

Bulletin

of the Rutherford and Appleton Laboratories

15 Dec. 1980 No.19

A Christmas Message from the Director General

The more observant amongst you may have noticed a change in the letter-head of this Bulletin during 1980, marking the fact that it is now a bulletin for both Appleton and Rutherford. In consequence, as Director-General it is my pleasant task to write you a Christmas message.

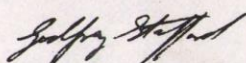
In December 1978, when I was Director of the Rutherford Laboratory, I wrote that the then Secretary of State had announced increased funding for the Research Councils over the next 4 years. We live in rapidly changing times because, as most of you know, the SRC as a whole has this year come up against some short term financial difficulties and in recent months the Laboratories have not been immune from the impact of these problems. I know this has caused some difficulties in your work and I would like to thank you for your help in coping with this tricky financial situation.

The Laboratory programme is, fortunately, still on a very sound basis. This was strongly in evidence when we displayed our activities to selected members of the public during the series of Open Days held in July. Many people wrote to congratulate us on a splendid occasion and I was proud of your achievements.

I am specially pleased to welcome the Appleton staff who are now beginning to appear at Chilton in ever increasing numbers. My impression is that the plans for the merger go well but I recognise that some hardship has been experienced by individual members of the Laboratory in moving themselves and their families.

May I, therefore, single out particularly these former members of the Appleton Laboratory for the spirit of tolerance and collaboration they have shown in making the merger go as well as it has so far. I am sure the outcome will be to generate a single Laboratory more effective and resilient than the two Laboratories would have been operating independently.

Finally I wish you and your families a very happy Christmas and a pleasant holiday over this festive season.



The Millimetre-wave Telescope

It is quite sometime since the Millimetre Wave Telescope (MT) was conceived but the intervening years have not been wasted. Work at Culham, Appleton and Rutherford has led to a practical design of telescope that will give UK universities a unique facility for astronomy at millimetre wavelengths. This major project has recently been approved by Council and DES and news of it is given here by Jim Hall.

What is it for?

Optical astronomy and radio astronomy developed separately but, as optical techniques embraced infra-red observations and radio techniques pushed to ever higher frequencies, the wavelength gap steadily narrowed. Now it has been finally closed by a new branch of astronomy at millimetre and sub-millimetre wavelengths. Observations at mm-waves can provide detailed information about the enormous clouds of interstellar molecules and dust which are known to be the breeding grounds of new stars. Star formation, however, is poorly understood. Such simple facts as the number created at one time, the range of star sizes and the initial cause of condensations in the clouds are all unknown. We cannot hope to understand how galaxies of stars have evolved without this basic information. Millimetre-wave astronomy will tell us about the density, temperature and distribution of the cold clouds and the abundant spectral lines available at these frequencies will allow us to deduce their chemical composition.

What will it look like?

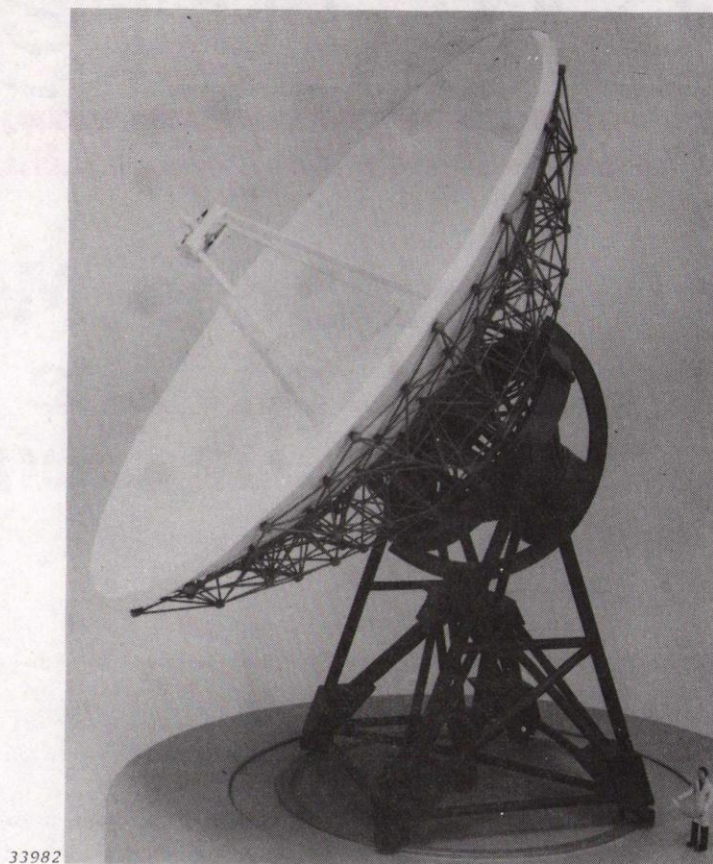
Superficially, the MT appears to be a conventional medium-size radio telescope. It will be similar to the model in the photograph. Like most radio telescopes, it will have a framework which rotates and a dish that tilts to let it observe all parts of the sky. A closer look at the complexity of the tubular structure behind the dish gives a clue to the unconventional nature of the design. The rotating enclosure, shown in the second photograph, that has to be built around the telescope makes it obvious that the MT is something special.

