Proceedings of Observatories

DEPARTMENT OF ASTROPHYSICS
UNIVERSITY OF OXFORD
(Director, Professor D.E. Blackwell)
(Report for the year ending 1969 December 31)

SOLAR RESEARCH

Professor Plaskett has completed his reductions of the limb darkening observations that he made in 1966, and started measurement of spectra obtained in 1966 and 1968 for determination of solar equatorial velocities.

Dr Adam's work on sunspot magnetic field configurations using the 1966 spectra has now been completed. During 1969 May, June and July the North Tower telescope and spectrograph have been used for further sunspot observations in the region of 5250 Å and also in the Hα region of the spectrum. Some of the 1968 observations have now been reduced and show that it is quite feasible to use the Babinet-Rochon unit directly over the spectrograph slit. As this is a much simpler arrangement than has been used hitherto, and gives greater stability in the optical train, it will be adopted for future observations using Tremain's method. Some theoretical work has also been carried out to determine the influence of line strength on magnetic field configurations as observed by Tremain's method.

Miss Hill started her work on material motions in sunspot regions in 1969 October. She has now completed the measurement of umbral velocities for one line of points across the centre of a large spot observed at the disc centre. These measurements have so far been made using several lines in region of 6300 Å where good atmospheric line standards are available.

The Gornegrat spectrometer has been used for investigations of molecular lines in the spectra of sunspots. Particular attention has been paid to possible HOH lines in the region of 5880 Å, where a significant increase in the equivalent width of telluric lines has been observed. Plans are being made to continue these observations in the more favourable infra-red regions. Drs Lambert and Mallia have completed their extensive study of the SiH $A^2Δ - X^2π$ (o, o) band in the Fraunhofer spectrum which includes a discussion of the occurrence of this band in the sunspot spectrum. A start has been made by Mr Kompfner on an investigation of damping in the sunspot and
solar atmospheres. Dr Petford and Mr Craven have started development of a new and very efficient technique for rapid scanning of infra-red spectra.

**STELLAR RESEARCH**

Mr Hockey has now finished his work on the spectrum of the magnetic star HD 153882, using his micrometer and photometric measurements in analysed spectra of the star to make a detailed test of the oblique rotator model for such stars. He found that the model, as developed by E. Böhmer-Vitense, with suitable parameters, gives a very good representation of his observations.

Dr Peach has continued his work on the interpretation of the redshift-magnitude diagram for first-ranked cluster galaxies and radio galaxies in the light of the new K-correction of Whitford which leads to a significant reduction in the value of the deceleration parameter. He has also shown that the distribution of the absolute magnitudes of brighter cluster galaxies is incompatible with the statistical model of Peebles, if Abell’s luminosity function for the Corona clusters is assumed typical of all rich clusters.

Observational problems now in course of investigation with the 98-inch Isaac Newton telescope include the determination of internal motions in barred spiral galaxies and galaxian mass determination.

In collaboration with Mr Beard the distribution of the absolute dimensions of rich clusters of galaxies are being investigated with a view to their use as cosmological test objects.

Dr Menzies has obtained more photographic and photoelectric data at the Radcliffe Observatory, Pretoria, for his programme of photometry of southern globular clusters. Alteration of an Askania iris diaphragm photometer that will be used for their measurement is now nearly completed. The photometer is being considerably strengthened to increase its stability, the iris diaphragm is to be controlled by a servo-motor and the settings of the diaphragm will be digitized and punched on cards.

**NIGHT SKY AND SPACE RESEARCH**

Using his spectrometer installed at the Observatoire de Haute Provence, Dr Ingham has continued to make measurements with Mr Sternberg of the continuous spectrum of the airglow. The observations of the pre-dawn enhancement of the red oxygen line at 6300 Å in the nightglow made in 1967 January have now been reduced and published. A statistical analysis of these data has revealed periodic fluctuations in the emission rate suggestive of geomagnetic micropulsations.
The measurements of the Lyman-α flux from the night sky, made in 1967 using a Skylark rocket at Woomera, have been published. They show that the flux of Lyman-α increases in the neighbourhood of the galactic equator and of the terrestrial horizon.

LABORATORY WORK

Dr Smith has constructed a monochromator for use with the North Tower spectrograph and used this, together with the two-beam scanning spectrophotometer, to study the effect of argon in broadening and displacing the caesium 4555 Å line. He and Mr Collins have photographed the ultra-violet absorption spectrum of europium vapour to provide additional data for spectral analysis.

The spectroscopic furnace has been developed further during the year and has been used by the Director, Mr Emerson and Mr Collins for studies of the spectra of strontium and iron vapour. The power input is limited to 120 kW by the amount of cooling water available, and it is planned to replace the present continuous feed system by a cooling tower.

THEORETICAL WORK

Miss Siddall has made an interesting comparison between experimental transition probabilities in neutral titanium and theoretical values calculated in the intermediate coupling approximation. Dr Smith is proceeding with an investigation into the energy level structure and transition probabilities in europium.

STAFF

Professor Plaskett has continued his work in the Department during this year. Mrs S.H.Rousseau, Messrs P.A.Ibbetson, M.S.Hockey, Miss J.Siddall, Messrs D.Emerson, B.S.Collins, J.R.Sternberg, P.Kompfner, J.M.C.Beard, P.Craven and Miss S.Hill have worked as Research Students.

Dr A.B.Sykes-Hart has given Tutorial Classes for candidates for Paper 13 (Astronomy) of Honour Moderations.

Dr Menzies spent a further observing period at the Radcliffe Observatory, Pretoria. Dr Ingham visited Haute-Provence Observatory twice. Dr Petford, Mr Kompfner and the Director made visits to the departmental outstation at the Gornergrat, Switzerland. Dr D.W.Dewhirst (Cambridge Observatories), Dr S.Leeman (Tel-Aviv University) and Dr R.J.Dickens (Royal Greenwich Observatory) spent their sabbatical leaves in the Department. Dr G.Smith attended the N.A.T.O. Advanced Study Institute on ‘New Directions in Atomic Physics’ held in Ankara, and he and Mr Collins attended the first meeting of the ‘Association Européenne de Spectroscopie Atomique’ in Paris.
Colloquia and seminars were held regularly throughout the year. Speakers from outside the Department included Dr J.A. Bastin (Queen Mary College), Dr M.J. Rees (Institute of Theoretical Astronomy), Dr V.C. Reddish (Royal Observatory, Edinburgh), Professor P.A. Sweet (Glasgow University), Professor T.D. Kinman (Lick Observatory), Professor R.J. Weymann (University of Arizona), Dr M. Rowan-Robinson (University of London), Dr D.E. Osterbrock (University College, London), Dr I.P. Grant (Pembroke College, Oxford), Dr R.J. Dickens (Royal Greenwich Observatory), Dr J. Shakeshaft (Mullard Radio Observatory, Cambridge).

Publications