CANADIAN SCIENTISTS REPORT — 41

THE MEETING OF THE NATIONAL COMMITTEE FOR CANADA OF THE IAU AT KINGSTON, MARCH 13–14, 1970

A meeting of the National Committee for Canada of the IAU was held at Queen's University, Kingston, on March 13–14. Official hosts for the University were the Principal, Dr. J. J. Deutsch, and Vice-Principal, Dr. G. A. Harrower.

The Kingston meeting will be remembered for setting a number of "firsts" in the history of the National Committee. It was the occasion of the first R. M. Petrie Lecture which was delivered by Dr. A. G. W. Cameron, Yeshiva University, on the subject of "The Chemical Evolution of the Galaxy". It was the first meeting (and hopefully the last) at which an invited speaker had to cope with a city-wide power failure throughout his talk.

For the first time there were not one but two distinguished guest speakers. Sir Bernard Lovell presented a timely address (following the Friday evening banquet) on the effects of recent science policy decisions in the United Kingdom on astronomical research.

This was the first meeting to welcome such large numbers of graduate students from out-of-town institutes. The thirty papers presented at the scientific sessions also set a new record. An open "Forum" was held for the first time during the Saturday afternoon session, with the topic set by a paper on "Employment Prospects for Astronomers in Canada" by R. C. Roeder and P. P. Kronberg. A lively discussion ensued for over an hour with a full spectrum of opinion expressed by faculty members, government officials, and graduate students on the problems that must be faced when an expanding production of astronomy graduates occurs during a period of widespread economic retrenchment.

Members and participants enjoyed a convivial social evening at the Queen's Faculty Club on the Thursday evening preceding the formal meetings. The Committee was honoured with a reception by Principal Deutsch before the Friday evening banquet. The organizers of the meeting, Dr. V. A. Hughes and Dr. M. J. Kesteven, were warmly complimented in a formal vote of thanks from the Committee for their highly successful efforts.

Abstracts of papers presented at the scientific sessions follow a brief report on the Business Meetings.

Business Meetings

The reorganization of astronomy in the federal government service and its effect on the future of the National Committee for the IAU was discussed at length. With the transfer to National Research Council Laboratories of astronomy in the Observatories Branch of the Department of Energy, Mines and Resources on 1 April 1970, the National Research Council will become the Adhering Organization for the IAU and be responsible for the National Committee. In order to conform with the existing NRC Committee structure, it was agreed to recommend to Council:

(a) that an Associate Committee on Astronomy be established which will also function as the National Committee for Canada of the IAU;

(b) that the members of the present National Committee be appointed for a one year term beginning 1 April, 1970, which will round out their present terms of office.

Alternative forms of the organization of Canadian astronomers were presented in a report prepared by Dr. Fernie's sub-committee on reorganization. A new sub-committee consisting of Drs. V. A. Hughes, M. W. Ovenden, and R. C. Roeder was appointed to recommend changes in the statutes and by-laws, membership, and methods of operation which it would be desirable to make when the Associate Committee structure takes effect. A special meeting of the full Committee will be convened in October 1970, to consider these recommendations.

Drs. A. H. Batten, J. D. Fernie, and L. A. Higgs were appointed at a general meeting of IAU members as a nominating committee to prepare a list of candidates for an election to be held immediately after the October meeting. Those elected will be presented to the National Research Council as the slate of nominees for appointment to the Associate Committee on Astronomy.

The remainder of the meetings dealt with matters of IAU business such as the consideration of late nominations for membership and the selection of recipients for official invitations to the XIVth General Assembly.