What is so special about it?

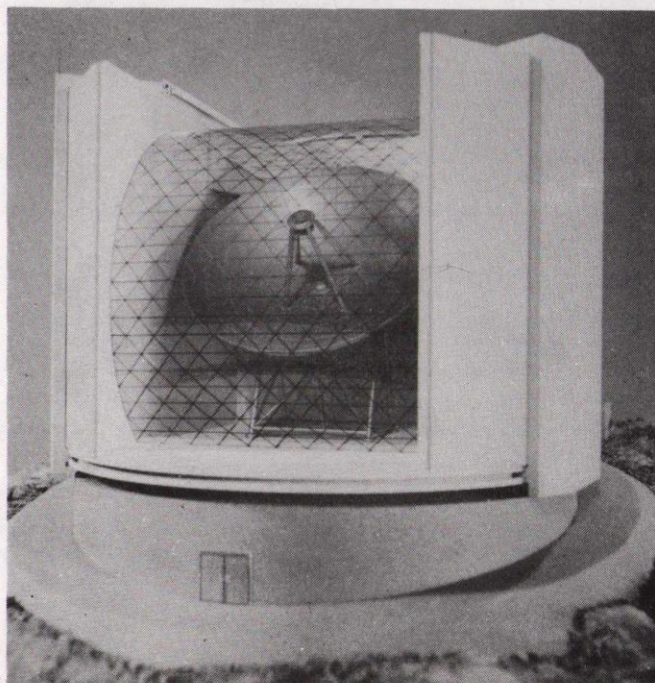
In a word, precision. The 15 m (49 ft) diameter paraboloid will be accurate to 0.05mm (2 thousandths of an inch) and the MT's performance at a wavelength

of 1mm will be unsurpassed by any other instruments in use or under construction anywhere in the world. A hundred and sixty light-weight panels will be assembled to make the reflecting surface. Each will have

been accurately formed on a hand-polished mould using an aluminium honeycomb construction developed at RAL. They will be carefully positioned on a special backing structure designed to maintain a parabolic shape



33982



30550

even under gravitational distortion. This distortion cannot be avoided when the dish tilts but the so-called homologous design allow the telescope to be refocused simply by making a small adjustment to the position of the secondary mirror.

Pointing is also unusually precise for a radio telescope - better than 2 arc seconds - requiring good encoders, drive control and overall stability. The aim of the enclosure is to preserve this stability by protecting the telescope from wind, rain and sharp temperature variations. To do so, the viewing aperture must be covered but the covering material has to be transparent at mm-waves. There are very few suitable materials and, although the span of the aperture is 60 feet, a very thin nylon will have to be used. This fabric will be similar to that used for spinnakers and hot-air balloons but it will be strengthened by steel cables to make it withstand wind gusts of 40 mph. In storm conditions the enclosure will close up completely. A roof will slide over and 65 ft high doors will close to protect the window material and telescope.

Who will make it ?

The work on the MT cuts right across the divisional structure at RAL and provides an excellent example of how ex-Appleton and Rutherford staff can pool their expertise. The work will not be entirely at RAL, however, since several university groups play important roles and there may be some Dutch involvement. Technology Division are designing the telescope and they will be responsible for construction and assembly on site. The Council Works Unit are looking after the enclosure design and construction except for the development of the window material which comes under Space and Astrophysics Division. The telescope control and data handling system will be contributed by Cambridge University and the receiver development will involve the Geophysics and Radio Division, Queen Mary College and Cambridge and Kent Universities. The overall management is at RAL.

Where will it be ?

Spain is developing a new international observatory at which there will be several large optical telescopes including three (1m, 2.5m and 4.2m) built by RGO. This site, at the Roque de los Muchachos Observatory on the island of La Palma in the Canaries, is at 8000ft and provides the dry atmosphere necessary for mm-wave observations. It has been agreed that the MT can go there and several RAL staff have already made visits to survey the site, measure atmospheric water vapour and set up meteorological instruments.

