

Bulletin

of the Rutherford Appleton Laboratory

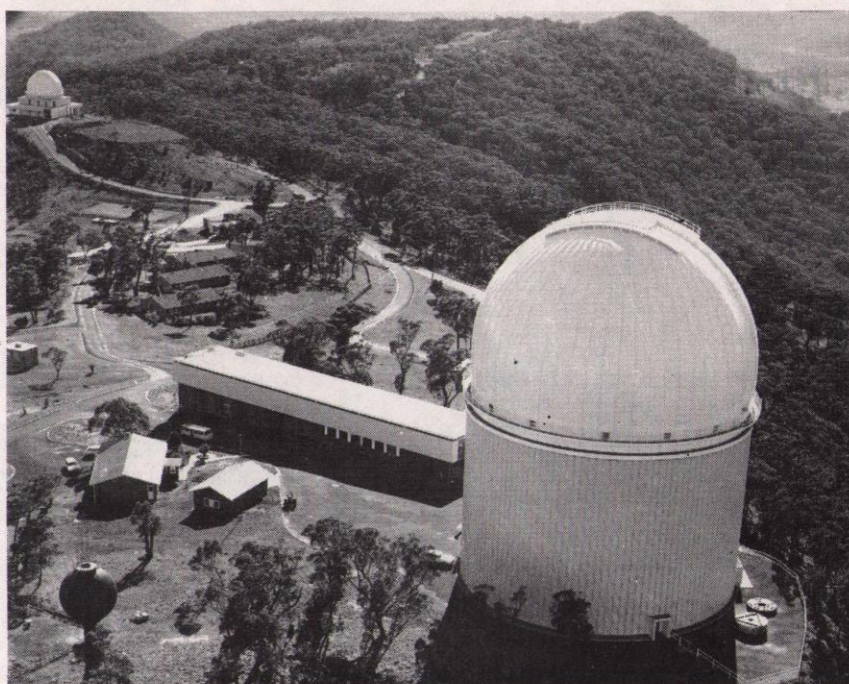
15 Feb 1982 No.3

The Anglo-Australian Telescope

A little over a decade ago, a distinguished UK theoretical astrophysicist described optical astronomy in this country as following "a trend from almost complete to absolute mediocrity". While such a judgement was considered to be over-harsh by many at the time, it did embrace a widespread concern that Britain had forfeited its place, proudly maintained over the more than 3 centuries since the advent of observational astronomy as an acknowledged science, at the forefront of the subject. Today, however, even the out-spoken critic of yesterday (now safely residing 6,000 miles from the site of his attack) would need to acknowledge that UK optical astronomy has fought its way back to its previous prestigious position. Many reasons might be put forward for this re-established glory; the rise of a new generation of gifted astronomers committed to the future of UK astronomy, improved financial support, the inspired leadership of a few individuals, spectacular advances in instrumentation for UK telescopes, the return to the UK of some distinguished expatriates, the construction of new telescopes, more widespread teaching of the subject in universities, optical astronomers embracing new technology developed for space applications, an increased number of positions available for post-doctoral research in astronomy, plus others. However, if one had to highlight a single piece of hardware that has spear-headed the counter-attack of UK optical astronomy, it would be the Anglo-Australian Telescope - the AAT.

Its Management

The AAT is situated on Siding Spring Mountain in the heart of the Warrumbungle National Park in northern New South Wales, although the observatory headquarters are sited in Sydney. As its name suggests, the observatory is funded jointly by the UK government (through SERC), and the Australian government (through its Department of Science), and controlled by a Board with 3 UK and 3 Australian representatives. Chairmanship of the Board alternates between the UK and Australia - the observatory Director



An aerial view of the giant dome housing the Anglo-Australian Telescope, with the SERC Schmidt Telescope building visible in the upper left of the photograph. (Photo: Anglo-Australian Observatory)

is Canadian - hemispherical impartiality in executive decisions is assured.