V. GAIZAUSKAS.

ABSTRACTS OF PAPERS

Magnetic and Cosmic Ray Pressures in the Galactic Disc by V. R. Venugopal and W. L. H. Shuter, The University of British Columbia

Our results of the analysis of the distribution of random motions in nearby hydrogen (M.N., **143**, 27, 1969) are combined with the value of 0.6 eV cm^{-3} for the energy density of galactic cosmic rays in the neighbourhood of the solar system given by Ginzburg and Syrovatskij (IAU Symposium No. 31 – Radio Astronomy and the Galactic System – P. 411, 1967, Academic Press) to compute

(i) the mean gas density ρ
(ii) the gas pressure ρ_G
(iii) the magnetic pressure ρ_B and
(iv) the strength of the magnetic field B

for the situation where cosmic rays and magnetic field are confined to the galactic disc as analyzed by Parker (Ap. J., **145**, 811, 1966) and Spitzer (Diffuse Matter in Space, 1968, Interscience Publishers). Also, the magnetic pressure derived above is combined with galactic non-thermal radio emission data to compute the pressure due to the electron component ($\rho_{c.r.el}$) of the cosmic ray gas.
The following results are obtained:

(i) $\rho = 2.8 \times 10^{-24}$gm $cm^{-3} \approx 1.67$ H atoms cm^{-3}
(ii) $\rho_G = 1.18 \times 10^{-12}$ dynes cm^{-2}
(iii) $\rho_B = 0.35 \times 10^{-12}$ " "
(iv) $B = 3 \times 10^{-6}$ Gauss
(v) $\rho_{cos.ray} = 0.32 \times 10^{-12}$ dynes cm^{-2}(assumed.)
and (vi) $\rho_{c.r.el} = \frac{2}{3}$ $_{cos.ray.}$

Results will be discussed.

Force-free Fields and Beltrami-flow in Astrophysics by S. R. Sreenivasan, University of Calgary

The conditions under which force-free fields may remain force-free in time are investigated and the kinds of flow that permit such fields are isolated.

These considerations are applied to some specific problems, e.g. solar flares, prominences and the amplification of magnetic fields in astrophysical situations.

Neutral Hydrogen Around the Compact Nebula K3-50 by M. J. L. Kesteven and A. H. Bridle, Astronomy Group, Queen's University.

A 1.3 square degree area of sky containing the compact nebula K3-50 has been mapped in the 21-cm line using the NRAO 300-foot and DRAO 85-foot telescopes. The observations suggest that an extended neutral hydrogen cloud of mass $\sim$150,000 $M_\odot$ and with excitation temperature $\sim$55K surround K3-50 and the adjacent continuum radio sources. The cloud has an antigalactic rotation with a period of $\sim 10^8$ years and may also be collapsing with a characteristic velocity $\sim$5.5 km/sec. The region has properties which might be associated with an early stage in the formation of a massive star cluster.

A Neutral Hydrogen Survey of the Cygnus X Region by W. H. McCutcheon and W. L. H. Shuter, The University of British Columbia

Fifty-one neutral hydrogen profiles have been observed in the Cygnus X region using the 85-foot dish at D.R.A.O. Penticton (beamwidth 36′; bandwith 10 KHz).

The correlation between the hydrogen velocities in the local arm and the 158α recombination line velocities, observed by Dieter in the DR sources, indicate that the complex is situated in the local arm.

The Orion (and Perseus) arms in this longitude region are found to be tilted in latitude by $+1°$. This means that the DR sources are symmetrically distributed with respect to the hydrogen in the local arm.

Absorption profiles have been obtained for DR 4, DR 5, DR 21, DR 23, and DR 27. However, the variation of hydrogen intensity from source to reference regions makes an accurate determination of the true absorption profile difficult.

The rms velocity spread of the DR sources, obtained from the 158α line, indicates that the region is bound to the plane. However, the Virial theorem suggests that the complex is unstable.

The longitude region and the patchiness of the area make accurate distance determinations difficult.

Recent 200-inch Observations of the Remnant of Cassiopeia A by S. van den Bergh, David Dunlap Observatory, University of Toronto

Observations with the Hale 200-inch telescope obtained between 1951 and 1969 have been used, in collaboration with Mr. W. W. Dodd, to study the expansion of Cas A. The explosion which gave rise to this supernova remnant is found to have taken place in AD1667 $\pm$8 m.e. No star brighter than $V = 22.5$ is visible within 8 standard deviations of the adopted centre of expansion. Even after reasonable allowance is made for interstellar absorption this result still implies that any pulsar in Cas A must be fainter than the pulsar in the Crab nebula.

