Las Campanas Observatory of the Carnegie Institution of Washington during the years 1972 - 1979. We have studied 12 variables, 5 of which were discovered by H.B. Sawyer (David Dunlap Publ. 1, no. 14, 1943) and 7 new ones. Of these, seven are RR Lyraes, two are population II cepheids, two are long period variables and one is an irregular variable. NGC 6284 lies in a relatively rich field at $\ell^{II}=358°$, $b^{II}=+10°$ and therefore, not all of these variables are expected to be cluster members.

Integrated Spectral type
vs period
for all RR Lyrae stars
How about different types
of RR Lyrae stars
a, b, c -

Colour magnitude diagram.

Castle Frederick Observatory : Location and Design

Roy L. Fisher

Acadia University

Wolfville, N.S.

In 1765 an observatory was erected in Nova Scotia at Castle Frederick, J.F.W.DesBarres' estate near Windsor. Although ostensibly an adjunct to DesBarres' survey of the coasts of Nova Scotia, its longevity (8 years), location (not in the survey area), and equipment (equal to some of the best at the Royal Greenwich Observatory and criticized by the British Admiralty for its cost) distinguish it from the several temporary observatories or surveying stations used for land and coastal surveys in that century. Artistic, cartographic, and photographic evidence regarding both the location and the design of Castle Frederick Observatory will be presented.

Review of "A Letter Concerning Earthquakes"

by

J.E. Kennedy

University of Saskatchewan, Saskatoon

and

Saskatoon Centre, R.A.S.C.

ABSTRACT

"A Letter Concerning Earthquakes" written in 1693 by the Rev. John Flamsteed, first Astronomer Royal, will be reviewed. This document was not published until 1750, more than thirty years after his death.

The publication in 1712 of Flamsteed's Star Catalogue without his concurrence, or his knowledge, resulted in the well known confrontation between Newton and Halley on the one hand and Flamsteed on the other. The preamble to this Letter also suggests that Flamsteed's relations with the Press were far from congenial.

Seven circumstances of Earthquakes have been outlined in this letter, based on the limited observations and accounts which were available to Flamsteed. He raised five separate points in attempting to reach a reasonable explanation for the causes of earthquakes. His views on the circumstances and points will be examined.

Flamsteed's extensive knowledge of science is clearly displayed in this short treatise; he favoured an explosion in the atmosphere as the major cause of earthquakes and treated this aspect at considerable length. The effect of earthquakes on different individuals provides an early account of what is termed in the 20th century as "motion sickness".

CCD Images obtained with the Canada France Hawaii Telescope

P. Hickson, J.R. Auman, G.G. Fahlman, T.K. Menon, G.A.H. Walker, R. Johnson, T. Lester. Geophysics/Astronomy Department, U.B.C.

In 1980 April we successfully observed a number of Seyfert, Radio and other Galaxies, as well as QSOs and BL Lac objects at the Prime Focus of the 3.6m CFH Telescope. Our detector was a 100 x 100 element (3mm x 3mm) Charge Coupled Device (CCD) lent by Bell Northern Research of Ottawa. Despite a bright moon we obtained useful V and R observations of some 18 fields in approximately two nights. We shall discuss briefly the technique of CCD area photometry and present representative results from our observations.

A PLANETARIUM FOR LONDON, ONTARIO

Peter Jedicke, London Regional Children's Museum
and London Centre, R.A.S.C.

The London Regional Children's Museum is a unique participatory centre where young children learn by doing. The Museum has been committed since its inception in 1975 to the furtherance of astronomy among young Londoners, and received a grant from a local service club in 1976 towards the long-term development of a planetarium.

In November, 1979, the Museum purchased a small commercial planetarium with an inflatable plastic dome, and this led directly to the acquisition of an almost-intact but non-functioning Spitz Model A3P in April, 1980. Recently, the Museum has announced the purchase of a school property near downtown London, which may serve as a permanent home for the planetarium as early as the summer of 1981.

This paper will present the history, philosophy, current program and future plans of London's first planetarium, as well as the role which the London Centre, R.A.S.C., hopes to play in it.

Protective Filters for Solar Observation

BY: B. Ralph Chou, B.Sc., O.D. *
Optical Radiation Laboratory
School of Optometry
University of Waterloo
Waterloo, Ontario
N2L 3G1

Abstract

Spectrophotometric data were obtained over the wavelength range 330 to 2140 nm for samples of protective filters commonly used to observe the sun. The retinal irradiance in the solar image formed in a model eye protected by each filter was computed, and the safety of the filter determined from criteria for adequate ocular protection which have appeared in the literature. It appears that the safest filters are devices which utilize monatomic metallic coatings as the filtering agent.

*- Secretary, Toronto Centre, R.A.S.C.

Double layer of B+W fully exposed is O.K.

Avoid eyepiece filters.

A SAAD System: signal-acquisition-averaging-display system

Martin MacDonell
Physics Department
Saint Marys University

A multipurpose signal acquisition, signal averaging, signal display, and control system is described. The system is implemented using the Commodore PET microcomputer (CBM 2001-16) with low cost analog/digital interfacing hardware and controlling software. The software is written in '6502' machine language to facilitate real-time data processing tasks such as signal averaging. Other 'signal-conditioning' or processing tasks could be implemented simply by writing the appropriate software. Complex processing tasks such as spectral analysis utilizing the Fast Fourier Transform(FFT) is conceivable with this system.

The averaged data is displayed on a CRT (oscilloscope with x and y axes) by an interrupt-driven display program. An x-y recorder can also be used in place of the CRT. The capability of instrument-control is also included in the 'signal-conditioning' system.

The 'signal-acquisition' system as described here will be used in conjunction with the radio telescope at Saint Marys to do hydrogen-line profiles, among other things. In general, the technique of averaging a number of 'noisy' samples is used to increase the signal-to-noise ratio of the signal, thereby making the signal more detectible.

33 Tauri - A New Ellipsoidal Variable by Douglas P. Hube, Department of Physics, University of Alberta, Edmonton.

The bright star 33 Tauri = HD 24769, located near the Pleiades though not a cluster member, is a known light variable (J.E. Winzer, unpublished Ph.D. thesis 1974) and spectroscopic binary (J.A. Pearce and Graham Hill, Pub. Dom. Astr. Obs. 14, 319, 1975). The published orbital solution is incorrect. New spectroscopic observations have been used to derive new orbital elements, including a period of 2.975258 days. New photometry is consistent with the old, and reveals a light variation which is approximately sinusoidal with half the orbital period. The star is, therefore, a member of the relatively rare class of ellipsoidal variables. A preliminary model for the system is presented.

Title: An amateur observing program in Southern Arizona

Author: David H. Levy

Centre: Kingston

This paper outlines an observing program that I have been undertaking in Tucson,Arizona. The clear sky that is so common here, especially during the fall and spring, allows me to undertake observing projects that would be severely limited by the more typically cloudy weather in Eastern Canada. The program centres around three areas. The first is an observation program of the nebular variables in M.42 that has so far (since Spetember) yielded over ten thousand checks of these flickering stars. Second, I have finally been able to check the sun on a fairly regular basis at a time when the sunspots are at their maximum. And third, I have been able to conduct a most relaxing but so far unsuccessful comet hunt during the post-dusk and pre-dawn hours of night.

MAKING A PHOTOGRAPHIC STAR ATLAS WITH A 5.5" SCHMIDT CAMERA.

During the Fall of 1977, I acquired a 5.5" SCHMIDT Camera. After some months of experimentation, I realized that even thought such an instrument is powerfull for it's size, due to a focal length of only 225 mm., the quantity of objetcs large enough to show an appreciable image on the film will be exhausted within a year.

I began searching for a more serious job for this instrument and arrived to the idea of a star Atlas, from North Pole to declination -30 degrees. I can't hardly go farter south because of my latitude of 48.5 degrees.

In my presentation, I would like to describe:

1- The SCHMIDT Camera optic system and its advantages.
2- Results of experimentation with different film - fiters combination and the standard arrived at, for this work.
3- Operating this camera is complicated by the fact each picture is recorded on different piece of 35 mm. film, about two inches long. Very special care are needed for processing, identifying and storing the over 900 exposures required for my project. I will also say some words about magnitude recorded (13) and the true resolution attained (25 arc sec.).
4- There are drawbacks using this instrument. I will list them and say how I overcome them, when possible.
5- Finally, I will present samples of the some 250 exposures already done.

I started this project for the pleasure of making it and I think it will be much more than this up to the end, that is 3-5 years from now.

80-04-18

Damien Lemay
Centre de Québec
C.P. 9396 Ste-Foy
G1V 4B5

DAMIEN LEMAY
477-15E RUE OUEST
RIMOUSKI QUE
G5L 5G1

GEAR SELECTION FOR CONSIDERATION WITH GEAR LOAD BALANCING FOR ASTROPHOTOGRAPHY

Michael P. Edwards
Halifax Centre

Some of the criteria of gear selection will be discussed in terms of drive trains for astronomical telescopes. As astrophotography is one of the areas in which balancing of a driven platform is most important to the end result, the proper gear selection is essential. In this light, gear load balancing for astrophotography will be discussed, through the use of illustrations.