Observing time on the telescope is assigned on a competitive basis; "scientific excellence" dominates the selection process, although with UK astronomers applying for 5 times as many nights as available in their 50% share, there are many outstanding research programmes which tragically cannot be supported. Successful applicants are expected to travel to Australia well in advance of their observing session to spend time, either in Sydney or at the telescope, with resident astronomers, engineers, and night-assistants planning their observations in considerable detail. Each minute of dark time is precious on the AAT, and cannot afford to be wasted searching the sky for the astronomer's objects of interest, or setting-up and adjusting equipment. Some astronomers then choose to spend time in Sydney following a successful observing run, being guided through data reduction techniques by resident staff. However, more experienced

observers may limit their time in the antipodes to their nights of observing on the mountain, being familiar enough with the telescope and its instrumentation to plan observations from their UK base, and returning with unprocessed data for reduction on the astronomical data computing system STARLINK, managed from RAL.

The Setting

The 300 mile journey from Sydney to the telescope is usually by air to the nearby town of Coonabarabran, followed by a 20 mile taxi ride through the spectacular scenery of the national park. A camera is a must for the first-time visitor; kangaroos and emus frequent the park in vast numbers, and even the occasional koala has been spotted by the road-side. The AAT dominates the mountain top, but several other telescopes (the majority operated by the Australian National University) are also sited there. The AAT's nearest neighbour is the SERC Schmidt

(cont'd on p.3)

INTERNAL Events

HEP SEMINARS

R61 CONF. RM. - 1100 hrs

- 16 Feb Dr Mike Daniel/Southampton
'Preliminary Results on Enhancement Factors in Proton Decay'
- 24 Feb Dr A K Nandi/RAL
'First Results from UA1'

NIMROD LECTURES

R61 CONF. RM. - 1400 hrs

- 22 Feb Prof H Oberlack/MPI Munich
'Results from the Cello Experiment'

ASTROPHYSICS SEMINARS

R3 CONF. RM. - 1400 hrs

- 17 Feb John C Brown/Glasgow
'Hard X-rays from the Sun: Analysis and Interpretation of the SMM Images and Spectra'
- 24 Feb Mandy R Sherrington/Leicester
'Cataclysmic Variables in the Infrared'
- 10 March J Leonard Culhane/UCL & MSSL
'X-ray Spectroscopy of Active Galaxies'

CONDENSED MATTER SCIENCE SEMINARS

R3 CONF. RM. - 0930 hrs

- 16 Feb C E Johnson/Liverpool
'Mössbauer Studies of One-dimensional Antiferromagnets'
- 2 March C D Bowman/Nat. Bureau of Standards
'eV Neutron Spectroscopy with the NBS Linac'

RAL LECTURE

LECTURE THEATRE - 1515 hrs

- 18 Feb Prof M J Rees, FRS/Cambridge
'Cosmology and the Constants of Physics'

EXTERNAL Events

ASTROPHYSICS COLLOQUIA

DEPT OF ASTROPHYSICS - OXFORD - 1630 hrs

- 16 Feb Dr A Rothman/Austin, Texas
'Primordial Nuclear Synthesis in Anisotropic Cosmologies'
- 23 Feb Dr L Sparke/IOA Cambridge
'Galactic Gas and the Shape of Radio Sources'
- 2 March Dr P M Gondhalekar/RAL
'The Ultraviolet Radiation in the Intergalactic Medium and the Consequential Ionisation Balance'

PHYSICS COLLOQUIA

CLARENDON LAB - OXFORD - 1615 hrs

- 19 Feb Prof M Balkanski/Paris
'Laser Annealing in Implanted Semiconductors'
- 26 Feb Prof C A Hutchison/Chicago
'ENDOR Spectroscopy and the Structure of Molecules in Crystals'
- 5 March Dr J Ellis/CERN
'Grand Unification and Cosmology'

THEO. PHYS. SEMINARS

LECT. TH. 424.4 - HARWELL - 1400 hrs

- 16 Feb Prof P Butcher/Warwick
'Hopping Transport in Disordered Systems'
- 23 Feb Prof J F Nye/Bristol
'Optical Caustics Catastrophe Theory and Dislocations in Waves'

NPD COLLOQUIUM

CONF. RM. H8 - HARWELL - 1530 hrs

- 25 Feb Dr P Treleavan/Newcastle
'Computers of the Fifth Generation'
- 2 March Dr R Ellis/Durham
'Galactic Observations and the Fate of the Universe'