Intercomparison of direct plates taken at different times shows that the expanding optical shell associated with Cas A is undergoing rapid changes. The halflife of an average luminous knot is found to be ten years. New knots are continually being formed in the same general area in which other knots are already present. The

emission spectra of moving knots suggest a two temperature model. The [OII] and [OIII] emission seems to arise from a hot zone with T = 50000°K, whereas the lines of [OI] and [SII] arise in a dense cool region. Available data suggest a provisional distance of 2.8 kpc which would place Cas A just behind the backbone of the Perseus spiral arm.

An Expanding Ring of Galactic HI with Centre Close to the Sun by V. A. Hughes, Queen's University and D. Routledge, University of Alberta

Evidence is given to show that there exists, around the sun, an expanding elliptical ring of dense HI with major and minor axes of about 1300 and 560 pc., which appears to be Lindblad's feature "A". The ring is at a temperature much below that of the surrounding medium and is a source of anomalous OH emission. The kinetic energy of the ring is greater than 6.5×10^{50} erg. and appears to be the remains of a large explosion of a type which, in the neighbourhood of the sun, occurs at a rate of about one every 10^7 years.

Galactic Radio Sources 4C51.12 and NRAO 588/589 by R. Butler and V. A. Hughes, Queen's University

Observations of the radio sources 4C51.12 and NRAO 588/589 at 9.2, 4.5 and 2.8 cm wavelengths are presented and analysed. 4C51.12 consists of two components with thermal spectra, one of which is an optically identified HII region, Sharpless 209. NRAO 588 has a flat, presumably thermal, spectrum. NRAO 589 has two components, one non-thermal, the other thermal with a high emission measure.

The distances to the sources which are estimated from observations of the 21 cm HI line in their directions are used to determine electron densities and masses for the main thermal sources.

Observations with a Carnegie Image Intensifier by S. Jeffers, Centre for Research in Experimental Space Science, York University

The paper will describe work carried out with a Carnegie image intensifier at the David Dunlap Observatory while the author held a one year post-doctoral fellowship. The paper is in two parts:

(a) a description of the use of the Carnegie image intensifier with a 24″ telescope for the direct recording of globular clusters. Also, the performance of a 74″ telescope using direct photography is contrasted with that of the 24″ telescope – image tube system.

(b) a proposal to use an electronically scanned image intensifier to detect optical pulses from pulsars.

Optical Signal Processing for a Cross-type Radio Astronomy Antenna by G. J. M. Aitken, L. Wang and A. H. Bridle, Queen's University

Successful operation of a large radio telescope at frequencies below 20 MHz requires efficient use of the relatively brief periods when the electron content of the ionospheric F layer is low and uniformly distributed. An optical system which permits efficient on-line processing of the data from cross-type antenna arrays operating at such frequencies is described. The optical processor operates on the outputs of the array elements to produce a field of light from which signals proportional to all of the necessary cross-correlation products can be extracted by an electronic scanning system. These products are the coefficients of the two-dimensional spatial frequency spectrum of the radio brightness distribution observed by the

antenna. An image of the radio sky is then obtained by modulating a coherent light beam with the signals proportional to the cross-correlation products, and Fourier transforming the resulting field of light with a lens.

