

REPORT ON I.A.U. COLLOQUIUM NO. 37 AND C.N.R.S. COLLOQUE INTERNATIONAL NO. 263

The above joint Colloquium covering the topics of "Red shifts and Expansion of the Universe" and "The Evolution of Galaxies and its cosmological significance" was held in Paris from Sept. 6-9, 1976. It provided an opportunity for a detailed discussion of the methods and uncertainties of determining the parameters useful in observational cosmology. The proceedings opened with a review by S. Van den Bergh of the status of the distance scale problem within the local group. This was followed by a detailed review by G.A. Tammann of the general problem of the extra-galactic distance scale. A later review by G. de Vaucouleurs also dealt with the same question. Tammann give a mean value for H_0 of 52 ± 2 km/sec/Mpc while de Vaucouleurs gave a value of $88 (1 \pm 0.15)$ km/sec/Mpc. Even though there was considerable disagreement among the various workers as to the relative accuracy of the individual methods of distance measurement there was only one method which gave significantly different values of the distance estimates to be of concern to everybody. This is the use of the diameters of H II regions as calibrators. This method as used by Sandage and Tammann gave a consistently low value for the Hubble Constant and as pointed out by de Vaucouleurs may not be fully reliable. Once this is taken into account there seemed to be general agreement that a value of 70 km/Sec/Mpc may be used for the present as a good approximation. Measurements of the widths of 21-cm emission lines from galaxies have provided a new method of distance determination. This method developed by B. Tully and J.R. Fisher was reported by Tully.

A number of papers dealt with the evidence for possible anisotropy in the expansion of the universe, particularly the Rubin - Ford effect. V. Rubin in her paper discussed the problems of choosing proper samples for anisotropy investigations. There was no general agreement as to what the observations of anisotropy really meant. S. Simkin pointed out that the distortion of H and K lines of Calcium by the night sky spectrum can produce the appearance of band structure in the magnitude-velocity diagrams as found for example by W.G. Tifft.

The theoretical and observational problems in the determination of the deceleration parameter q_0 and the associated cosmological parameters H_0 , t_0 and Λ were discussed in detail by J. E. Gunn, B. Tinsley, V. Petrosian, S. White and others. Since the observed apparent magnitudes and angular sizes of distant objects have to be corrected for the effects of stellar and dynamical evolution before one can infer the effects of cosmological evolution major efforts are being put into model calculations of the corrections. As is obvious this is a bootstrap operation and, as yet, not an encouraging one.

On the observational side the extension of the Hubble diagram for faint radio galaxies to $z=0.75$ for 3C 343.1 was reported by (U.C.) H. Spinrad and H. E. Smith. The Hubble diagram for Seyfert galaxies was discussed by E. Khachikian and D. Weedman. J. Kristian, A. R. Sandage and J. A. Westphal reported on the extension of the Hubble diagram for red magnitudes of bright cluster galaxies. From their data they derived a formal value of $q_0=1$. The question of the Mass to Light ratios of diffe-

rent types of galaxies was discussed by J. Huchra and by E. L. Turner.

Beginning with a paper by K. I. Kellermann and C. B. Shafer on VLBI observations of expansion of radio sources there were a number of papers concerning possible anomalous nature of red shifts in quasars and galaxies. Kellermann preferred a model, where the apparent super-relativistic velocities can be interpreted in terms of a geometrical model of the type discussed by Rees, which involved expansion with velocities less than the velocity of light. Considerable discussion was generated by the presentation by H. Arp, J. Heidmann and others regarding the observational evidence of anomalous red shifts. Even though a number of observations were very interesting as well as puzzling it would be an exaggeration to say that the evidence for the existence of anomalous red shifts is conclusive. J. C. Pecker discussed the various possible explanations of non-cosmological redshifts including the photon-photon scattering theory of the Paris group.

M. Roberts summarised the present status of 21-Cm emission and absorption line redshifts up to $z=0.692$ and from this derived an upper limit on the variation of certain atomic constants. Measurements of a large number of high z southern quasars were reported by P. Osmer and M. Smith as well as by Peterson. One of these objects a radio source PKS 2142-75 has an emission redshift of 3.96 and an absorption redshift of 3.56. It is clear that with such high red shifts when Lyman α appears around 6000 Angstroms the usual criterion of ultraviolet excess for the object is no longer valid. The last two formal presentations were by G.R. Burbidge and M. Rees about the non-cosmological redshifts and conventional interpretations of redshifts respectively. P. Morrison gave a forceful and graceful summary of the conference. I personally do not remember another scientific conference where all opposing points of view were so fully represented and where there was such lively discussion. At the same time it demonstrated that in the expanding frontiers of scientific research objectivity is not and, perhaps need not be the guiding criterion in the selection of hypotheses to be tested by observations.