Sales to Employees

Sales of scrap metal/plastics as set out in RLN 12/73 will be made on 9 and 23 January at the Scrap Compound, rear of R40 from 1200 - 1230hrs.

New Pasta - time ?

How would you like to feed 25 metres of wet spaghetti down a 25 metre length of plastic tube only 7 millimetres in diameter? In fact, how about feeding 20 such pieces down the same tube, with no breakages allowed? Difficult? Impossible? Ask the Physics Apparatus Group! Recently they have put 7000 lengths into plastic tubes for the Proton-Antiproton Experiment at CERN.

The "spaghetti" was actually 25 metres of quartz fibre, 1 millimetre in diameter, very flexible and fragile. These fibres are used to calibrate the detector by transmitting ultra-violet light from a pulsed laser to each of the 7000 scintillators in the hadron calorimeter (which measures the energy of the hadrons produced in the $p\bar{p}$ collisions). The fibres are mounted in the plastic tubes for protection, cleanliness and to ease some of the assembly problems. Either 16 or 25 fibres (colour-coded for identification) were put down each tube. This work was completed with very few broken fibres and now all fibres are mounted on the detector.

Come and take a look next time you are at CERN.

Well done lads!

We thank R J Homer for this delightful snippet.

SNS Ion Source Success

A major success was achieved on Tuesday 2 December when the prototype SNS Ion Source delivered its first H^+ beam at an efficiency nearing its design specification.

Unique

An important feature of the SNS accelerator is the use of H^+ charge exchange injection to increase efficiency. To achieve the necessary circulating beam intensity the 70MeV linear accelerator is required to deliver 40mA of H^+ ions in pulses 500 μ s long at a repetition rate of 50Hz. There are at present no H^+ ion sources that can operate at such a high duty factor and produce high quality beams suitable for accelerators. The recent success therefore represents a significant advance in the development of such sources.

The prototype ion source consists of a discharge chamber and a magnet and extraction assembly. Energetic hydrogen atoms and protons (H^+ ions) produced in the hydrogen discharge are converted into H^+ ions at caesium covered cathode surfaces. These H^+ ions are then extracted at 18kV through a 90° sector magnet. This removes all unwanted ions and electrons from the extracted beam and focusses it into a shape suitable for injection into the 665 keV preinjector column. The use of magnetic rather than electrostatic

focussing also prevents excessive blow up of the beam by enabling space charge neutralisation to occur. The correct coverage of caesium on the cathode is provided by injecting the caesium into the discharge at a carefully controlled rate by means of a boiler assembly.

Stability is Vital

In order to produce a high quality beam, all power supplies must be of high stability. For example, the extraction voltage of 18kV must not drop by more than 50 volts during a pulse even when loaded with a drain current of 100mA. All supplies have been developed by our own Electrical Engineering and Operations Group.

It is expected that small adjustments to the source will enable the full design intensity to be achieved shortly.

We thank Peter Gear for this encouraging news.



Lecture Theatre - 8 Jan - 3.15pm

LASER DRIVEN COMPRESSION AND FUSION
by Dr Mike Key

Lasers generating optical power in the terawatt (10^{12}) region are being used in the laser division and elsewhere for research into compression of tiny spherical targets to ultra-high pressure (greater than 10^9 atmospheres). One motivation is to study the physical properties of matter under such extreme conditions but there is also an important practical objective, namely controlled (miniaturised H-bomb) thermonuclear fusion for energy production. The lecture will describe with some practical demonstrations the principles of high power lasers. Then compressions in spherical implosions will be discussed and it will be shown (no demonstrations!) how the conditions for thermonuclear explosions can be reached.

Lectures

ASTROPHYSICS SEMINARS
CONF. RM. R61 - 1400

17 Dec. Dr Douglas C Heggie/Edinburgh
"Globular Clusters in Collapse"

TWO INTRODUCTORY TALKS
CONF. RM. 5 - R20

13 & 20 Jan. J M Loveluck/RAL
"The Classical Heisenberg Chain with Anisotropy Fields, Crossovers, Scaling, Energy Fluctuations and Solitons".

CAROL SERVICE

Lecture Theatre - Mon. 22 December
12.30 pm.

All are welcome to come along for a time of seasonal carol singing lasting about 40 minutes.

This year's service will be led by the Rev. Brian Meardon, an ex-member of Neutron Division, now an Anglican priest in Reading.

You will also be amazed by the musical versatility of a number of staff, who will bring to us special items (it was thought that an appropriate name for them might be the "Quasar Quintet"!). We will be accompanied by yet another member of staff on piano.