THEORY GROUP SEMINARS

DARESBURY - 1400 hrs

- 22 Feb Dr D Edwards/Imperial
'Itinerant Electron Magnetism at Finite Temperatures'

THEO. PHYS. SEMINARS

MANCHESTER - 1430 hrs

- 17 Feb Dr J Barrow/Sussex
'Particle Physics and Cosmology'
- 24 Feb Dr K Taylor/Daresbury
'The Quadratic Zeeman Effect in Hydrogen'
- 3 March Dr K Ledingham/Glasgow
'Measuring the Electron Neutrino Mass'

PART. PHYS. DISC. GP. MEETINGS

BIRMINGHAM - 1615 hrs

- 19 Feb Dr J D Davies/Birmingham
'A Study of $\pi^0 \rightarrow e^+ e^-$ and Related Physics with the Omicron Spectrometer'
- 26 Feb Dr R Ansorge/Cambridge
'A Progress Report on the SPS Collider Experiment UA5'
- 5 March Dr G Ringland/RAL
'Technicolour and its Experimental Consequences'



COSMOLOGY AND THE CONSTANTS OF PHYSICS

by

Professor M J Rees, FRS

Univ. of Cambridge, Inst. of Astronomy

Lecture Theatre - Thursday 18 Feb.

3.15 pm

Over the last decades, astrophysicists have come to understand the properties and evolution of stars, in terms of the basic laws of physics established in the lab. A similar understanding of entire galaxies has not yet been achieved. This is partly because of

poor data, but also because many of the essential properties of galaxies may be "imprinted" in the early universe, so one must extrapolate back to extreme physical conditions near the time of the big bang. The origin of helium and deuterium, and maybe even the origin of the matter and radiation in the universe, depend on the quantitative details of particle and nuclear processes. Studies of this type suggest that the physical laws and constants determined experimentally still apply not merely as far as distant galaxies and quasars, but even in the initial instants of the big bang. Conversely, cosmology can offer empirical tests of some aspects of physical theories (eg, neutrinos, ultra-high energies) which are not amenable to terrestrial experiments.

New Year Honours

Congratulations to all our colleagues and close associates of the SERC who have been honoured in the New Year List.

Dr J L Gowans, FRS - assessor to the SERC - Knight Bachelor; Prof J C Gunn, - former member of Council - Knight Bachelor; Prof Jack Lewis, FRS - member of Council - Knight Bachelor; Dr A Muir Wood, FRS - member of Council - Knight Bachelor; Mr J Brown - former member of Council - CBE; Mr P A B Hughes - member of Council - CBE; Mr D T Shore - member of the Engineering Board - OBE; Mr M F Wood - member of Co-operative Research Grants Committee - OBE.

The AAT (cont'd from pl.)

telescope, planned originally as a "scout" instrument for the AAT, but producing forefront research in its own right.

The Telescope

The AAT is the largest optical telescope in the southern hemisphere - one of the class of "4-metre" telescopes dominating optical astronomy at the present time. UK astronomers will gain access to a telescope of similar size in the northern hemisphere with the construction of the new William Herschel telescope (a joint SERC endeavour with Spain and Holland) on La Palma in the Canary Islands. The dimension of "4-metre" (more accurately, 3.9 metre for the AAT) refers to the diameter of the primary mirror of the telescope; the larger the primary mirror, the greater its light-gathering capacity and hence the fainter (and usually the more distant) the objects that can be observed. (The light-gathering capacity of a 4-metre telescope is about a million fold that of the fully dilated pupil of the human eye). However it is not merely the size of the AAT that sets it apart. The telescope, under computer control, is able to point with previously unobtainable precision for a telescope of its size to a position in the sky, and accurately "track" under computer control that position for the extended periods required for observations of very faint objects. The pointing and tracking precision of the AAT is unequalled by any other telescope, as is the wide range of advanced instrumentation available to observers. During observing, the telescope is under the control of a "cheerful and well-informed" night assistant, while the astronomer operates the sophisticated instruments and computers acquiring data.