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REPORT ON THE I.A.U. SYMPOSIUM ON RADIO ASTRONOMY AND COSMOLOGY

This symposium was held in the Cavendish Laboratory, University of Cambridge from 16th to 20th August. The emphasis of the Symposium was on the observational aspects of cosmology from the point of view of radio astronomy.

The Symposium began with the description of the latest radio source surveys from Cambridge (151 MHz), Texas (365 MHz), Bologna (408 MHz), Molonglo (408 MHz), Westerbork (610 and 1415 MHz), Parkes (2700 MHz) and N.R.A.O. (5000 MHz). Although a recent analysis by Webster of many of the above surveys has not shown any significant evidence of

anisotropy in source distributions, some suggestions of anisotropy in source counts were presented, especially between the Northern and Southern Galactic Hemispheres for the 5 GHz Parkes and NRAO surveys. No general consensus emerged as to whether the anisotropy was real or due to some observational selection. A discussion initiated by Kellermann on whether the source count data required the deduction that the Universe is evolving brought out some of the controversies of interpretation.

Extensive data on spectral index distributions and angular sizes of radio sources was presented, including the recent work of Swarup and Kapahi based on the Ooty and 3CR surveys. The Cambridge data presented by Riley showed that high luminosity quasars do not show size evolution. Narlikar and Roeder respectively presented statistical and theoretical reasons to show that the angular size flux density relation is not yet capable of arriving at a clear cosmological conclusion. Roeder pointed out the uncertainty of interpretation arising from the inhomogeneity of the intergalactic medium. The determination of redshifts exceeding 0.45 up to about 0.7 for about 10 radio galaxies, have become possible due to the recent availability of stable high quantum efficiency detectors which allow subtraction of the sky noise.

Kristian, Hazard and others presented the details of latest efforts in the optical identification of radio sources and quasars. Fanti and Perola discussed the radio luminosity functions. Physical conditions in quasars and radio galaxies were discussed in detail by Osterbrock. Bokserberg discussed absorption line redshifts in large redshift quasars. The controversial topic of whether absorption line systems are intrinsic or due to intervening galaxies gave rise to a lot of discussion. Of considerable controversy because of its implications, was the identification of the radio source 3C 303 with a quasar-galaxy system with anomalous redshifts. Those who do not like anomalous redshifts argued in favour of a possible mis-identification. Margaret Burbidge was among those who thought that the case for identification was a good one.

The evolutionary aspect of the radio sources was presented in various forms by Maarten Schmidt, Malcolm Longair (who also presented work of the absent Russians Sunyaev and Novikov), John Bahcall, Peter Scheuer, Julia Riley etc. Against this avalanche of the evolutionary theology the lone agnostic voice was raised by Geoffrey

Burbidge who argued that the radio source data in its present form did not really warrant the conclusion that the universe is evolving.

The microwave background measurements were reviewed by Robson who pointed out the difficulties in millimetre measurements which would really establish the crucial fact whether the background is of blackbody character. Measurements to date indicate a turnover as required by the blackbody curve but further work is necessary to establish the Planckian character.

A light relief after an exhausting and controversial discussion of the present data was provided by Bill Saslaw who discussed possible short-term (1-2 years), middle-term (10-30 years) and long-term (\sim century or more) observations of cosmological significance. Of the last type was one in which we wait to be discovered by superior extraterrestrials, and then ask them what the universe is really like!

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soil determined by the x-ray spectrometer suggests 15% iron, 15% silicon, 5% calcium, 5% aluminium and about 1% titanium. There are also indications of small amounts of sulfur and chlorine. The red colour of the planet is attributed to a thin coating of the red oxide of iron - limnolite.

Biologically the results for search of living organisms or organic constituents of life have been negative. It is hard to distinguish chemical activity from biological activity by preplanned experiments but, apart from a few results which are not understood completely, there seems to be no indication for life bearing organisms in the martian soil.

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