The Culham-Imperial College-Harvard College Observatory-York University International Solar Flash Vacuum Ultra-violet Spectrum Experiment on the March 1970 Solar Eclipse by R. W. Nicholls, Centre for Research in Experimental Space Science, York University, Toronto

An international collaboration between workers from the Astrophysical Research Unit, Culham Laboratories; Imperial College; Harvard College Observatory; and the Centre for Research in Experimental Space Science, York University, resulted in very successful rocket observations on the solar flash spectrum in the wavelength range 850Å – 2150Å at about 20A/mm. A stabilized Aerobee 150 rocket was launched from the NASA Wallops Is. Rocket range over which the eclipse was total, at 1.36 pm EST March 7th, into the path of the eclipse. It contained two spectrographs which automatically photographed a sequence of flash spectra in the vacuum ultraviolet. The payload was stabilized to an accuracy of 0.4 arc seconds. The rocket reached an apogee of about 142km and parachuted into the Atlantic about 70 miles down range where it was recovered by personnel from the USS Guam. About 50 excellent spectra of the solar corona and chromosphere were obtained. Many new features appear to be present and a systematic study is being made of the spectra by members of the participating groups.

Meteoritic Flux Determined from Visual Observations by P. M. Millman, National Research Council

A new determination of meteoritic flux at the earth has been made, using Canadian visual meteor observations from Ottawa for the 23 years from 1947 to 1969 inclusive. Only meteors as bright or brighter than absolute photographic magnitude zero were counted. This corresponds to a count down to an initial mass of approximately one-quarter gram. In round figures, to this mass limit, a daily total of two million meteoroids is encountered by the earth.

Measurements of the Integrated Linear Polarization of Discrete Radio Sources at 610 MHz by P. P. Kronberg, University of Toronto, and R. G. Conway, University of Manchester, Jodrell Bank, England

The integrated linear polarizations of over 90 radio sources have been measured at λ49.1 cm. (610 MHz). A striking correlation between the spectral index at 400 MHz and degree of polarization is found. This correlation is not removed when redshift is taken into account, and is therefore an effect intrinsic to the sources.

There is some correspondence between degree of polarization at 49.1 cm. and optical identification. There is little galactic depolarization of sources for $b^{II} \gtrsim 20°$.

The Formation of the Ca II K Line in a Spinning Spicule by L. Avery, National Research Council

The emission of the Ca II K line from a spinning, cylindrical spicule model is considered. In order to reproduce the observed spicule K line profiles, the model must have both radial and axial gradients in electron density and temperature. The rotating spicule model is optically thin at all heights above the solar surface and is characterized by electron densities of 1.5 to 4.0 $\times$ 10^{12} cm^{-3} and temperatures of

1.6 to 2.4 $\times$ 10^{4}° K. It is proposed that the so-called Type I and Type II spicules may structurally have the same features, with different rotational velocities.

Rapidly Rotating White Dwarfs Near Chandrasekhar's Limit by S. P. S. Anand, David Dunlap Observatory, University of Toronto

The structure of rapidly rotating white dwarfs is investigated near Chandrasekhar's limiting mass (M_3). This study is made in the post-Newtonian approximation of general relativity. It is found that the combined effects of rotation and general relativity under certain extreme conditions decrease M_3 by ten percent, but the stability of such a mass is questionable. The maximum stable mass of the white dwarf before the rotational relativistic instabilities set in is very close to M_3. The physical implications of these results are also discussed.

Alignment Problems in the Oblique Rotator Model for Pulsars by W. Y. Chau, R. N. Henriksen and P. Srulovicz, Queen's University

Equations are given that describe the simultaneous "spin down" and "alignment" of an oblique rotator when both magnetic and gravitational radiation are present. Application is made to pulsars and in particular, to the predicted lifetime of NPO532.

Relativistic Magnetospheres by R. N. Henriksen and D. R. Rayburn, Queen's University

We have applied the relativistic hydromagnetic equations of motion to the steady state stellar wind problem. The results are compared with a mechanical analogy consisting of a bead sliding without friction along an infinitely rigid wire which is rotating about an axis perpendicular to one end. The agreement is excellent. Both the analogy and the hydromagnetic solution break down at the same point for analogous reasons. The breakdown in the physical significance of the two problems is discussed.