A LEAST SQUARES DETERMINATION OF CEPHEID MAXIMA

Robert G. McCallum J. Micheal Roney

Ottawa Centre
R.A.S.C.

Abstract

A model independant method of determining maxima of Cepheid variables using a least squares technique is developed and compared to the traditionally used Pogson method. The method is applied to a series of visual observations in a demonstration of the period stability of the Cepheids X Cygni and Delta Cephei.

NAVIGATION VS ASTRONOMY

Raymond Auclair

Member of R.A.S.C.

The Navigator has a professional interest in astronomy. But because of the special use he makes of astronomy, there are problems which he has to face before he can make an efficient use of this science.

PROBLEM NUMBER ONE: The navigator has to become an expert in an ever increasing number of fields and sciences. The knowledge required of him is wider and more complex than ever. He can thus devote less and less time to astronomy.

PROBLEM NUMBER TWO: The systems of coordinates differ, in navigation, from the ones used in astronomy. While the astronomer uses mostly an equatorial system, the navigator is stuck with the horizontal (alt-azimuth) system, where the basic measurements are altitude measured from the horizon (with a sextant) and azimuth measured from the north with a compass.

PROBLEM NUMBER THREE: Unitil recently (relatively speaking), the navigator could not make the observations needed for a 'fix', during the night. Due to darkness, the horizon was invisible except for a small portion directly under the moon. Unfortunately, data on the moon were not as precise as that for the stars.

TEAM WORK: Professional and amateur astronomers combined their efforts and such team work provided the navigator with a better nautical almanac. With better data at hand, celestial navigation, as we call it, is easier and, more important, safer.

A UNION CATALOGUE OF ANTIQUARIAN ASTRONOMY BOOKS

Randall C. Brooks

Halifax Centre, RASC

A project will be described which is being carried out to create a "union catalogue". The criteria for inclusion in this union catalogue are:

1) that the books be on astronomy or a closely related science

2) that they were published prior to 1901

3) that they be held in the collections of a private or public library in Canada.

The impetus and progress of the project will be discussed and a few slides will illustrate some of the more interesting "finds" to date. A request will be addressed particularly to private collectors for assistance in listing books which meet the above criteria.

APOLLO ASTEROIDS

Clifford Cunningham

Grand Valley Astronomers

This paper on Apollo objects first defines what they are, then describes their orbital properties and size distributions. The chances of an Apollo object impacting Earth leads to an analysis of Earth-Moon cratering rates, with the conclusion that most if not all moderately-sized craters are caused by Apollo objects. A steady-state model is presented showing that resonances in the main asteroid belt may be the source of 10% of Apollo objects, the remainder being degassed comets. The paper concludes with details of a proposed space mission to a particular Apollo asteroid, 1976AA, in 1993.

LIST OF PARTICIPANTS

AUCLAIR, Raymond	Cornwall, Ont.
BAHNIUK, Richard	Waterloo, Ont.
BAKER, Mrs. Sally	Vancouver, B.C.
BISHOP, Roy L.	Avonport, N.S.
BOCHONKO, Richard	Winnipeg, Man.
BRADFORD, Henry M.	Sydney, N.S.
BRISBIN, Jack	Canton, Mich.
BROOKS, Diane	Dartmouth, N.S.
BROOKS, Randall	Dartmouth, N.S.
BROTEN, NORMAN	Ottawa, Ont.
BROUGHTON, Peter	Toronto, Ont.
BUCHANAN, Jonathan	Nepean, Ont.
CAMPNEY, Walter K.	London, Ont.
CHAU, W.Y.	Kingston, Ont.
CHOU, B. Ralph	Willowdale, Ont.
CLARKE, Thomas	Toronto, Ont.
CLEMENT, Christine M.	Toronto, Ont.
CLEMENT, Maurice J.	Toronto, Ont.
CLINTON, Eric	Chatham, Ont.
CLINTON, Robert J.	London, Ont.
CLUTTON-BROCK, M.	Winnipeg, Man.
COLLINS, Gary	Halifax, N.S.
COSTAIN, Carman H.	Penticton, B.C.
COX, Louis B.	Deep River, Ont.
CREIGHTON, Harlan	The Pas, Man.
COBBAN, Jim	Willowdale, Ont.
CUNNINGHAM, Clifford	Kitchener, Ont.
CUNNINGHAM, R. Murray	Halifax, N.S.
DELANEY, Paul	Victoria, B.C.
DELIGIANNIS, Dino	Waterloo, Ont.
DEMERS, Serge	Montreal, Que.
DEWDNEY, Peter	Penticton, B.C.
DODGE, David	Vancouver, B.C.
DODGE, Joanne	Vancouver, B.C.
DRAKE, Cathy	Toronto, Ont.
EDWARDS, Michael P.	Bedford, N.S.
EDWARDS, Peter J.	Bedford, N.S.
ELLIS, Dale	Dartmouth, N.S.
ENGLISH, Darlene	Victoria, B.C.
FASSEL, Charles	St. Catherines, Ont.