Discoveries

The astronomers at RAL make most of their observations using instruments on spacecraft, in the X-ray, ultra-violet, and infrared radiations which cannot be detected from the ground. Nevertheless space astronomers have a strong vested interest in the continued success of the AAT (many of the RAL space astronomers make extensive use of it), and the future success of the optical telescopes at the La Palma Observatory. One of the strengths of UK astrophysics in recent years has been the very close integration of theoretical investigations with astronomical observations at various wavelengths - radio, optical, and some infrared observations from the ground, and, gamma, X-ray, infrared and ultraviolet observations from space. Many of the more spectacular discoveries in astronomy in recent years have arisen from this close interaction - for example, the discovery of the optical Vela pulsar was based on radio data (from Australia) and observations with the AAT; the discovery of the "double quasar" resulted from a radio survey

Petrel Rocket Campaign at Kiruna

A launch campaign of three Petrel II rockets at Kiruna northern Sweden, with firing slots planned in the period 1-21 December has been concluded successfully and to schedule.

All arrangements for the campaign (sponsored by the SERC) were made by the Rocket Management Section at RAL, which included negotiating a contract with the Swedish Space Corporation for access to the Kiruna range. This had to be handled quickly in the six weeks before mid-October, when the project was finally approved by the Solar System Committee, and the opening launch slot on 1 December. Other activities concerned transport of the rocket motors and chemical payloads (which are classified as explosive) to Kiruna, and setting up the rocket launcher plus its cabling and other equipment.

Dr D Rees, of University College London, was the project scientist, in whose group the chemical release payloads were made. Two types of payload were produced, one for ejecting liquid tri-methyl aluminium (TMA) and the other for burning lithium thermite. The actual flight chemical releases could thus be chosen to suit the prevailing conditions at the time. The rocket experiments left trails of TMA or lithium depending on payload choice, which were illuminated by sunlight against a dark sky background at twilight. Cameras at three sites recorded the motion of the trails to give wind measurements. Simultaneous measurements were made of neutral winds between 80 km and 200 km altitude over northern Scandinavia, using ground interferometers, EISCAT, the Petrel II rockets and the Dynamics Explorer (DE) satellite.

Dr Rees' main objective was to assess various techniques of analysing data from the UCL Fabry Perot interferometers in the DE satellite against the ground-based and rocket measurements. A detailed study was also required of the latitudinal and local time structure, and the circulation of the mesosphere and lower thermosphere. To this end,

at Jodrell Bank, followed up by ground-based optical observations and ultra-violet observations from space; the discovery of the enigmatic object SS433 (one of the most bizarre stellar sources in the heavens, shooting out material in finely-collimated jets at a quarter the speed of light) resulted from closely related X-ray observations with the UK5 spacecraft, radio observations from Cambridge, and optical observations from the AAT; optical identification of the majority of active galactic systems discovered by UK5 were made with the AAT; the identification of the intrinsically brightest stellar X-ray source yet



Typical TMA trail from a sounding rocket showing movement due to upper atmosphere wind. (Photo. UCL)

the satellite data were used to give latitudinal profiles, the rocket data gave the detailed vertical structure, and continuous wind profiles were obtained from ground-based results.

The necessary conditions for launching the rockets (clear skies at the observation sites, low altitude winds slack enough for safe firing, twilight pass of the DE satellite and EISCAT availability) occurred on 1, 9 and 16 December, and a Petrel II was duly flown on each of these dates. The campaign was concluded with two days of the scheduled period remaining. Two members of RAL EISCAT section assisted with the EISCAT observations, data from which will be processed with RAL assistance.

The measurements on 9 December preceded the flights of three other rockets (one Skylark and two Skuas) in the last phase of the West German "energy" campaign, and so were able to enhance their scientific value.

We are indebted to Charles Whitlock and John Reed for this news of a successful project.

detected again linked UK5 and the AAT; the list is seemingly endless.

Despite current economic stringencies, it is imperative that any sense of rivalry between the ground-based and space astronomical communities, struggling for a share of diminishing resources, be avoided. The re-emergence of UK optical astronomy owes much to the strength of UK space astronomy; and UK space astronomers have gained immeasurably from access to SERC's ground-based facilities, especially the Anglo-Australian Telescope.

David Clark

Greenhill Award for Ray Smith



Ray Smith is the man who prints the *Bulletin*, amongst a few hundred other things, so naturally we couldn't let this piece of news slip by without comment. The Award is presented to - 'the best student on the course' (at Watford College), in this case "Certificate in Reprographic Techniques". So, at RAL we can now rest assured that our printing is in the hands of a master.