The Ultraviolet Spectrum of VV Cephei by K. O. Wright, Dominion Astrophysical Observatory

As part of a continuing study of this important system a series of plates covering the region 3200–4000A has been obtained in 1968 and 1969; the dispersion is 5A/mm. The region includes the Balmer limit and the converging series of hydrogen lines (to about H32) as well as the numerous lines of ionized titanium, vanadium, chromium, iron, manganese and nickel that were identified by Struve (1944, *Ap. J.* 99, 70); nearly all permitted lines of ionized titanium can be seen but only the stronger lines of most of the other atoms. Several forbidden lines of ionized iron, nickel and copper have been observed. Two Si II lines at 3856 and 3863 have been measured; the lines are broad and the intensities vary; it would seem to be possible that they arise in the envelope of the secondary star but the broad lines are difficult to measure. The strong neutral lines of the M-type spectrum can be observed to about 3770A; at shorter wave-lengths the ultraviolet continuum takes over. Nearly all ionized lines and the hydrogen lines have an absorption component and a shorter wavelength emission component; a few plates show double absorption components; they are particularly prominent on a plate taken 1969, December 9. The Ca II H and K lines show these lines on December 9 in addition to the two components with velocities about –16 km/sec and –33 km/sec that are always present. Plates taken in 1958 and 1959, a year after the end of total eclipse show nearly the same lines,

though the intensities are quite different. On the post-eclipse plates the principal difference is in the ionized scandium lines that are quite strong in 1958–59 yet barely visible in 1968–69. It seems probable that many of the observed lines arise in gas streams flowing from one star to the other, although the interpretation of the hydrogen lines as arising in the envelope surrounding the B star, as has been considered for Hα (Wright and Larson 1969, *Cont. D.A.O.*, No. 127) may apply here also. The velocities and intensities are to be studied in detail before a more complete interpretation is attempted.

A Study of Turbulence and Chemical Composition in FO-K4 High-Luminosity Stars by J. Smolinski, University of Victoria

Little information is available on the microturbulence in the stars of classes Ia, Ib and II, and even less is known about the dependence of macroturbulence on spectral type. Determination of turbulent velocities for the most luminous stars on the H-R diagram is of interest in connection with mass-loss processes.

Observations were begun in July, 1969, to obtain spectrograms of about 60 bright giant (class II) and Ia, Iab super-giant stars – types FO to K4 – to determine the physical parameters. However, the main aim is the determination of micro- and macro-turbulent velocities in order to compare these results with those from models where convection has been considered. This program is extensive as it includes many stars which encompass a large spectral range of classes II, Ia – Iab and because stars of the last class are rather faint (to 8th magnitude). However, now, excellent spectra for 65% of the stars have been obtained in the spectral regions 3500 – 4900 A. and 4850 – 6300 A. with the coudé spectrograph of the 48-inch telescope (dispersion 6 A/mm) of the Dominion Astrophysical Observatory.

The Variability of 3C 120 by B. H. Andrew, W. J. Medd and J. L. Locke, National Research Council

Observations of the variable radio source 3C 120 have been made monthly at the Algonquin Radio Observatory at wavelengths of 2.8 cm (since 1966) and 4.5 cm (since 1967). Pauliny-Toth and Kellermann analysed observations at 2, 6, 11, and 21 cm of the 1966 and 1967 outbursts and demonstrated classic agreement between their observations and the expanding source model of variable sources. However, the 2.8 cm and 4.5 cm ARO observations of the 1967 outbursts are somewhat inconsistent with the parameters obtained in the analysis by Pauliny-Toth and Kellermann. If the expanding source model is used to explain the observations then the quiescent flux density underlying the burst appears to be an irregular and rather arbitrary function of wavelength.

Three outbursts similar to each other have been observed in 3C 120, in 1966, 1967, and 1968. In 1969 there occurred a fourth outburst which had only about $\frac{1}{50}$ of the radiated power of the three preceding bursts. Clearly the physical conditions within the source are not constant. Further, amplitudes of this fourth burst at 2.8 cm and 4.5 cm were approximately equal, contrary to theoretical expectation. If it is assumed that the electron energy distribution is affected by either synchrotron or inverse Compton energy losses, resulting in a relative reduction of the shorter wavelength radiation, then the magnetic field strengths in the source must be either $\gtrsim 1.6$ gauss (synchrotron losses) or $\lesssim 4 \times 10^{-7}$ gauss (inverse Compton losses). From other evidence one typically thinks of magnetic field strength $\sim 10^{-4\pm1}$ gauss.

Spectra of Radio Sources in Rich Clusters of Galaxies by A. H. Bridle, Queen's University and C. H. Costain, Dominion Radio Astrophysical Observatory

Radio spectra have been derived for ninety sources in the directions of rich clusters of galaxies in Abell's catalog, using radio observations in the frequency range 10 to 5000 MHz. The distribution of spectral indices among a complete sample of such sources with flux densities $>3 \times 10^{-26}$ $Wm^{-2}Hz^{-1}$ at 178 MHz differs significantly from that found among radio galaxies selected at the same frequency. The mean spectral index at 178 MHz among the sources associated with rich clusters is 0.926 $\pm$ 0.032, whereas that for the radio galaxies is 0.753 $\pm$ 0.013. At radio frequencies below 40 MHz many of the sources in rich clusters are dominated by low-frequency components with high spectral indices. Some of these components may be comparable in angular extent with the optical clusters. The sources are generally of low radio luminosity and may represent late stages in the evolution of radio galaxies. Mechanisms which might result in their systematically high spectral indices are considered.

Redshift and the Size of Double Radio Sources by T. H. Legg, National Research Council

Published data have been collected on 32 radio galaxies and 25 quasi-stellar sources that have a measured redshift and predominantly double structure. The quasi-stellar sources are found to fit smoothly into a redshift-size relationship with the radio galaxies, supporting the cosmological interpretation of redshift. It is suggested that features in the distribution of linear size of the sources imply that the parent objects of quasi-stellar sources may have envelopes in the range from 60 to 140 kpc.

The Selection of Cosmological Models Using Q.S.O.'s by R. C. Roeder, Dept. of Astronomy and Scarborough College, University of Toronto

Current evidence seems to indicate that the QSO absorption line spectra are intrinsic to the objects, with one possible exception. Using the results of previous work on the screening of distant galaxies by intervening galaxies, it is possible to calculate the probability that (a) one object, or (b) no object, of the 20 with redshifts in the range 2.0 $\pm$ 0.1, is screened. This probability is dependent on the cosmological model, so models can be ranked in order of their probabilities. If no object is screened, the steady state model has the highest probability, while if one object is screened, a simple, closed Friedman model is most likely.

The Variable Radio Source VRO 42.22.01 (BL-LAC) by B. H. Andrew, J. MacLeod, J. L. Locke, W. J. Medd, National Research Council and C. R. Purton, York University

Measurements of the flux density and polarisation of VRO 42.22.01 at 2.8 and 4.5 cm wavelength have been made at the Algonquin Radio Observatory at about 5 day intervals since 1968. These results were compared with similar observations made at the University of Michigan at 3.75 cm. The observations show that there are several outbursts per year, that the shape of the bursts, i.e. the relative rate of increase and decrease in flux density, varies from burst to burst, and that while the amplitude of the bursts is almost constant at 2.8 cm it varies considerably from burst to burst at 3.75 cm and 4.5 cm. There is a time lag of 5 days between events at 2.8 and 3.75 cm and of 8 days between 2.8 and 4.5 cm. The observations of polarisation clearly show that the outbursts are polarised. Large changes in the polarisation have been observed

both when the flux density is increasing, and when it is decreasing. The polarisation observations have been used to resolve two individual bursts which appeared from the observations of flux density to be a long single burst.

Absolute Flux Measurements at CM Wavelengths by W. J. Medd, National Research Council

Recent measurements at 2.22 cm (13.5 GHz) have been made of the flux density received from Cassiopeia A and Taurus A. The values obtained are respectively 380 and 520 flux units. These results establish a constant spectral index for both sources at the high frequency end of the spectrum.