FELDMAN, Paul	Ottawa, Ont.
FOOTE, N.M.	Erie, PA
FORBES, Douglas	Victoria, B.C.
FREEMAN, Rosemary	Toronto, Ont.
GADA, Andreas	Toronto, Ont.
GAIZAUKAS, V.	Ottawa, Ont.
GASBARINI, Ron	St. Catherines, Ont.
GEEKIE, Mary	Ottawa, Ont.
GEORGE, Doug	Nepean, Ont.
GLASPEY, John	Montreal, Que.
GRAY, Mary	Ottawa, Ont.
GREEN, Norman	Niagara-on-the-Lake, Ont.
HALLIDAY, Ian	Ottawa, Ont.
HARROWER, George	Thunder Bay, Ont.
HAYES, Jeffrey	Halifax, N.S.
HIGGS, Lloyd A.	Ottawa, Ont.
HOGG, Helen S.	Richmond Hill, Ont.
HUBE, D.P.	Edmonton, Albt.
HUDAK, John	Hamilton, Ont.
INNANEN, K.	Toronto, Ont.
JEDICKE, Peter	London, Ont.
JEDICKE, Robert	Niagara Falls, Ont.
JONES, J. Donald	Castlegar, B.C.
KAPITANIUK, Dianne	London, Ont.
KENNEDY, J.E.	Saskatoon, Sask.
KIRALY, Norah	Toronto, Ont.
LAKE, Kayll W.	Kingston, Ont.
LEMAY, Damien	Rimouski, Que.
LEVY, David H.	Tuscon, Ariz.
LOCKE, J.L.	Ottawa, Ont.
LOEHDE, Franklin	Edmonton, Albt.
LOPES, Tony	Toronto, Ont.
MacLEAN, Mark T.	Hopewell, N.S.
MacLEOD, John	Ottawa, Ont.
McCALLUM, Robert G.	Ottawa, Ont.
McCARTHY, Jean	Toronto, Ont.
McCUTCHEON, W.H.	Vancouver, B.C.
McWATTERS, Richard	Toronto, Ont.
MEYER, Renée	Ottawa, Ont.
MILLMAN, Peter M.	Ottawa, Ont.
MITCHELL, George F.	Halifax, N.S.
MORRIS, Steven	Calgary, Albt.

NELSON, L.A.	Kingston, Ont.
OAKLEY, Kathy	Halifax, N.S.
van OPHEM, John	St. Catherines, Ont.
ORR, Eric L.	Hamilton, Ont.
OSBORNE, Raymond	Niagara Falls, Ont.
PAPP, Kim	Downsview, Ont.
PERCY, John R.	Toronto, Ont.
PURTON, Chris	Downsview, Ont.
RACINE, René	Montreal, Que.
RICE, J.B.	Victoria, B.C.
ROUTLEDGE, D.	Edmonton, Albt.
RUSS, Nonna	Scarborough, Ont.
SCARFE, Colin	Victoria, B.C.
SCHMIDLIN, Marlis	Toronto, Ont.
SCRIMGER, J. Norman	Halifax, N.S.
SEAQUIST, E.R.	Toronto, Ont.
SECORD, Lloyd	Toronto, Ont.
SOSNKOWSKI, Anthony	Toronto, Ont.
SPERLING, Norman	Cambridge, Mass.
SUNDELL, Sidney M.	Montgomery Centre, VT.
SWIFT, Michael	Halifax, N.S.
TAYLOR, Andrew R.	Vancouver, B.C.
THURLOW, William	Digby, N.S.
TURNER, David G.	Richmond Hill, Ont.
UNDERHILL, Anne B.	Greenbelt, MD.
VARSHNI, Y.P.	Ottawa, Ont.
VALLÉE, J.P.	Kingston, Ont.
WALKER, Gordon A.H.	Vancouver, B.C.
WELCH, Douglas	Toronto, Ont.
WELCH, Gary A.	Halifax, N.S.
WESCOTT, Guy	Winnipeg, Man.
WHYTE, Anthony	Edmonton, Albt.
WHYTE, Mrs. M.	Edmonton, Albt.
WILCOX, Lillia	Saskatoon, Sask.
WILSON, David	Thorold, Ont.
WOODSWORTH, A.W.	Ottawa, Ont.
WONNACOTT, Earl L.	Charlottetown, P.E.I.
YOUNG, Jim	Saskatoon, Sask.

[Blank Page]