Congratulations, Ray - of course your editor always knew it!

RAL RecSoc '200 Club'

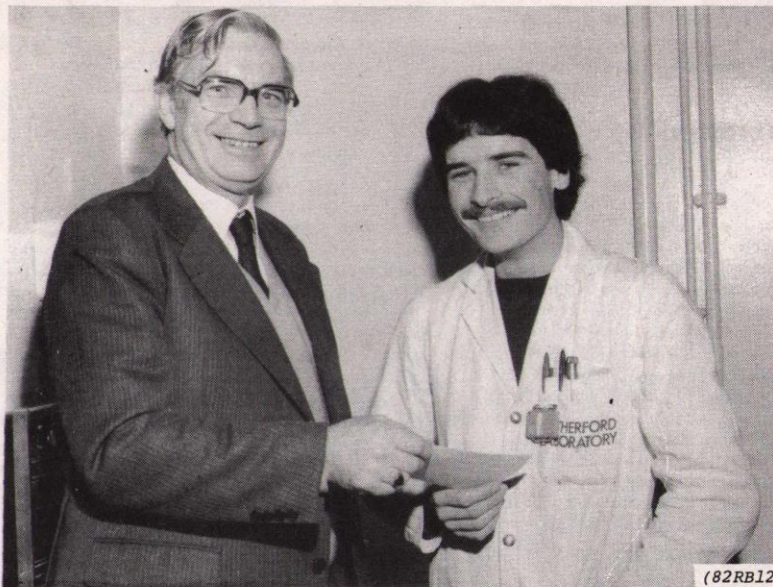
The Rec. Soc. is hoping to start a 200 Club at the beginning of March. If you would like to join would you please contact Mr R Smith, R3 Reprographics or Mr T Morgan, R18. It will be 25 pence per week, with a draw every month for £50 and four draws during the year for £50 and £250.

The first 200 names in, the sooner we can get the cards and rules out. One rule that Management has stated is that all members of the '200 Club' must be members of the Rec. Soc.

Crib

The lunch-time Crib League is running well, but new members are always welcome! For information of times and venue please contact Tony Lubbock Ext 217.

Saved, Stress and Strain



(82RB1214)

An award of £150 was made to Andrew Inchley of R2 Mechanical Workshop on Wednesday 20 January for an idea to improve the method of aligning the SNS Quadrupole Magnets.

This was the latest substantial award made under the SERC Suggestions Award scheme, designed to promote ideas making for more efficient, safer, and cost effective working. The crux of the matter being that the award winner receives one half of the cost for the year saved by the adoption of the suggestion. "Andrew's suggestion has saved much heartache" said David Gray, making the presentation. The award came in two parts - £130 for a modification to the magnet mounting frame to eliminate

stresses due to flexing of the frame on the alignment table, which when released, on lifting to place it on its concrete mounting block, caused misalignment. Previously the process had to be repeated several times, to achieve proper alignment, with the modified frame this problem has been overcome.

An encouragement award of £20 was also included for an idea, using a mirror to help with alignment, which had reduced the number of people needed to do the job. "I am pleased to be able to give you this cheque", said David to Andrew, "and I encourage you all to put forward any more suggestions you might have to the Suggestions Panel. Thankyou."

Missing

A blue check blanket is missing from the Ladies Rest Room in R1. If you borrowed it during the 'great freeze' - please return it. We may need it again!

Library Notice

The following book has been FOUND in the Library.

Hofstadter D.
Gödel, Escher, Bach - An Eternal Golden Braid

It is the American edition and looks brand new. Please contact the Library for further details.

Sales to Employees

The sale of scrap metal and plastics as set out in RLN 12/73 will be made on 19 Feb and 5 & 19 March.

Sales take place at the rear of R24 Store from 1200-1230 hours.

Film Badge Notice

It is PERIOD 2 Colour Strip BROWN Please check that you are wearing the correct film and that all last year's films have been returned to enable the records to be completed.

Anyone requiring a new holder please 'phone Jenny Coates, Ext 430.

Next Film Change

Monday 1 March

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