This work completes a program of absolute flux measurements at the National Research Council, which has covered the range from 9.5 to 2.2 cm (3.15 to 2.2 GHz). Combined with other reported results, the spectral indices of Cass A and Taurus A are respectively 0.78 and 0.245.

A Catalog of Radio Sources at 1400 MHz by A. H. Bridle, Queen's University, M. M. Davis, National Radio Astronomy Observatory and J. Lequeux, Observatoire de Paris, Meudon

The 300-foot telescope at the National Radio Astronomy Observatory and the twin-element interferometer at the Owens Valley Radio Observatory are being used at 1400 MHz to measure accurate flux densities, positions and structures of ~700 discrete radio sources selected from existing surveys. These observations will provide a catalog of ~300 radio sources between declination $-5°$ and $+70°$ and at galactic latitudes $>5°$, which should contain most of the sources whose flux densities exceed 2×10^{-26} Wm^{-2} Hz^{-1} at 1400 MHz. The completeness of the catalog will be estimated statistically from the new observations. This work will permit statistically unbiased studies of the distribution of optical identifications, radio structures, radio spectra and radio polarization among extragalactic sources in a sample complete at a relatively high frequency. The sample is of particular interest as it will contain both the 'transparent' radio galaxy population characterized by the majority of the Revised 3C Catalog and the 'opaque' population revealed by recent microwave data.

Distributions of Linear Polarization in Radio Galaxies by P. P. Kronberg, David Dunlap Observatory and Scarborough College, University of Toronto

The one-dimensional distribution of linear polarization at 21 cm has been mapped for a number of radio galaxies using the Jodrell Bank Mark I and II radio telescopes as a tracking interferometer.

In some cases published 21 cm interferometric data covering complementary portions of the "u-v" plane were made by observers at Caltech and Parkes for the same sources. By combining these data with the Jodrell Bank measurements, two-dimensional models of the Fourier transform of the total intensity and linear polarization distributions were constructed. Fourier inversion of the results yield a two-dimensional map of the sources with a resolution of approximately 1′ arc.

Low Frequency Type III Solar Radio Bursts by H. M. Bradford and V. A. Hughes, Queen's University

Results are presented from twenty-five of the best type III solar radio burst spectra from Alouette I records from a sample of sixty obtained between Alouette I launch, September 1962, and 1966.

The data were computer processed to display the burst spectra in three forms for convenient analysis: an intensity-modulated dynamic spectrum; a plot of the spectrum of each frequency scan of the receiver; and fixed frequency plots of flux versus time at ¼ MHz intervals.

Time delays between flux peaks at different frequencies are consistent with an average exciter velocity of 0.18 c if the bursts occur at the mean coronal plasma frequency, and 0.5 c if they occur in streamers 10 times denser than the mean corona.

Assuming the spectrum to be due to a superposition of damped plasma oscillations, the type III flux plots were deconvolved to obtain the decay time constants and electron temperatures of the ambient coronal plasma.

The temperatures inferred from the type III bursts are less than two times lower than those of a model quiet corona at 10 MHz, but are about nine times lower at 2 MHz.

A Possible Relation Between the Linear Separation of Quasars with Two Components and the Frequency at which a Break-Point Occurs in their Spectra by M. B. Bell, National Research Council

A possible relation between linear separation and the frequency at which the break-point occurs, suggests that the break-point frequency increases with increasing separation. This is opposite to the change predicted for a 'synchrotron loss bend'.

Radio Luminosity Evolution and Selection Effects in Optical Identification by M. B. Bell, National Research Council

It is shown that the radio luminosity evolution in quasars reported by other workers, can be traced directly to similar effects in the flux density data for 4C sources with measured redshift. It is suggested that these effects can be produced by a combination of two different selection effects, one arising as a result of the "plate cut-off" and the other occurring when the flux densities were determined and resulting in a reduced flux value for objects with small redshift. Such a reduction might be accounted for, in part, by partial resolution of nearby extended objects.