Acknowledgement

Helen Reader, Philip and Brian would like to thank Jim's many friends and colleagues for their letters of sympathy, generous contributions to the nominated charities and the signed book of Remembrance they have received. They would also like to express their appreciation to the many friends who attended the funeral service. Please accept this as a personal acknowledgement.

Thanks

All too soon another year has flown by, compensated only by the tradition that the Christmas edition allows the editor a chance to thank all who have given such invaluable help in making the task of producing the "Bulletin" almost painless.

My sincere gratitude then, to all my colleagues in Reprographics, Photography and, of course, in the Typing Pool; to contributors, to whom I again apologise, for mistakes past and present and I fear, future - and to readers for pointing them out!

May I wish you all a very happy Christmas and continuing success in the coming year.
(I need the copy!)

Trade Exhibition

There will be a one-day exhibition by TELONIC/BERKELEY UK on Tuesday 13 January from 1000 to 1600 hrs. in Conference Room, Building R12. On show will be filters, attenuators, swept frequency generators, RF amplifiers and digital instruments.

Christmas in the Restaurant

Special dishes will be served in the Restaurant from 16-19 December for the Christmas Celebration. Menus and Wine Lists will be circulated to all staff. Prices for these dishes will be about £1, vegetables extra.

A limited number of reservations will be available by telephoning Ext 6229. Wine can also be ordered at the same time. The Restaurant will be open during the Christmas period:

Mon-Thurs. 15-18 Dec. 11.45-13.45
Evening 17.00-19.00

Friday - 19 Dec. 11.45-13.45
No evening service

Mon-Tues. 22-23 Dec. 11.45-13.45
Evening 17.00-19.00

Wed. 24 Dec. 11.45-13.30
Grill and Salad Bar only
No evening service

Mon-Wed. 29-31 Dec. 11.45-13.30
Grill and Salad Bar only
No evening service

Open Days Film

Several people have asked us to re-run the film which was specially made for the Open Days 1980. Entitled "Partnership in Research", the film outlines a wide range of research involving SRC staff working closely (in partnership) with university scientists. The scene is set mainly at Chilton with some location filming at the CERN Laboratory in Geneva and at the Institut Laue-Langevin in Grenoble.

The film was produced by Michael Hall from the Department of Drama at Bristol University. Michael, an arts graduate, succeeds in conveying an attractive yet effective impression of the SRC's role in fostering university research.

The film will be shown at 12.30pm on Tuesday 6 January 1981 in the Lecture Theatre.

Light Lecture

Anyone interested in the History of light sources from Swan & Edison to the present day, is welcome to attend a Christmas Lecture "Developments in Lighting" by Dr F A Benson of Sheffield University at 'Elms Court' Botley, Oxford on Monday 15 December at 7.30pm.

Admission is free and Bar facilities are available.

HARWELL Rec. Association

At the recent AGM of the Association it was agreed that it should be retitled HARWELL RECREATIONAL ASSOCIATION. The reasons for the change, taken after thirty years under its former 'AERE' title, were the combination of, the wider range of associated laboratories whose personnel are eligible for membership (ie. MRC, SRC, NRPB, TRCL, ARC, Culham) coupled with the fact that the Establishment is now known locally and nationally as 'Harwell' rather than 'AERE'.

Also at the AGM, subscription rates were increased. The new rates which become effective on 1 Jan. 1981, will be as follows:

Category	Deduction Rate	Annual Rate
Ordinary	Weekly 19p	£9.88 (weekly)
	Monthly 83p	£9.96 (monthly)
Adult Family	-	£5.00
Junior Family	-	£2.50 (Under 18)
		£10.00 (Over 18)
Associate (Auth.)	-	£10.00
Associate (Club)	-	£15.00

All members, other than Ordinary members are reminded that all memberships expire on 30 April annually.

Social Club Opening Times

Saturday	Lunchtime	Evening
Upstairs	11.30am-2.30pm	7-11pm
Games Bar		
Lounge Bar	Closed	8-11pm
Sunday		
Upstairs	12 noon-2.00pm	7-10.30pm
Games Bar		
Lounge Bar	Closed	8-10.30pm

During weekdays, the usual lunchtime opening of 12 noon - 2pm will be operated in both bars. The Games Bar will open at 7pm each evening and the Lounge Bar at 8pm.

Closing times remain unchanged.

Training

Commodore PET Programming Courses

AERE Education and Training Centre is proposing, in March/April 1981, to run a practical course in BASIC for staff involved with the PET system. RAL staff who are interested should contact TRAINING SECTION, R20 Ext.266.

Bulletin

Editor: Jean Banford
Building R20
Rutherford and Appleton Laboratories
Chilton, Didcot, Oxon OX11 0QX
Abingdon (0235) 21900 ext 484

Deadline for insertions: