

Bulletin

of the Rutherford Appleton Laboratory

2 Nov. 1981 No.19

RAL Wiggler at Daresbury

The 5 Tesla superconducting Wiggler magnet, designed and built at RAL, has just been successfully tested with its refrigerator at Daresbury. The magnet will be installed in the Synchrotron Radiation Source (SRS) at Daresbury and will extend the useful wavelength of the machine down to about 0.1 \AA . The testing of the magnet/yoke system was reported in Feb 81 (Bulletin No 3) this article gives an account of its incorporation into its horizontal cryostat and final testing.

Integration

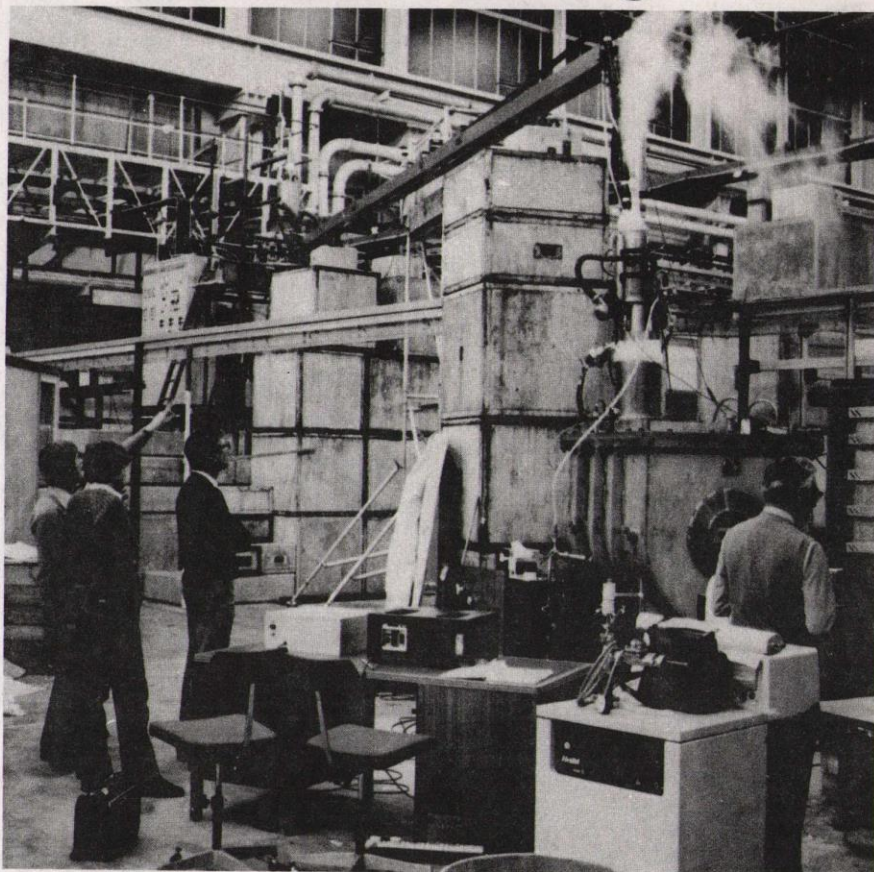
The problem of integrating the magnet into the SRS dictated the limited physical dimensions of the cryostat and its operation from its closed loop refrigeration system necessitated a helium vessel capable of withstanding 10 bar pressure.

The magnet was built into its cryostat in R25 Heavy Duty Laboratory before it was delivered to Daresbury in August 1981 (Daresbury News 10).

At Daresbury transportation plugs were removed from the cryostat and a dummy beam tube fitted through the magnet bore. The long helium transfer line between the refrigerator and cryostat was inserted for the first time and the cryostat was then ready for its first cool down coupled to its associated refrigerator. Cool down to liquid helium temperature (4.35K) took about 80 hours for this run but with the experience gained it is hoped to reduce the cool down time to ~ 48 hours on a fully computer controlled automatic system.

Commissioning

Final testing of the magnet was to commission the instrumentation racks and quench detection system built at RAL together with the power supplies and to measure the magnetic field produced. The system was energised and a field of $\sim 5.5\text{T}$ was reached without a quench, this gives an operating margin of $\sim 10\%$ over design field. A quench was induced at a field of $\sim 5\text{T}$ and the detection system and the cryostat performed



The 5 Tesla Wiggler magnet undergoing successful tests at Daresbury.

satisfactorily. The magnet field integral measurements were very close to that predicted by the computer code GFUN3D. The trim currents necessary to correct the errors in the dipole field were checked and these will be fed into the computer for automatic trimming when in the SRS. The measured harmonic errors were within the correction capability of the SRS multipole magnets.

using the Daresbury control computer the magnet will be cooled down, energised and warmed up automatically before installation into the SRS during December.

For detailed technical information of the superconducting magnet contact B Wyborn on ext 447.

In Excellent Shape

In conclusion the magnet has achieved its design field and the cryostat operated successfully in conjunction with its refrigerator and power supplies. The final beam tube will now be assembled into the cryostat and

UOSAT Calling

Anyone walking along the top corridor of R25 last week, between 2 and 5 o'clock, would have been surely puzzled by the strange sounds, not unlike a demented cuckoo emanating from one of the offices. Those inquisitive enough to step inside would have ascertained immediately that the local origin of this sound was a 2-meter band receiver, tuned to pick up telemetry signals from the newly launched UOSAT spacecraft. UOSAT is the latest in the series of radio amateur spacecraft, and the first British Educational Satellite. It is also the first satellite to carry an experiment from the recently combined Rutherford Appleton Laboratory.

Space Science at School

All the previous radio amateur spacecraft launched under the auspices of AMSAT (Amateur Satellite Corporation) have been primarily intended for relaying radio signals, thus increasing the VHF and UHF range of transmissions by radio amateurs. UOSAT has a different function: its purpose is to stimulate a greater interest in space science amongst schools, colleges and universities, to provide radio amateurs with a tool for studying the ionosphere through which their transmissions travel, and to establish an active body in the UK with the resources to contribute further to the amateur satellite program. The UOSAT spacecraft carries a number of experiments intended for scientific research. These include a series of beacons transmitting at different frequencies; two particle counters to provide information on solar activity and auroral events; and a magnetometer identical to those used on the VOYAGER missions to Jupiter and Saturn - for measuring the Earth's magnetic field.

UOSAT (University of Surrey Satellite) was built by the Department of Electrical Engineering of the University of Surrey at Guildford, under the project management of Dr Martin Sweeting, and sponsored primarily by the UK, USA and West German sections of AMSAT, British Aerospace, British Telecom, Feranti Ltd, MEL Ltd, Racal and the Radio Society of Great Britain. It was launched by a (NASA) Delta 2310 rocket from Western Test Range California riding piggy back on the launch of SME (Solar Mesospheric Explorer). The launch at 6 October put UOSAT into a roughly polar orbit at a height of 549 kilometres. The orbit is sun synchronous in a 3am-3pm orbital plane (the satellite travels from North to South in the morning hours), with an expected lifetime, before re-entry, of four to five years.

The RAL interest in UOSAT began in September last year, when we were invited by the UOSAT team to provide an experiment which could monitor Solar particles and auroral events. The

basis of the experiment is two LND type Geiger-Mueller tubes which are designed to measure fluxes of electrons above threshold energies of approximately 20 and 40 keV. The tubes have thin mica end windows and are filled with neon together with a small quantity of halogen to provide the quenching. In addition to detecting electrons the tubes also detect protons of approximately 20 times higher energy.

Under control of the spacecraft's powerful on-board computer (based on an RCA 1802 microprocessor) the experiment will operate continuously, information being relayed to ground in two different forms.

In what is known as fast-time format each detector is read ten times each second, the information stored in the computer memory and relayed to the control centre on command. In this way it should be possible to store enough data to build up a clear picture of the more interesting precipitation regions i.e. the north and south auroral ovals and the polar caps. Using the real-time format the satellite transmits continuously to ground, every eight seconds, the average count rate. These two formats available from UOSAT make it potentially useful for professional researchers and amateurs alike. In particular amateurs operating close to the auroral zones will be able to compare directly their communications results with real-time measurements of the electron fluxes. Those working at lower latitudes will have similar data at their disposal in the form of stored data read-out from the on-board memory.

Domestic TV Display

In addition UOSAT possesses one other feature of special interest to science groups and radio amateurs. It is the first satellite designed to transmit data, including pictures of the earth's surface, in a form which can be readily displayed on a domestic TV. The pictures are obtained from an earth pointing camera which images a 500 X 500 km area of the earth's surface equivalent to most of England south of Newcastle or the whole of Scotland. This image is formed on a solid-state charged coupled device and stored in the spacecraft computer for transmission to ground, a process taking 3 to 4 minutes. Unlike images from a conventional weather satellite, the picture will be transmitted in such a way that it can readily be received and stored by a simple receiver. The picture will have a resolution of about 2km and will show 16 grey levels.

At the time of writing (21 October 1981) UOSAT is in excellent shape. The average spacecraft temperature has stabilised at about -8°C , and the solar-cells battery and radio beacons are all working correctly and transmitting details of the spacecraft

health and attitude. Over the next two to three weeks a long boom with a weight attached will be lowered from the spacecraft, which when fully deployed will maintain the axis of the spacecraft roughly (roughly because of drag forces) vertical. The particle counters have been switched on and are functioning correctly. A full evaluation of the experiment will be made when the on-board microprocessor has been activated.

We are indebted to D R Lepine for news of this project.



The scope of the "What's New?" lecture series has been widened to include all interesting programmes within SERC and (occasionally) to invite eminent speakers from outside RAL.

The new season last year opened with a "bang" with David Clark's talk on stellar explosions. This year we head into space to view the Earth from orbiting satellites. The first lecture is:

"OBSERVING THE CLIMATE FROM SPACE"

by John Houghton at 3.15pm on Thursday 5 November 1981 in the Lecture Theatre

Satellites are used for observing the atmosphere, ocean and land surface through "remote sounding" measurements over a wide range of the electromagnetic spectrum. In particular, microwaves can provide valuable information on the global surface of the oceans.

DO COME ALONG & ENJOY THIS "WHAT'S NEW?" LECTURE

for the future, please note in your diary:

Thursday 10 December 1981:
"SYNCHROTRON RADIATION-THE LIGHT FANTASTIC" by Ian Munro (Daresbury Lab.)

Thursday 4 February 1982:
"HIGH POWERED PERSONAL COMPUTER SYSTEMS" by Bob Hopgood

Wednesday 10 March 1982:
"SNS-NEUTRONS GALORE" by David Gray

New Post for Rishbeth

Henry Rishbeth, Geophysics and Radio Division, has been appointed Visiting Senior Fellow at the Department of Physics, University of Southampton for a period of three years. He will divide his time between the University, where he will join Pamela Rothwell's group engaged in upper atmosphere research, and RAL, where he will continue his work in ionospheric physics, particularly in connection with the European Incoherent Scatter radar project EISCAT, for which he is UK project scientist. EISCAT has recently begun to produce exciting new data for the polar ionosphere; it was formally opened by HM the King of Sweden on 26 August 1981.

Lazy Days

An account of the 1981 Interdepartmental Race as seen from Lazy-S

This year at SERC, our plans for the Interdepartmental started with two Contessa 32's chartered from Festina Yachts, but then three other SERC skippers all independently found private charters of competitive yachts at equally competitive rates. Lawrence Byrne and Martin Hall then took on the complex task of finding sufficient SERC sailors and assembling balanced crew lists, a process which continued right up to the last minute. Crews were mixed between the various SERC sites to ensure an integrated team and the final crews contained 26 members plus two yacht owners. About half of the crews had little or no previous offshore racing experience but all five yachts completed both races and performed with credit in a field of 26 entries as follows:-

Yacht	Type	Skipper	Position
Lazy-S	Sigma 33	C Sutherland, RAL	1st
Eymet	Contessa 32	G Stapleton, RAL	7th
Archimedes	"	M Hall, RAL	10th
Secunda	"	M Hawkins, ROE	13th
Dartella	Offshore	8m.P Moore, DL	20th

Dartella was one of the smaller yachts and did well to finish both races despite gear damage.

Preparation

On Lazy-S we had sailed very little together before, so we decided unlike the other SERC yachts to go on the optional two days training course at the National Sailing Centre, Cowes, before the competition races. This turned out to be an excellent idea all round.

In spite of strong winds the instructors soon had the ten yachts racing back and forth on very short courses while they whizzed about in rubber dinghies shouting at us and occasionally leaping aboard. We practised starting, reefing, sail changing, tacking, gybeing and spinnaker work repeatedly until we worked smoothly as a team.

In the shore lectures Rod Carr the Chief Instructor emphasized the need for a set of defined tasks on each boat, and then finding a way of combining these into jobs which suited each available crew member. The helmsman must concentrate only on the sails, the wind and the waves. Tactics, tides and navigation is another separate job and the skipper may do any one of these jobs but certainly not all three.

We soon decided that John was our best helmsman, and should steer throughout the races. With my previous Sigma 33 racing experience I then became crew boss and the other jobs fell naturally into place. After some more practice on the Wednesday in gale force conditions we were ready for anything.



Racing

The racing from Cowes was organised by the Island Sailing Club and three races were planned.

- Race 1. Long Solent Course
Thursday 8th. 1030
- Race 2. Short Solent Course
Friday 9th. 0930
- Race 3. Cowes - Cherbourg
Friday 9th. 1430

OR

- Race 3. Long Solent Course
Saturday 10th. 1030

The Solent courses to be displayed at the ten minute gun as a letter sequence above the starting box. On Thursday gales were forecast and Race 1 was first postponed and then cancelled. The Solent was white with waves but very few sails as we watched from the Island S.C. balcony over lunch. In mid afternoon there was a lull for a few hours, and several CSSA yachts held a series of informal races round the bouys near Cowes and showed it was possible. On Lazy-S we checked the safety gear and oiled our bolt croppers!

On Friday the gale force winds persisted so a short 9 mile triangle was set, a run, a reach and a beat in the Eastern Solent. Two spinnakers were seen for a short period on the first leg but one of those soon blew away in shreds.

On Lazy-S we carried working jib throughout and changed the mainsail from 2 reefs to three for the last beat back through the waves. By keeping moving steadily without any broaches or sail changing problems as seen elsewhere we finished second on handicap.

The next race on Saturday was a slightly larger triangle of 11 miles starting with a beat to the west. The wind was about SW force 5 at first but as it swung to SE and lightened full sail became possible at last.

On Lazy-S after a second rate first leg we found our form and gained steadily on both spinnaker legs and the second beat. Some tide dodging and boat tactics helped put us second across the line, clearly first on handicap and first overall in the series.

Much of the credit must go to John Spivey the owner for providing such a superb fast and reliable yacht and for steering it so immaculately all the way. The rest of the crew was made up as follows:-

Clive Sutherland	Skipper
Ken Pavitt	Crew boss/navigator
Graham Toplis	Foredeck
Mike Courthold)
Colin Cumming) Cockpit winches

There must have been many more moments of excitement and drama on the other yachts, everything went very smoothly and efficiently for us with a minimum of errors by all the crew.

We must thank RAL Rec.Soc. for their supporting grant towards expenses, and hope we have performed as they wished.

Ken Pavitt

Film Badge Notice

It is PERIOD 12 Colour strip BLUE Please check that you are wearing the correct film badge and that all old ones are returned.

Next Film Change
Monday 30 November.

Jack Dawson Retires

Jack Dawson really enjoyed the farewell presentation, his friends and colleagues prepared for him to mark the occasion of his retirement on Monday 28 September. In fact he has enjoyed all the time he has been associated with this area, both as a Harwell man from 1957 - 1960 and his Chilton days, with what has become RAL, from 1960 to date.

One of a rare breed, qualified as both mechanical and electrical engineer, Jack started his working life as a trade apprentice with Metropolitan Vickers. He became a draughtsman, was promoted to design engineer and by 1956 was lecturing part-time at the Royal Technical College, Salford.

In Nimrod days he worked on the magnet coils, water cooling also power cabling and distribution, but his *pièce de résistance* is said to have been his plunging extraction magnet! Subsequently he transferred to Superconducting work, which is why Dr David Thomas had the pleasure of making the presentation of gifts of a multi-meter, a calculator and the



traditional card on behalf of all Jack's friends. David thanked Jack for all his efforts on behalf of the Lab and wished him all the best for the future.

Jack thanked all for their kindness, and invited them to call on him at his home in East Hendred, where they would always be welcome.

HortSoc

The Society have arranged for Ken Burras, Superintendent of the Botanical Gardens, Oxford to give an illustrated talk "Plant Hunting in the Lost World".

If you would like an enjoyable evening in the company of an expert lecturer, come along to the RAL Lecture Theatre on Wednesday 4 November at 7.30pm. Tickets, 50p members, 60p non-members (including coffee) are available from Mrs B Miles Harwell Ext 4712 or J Hogston, SERC Ext 6692.

Coffee at Cosener's

More than twenty RAL wives enjoyed a very pleasant Coffee Morning in September at Goldie Stafford's house, when a small presentation was made to Mrs Stafford from the group in recognition of the support she has given over the years.

We are pleased to see that the wives of our Appleton colleagues are now joining these coffee mornings and we hope to welcome more of you to our next meeting which will be at the Cosener's House, Abingdon on Thursday 12 November at 10.30am till 12 noon.

If you are new to RAL or have transport difficulties - or would like more information, please ring either Mary Rousseau, Wantage 3676 or Ann Corbett, Abingdon 20434.

Thanks

Jean Naish would like to say another thank you to all her friends and colleagues at RAL for the beautiful china she received as a farewell present. She is sorry that she could not say goodbye to everyone personally, but remembers you all with gratitude.

Reg Atkinson thanks all at RAL who made his retirement send-off so memorable. He writes, "I would have had to use a Laboratory Circular to contact everyone, and even though I made some extensive tours I am sure there will be those I have missed. Goodluck and Bon Voyage to everyone".

Jack Dawson would like to thank all those friends and colleagues who so generously contributed to his leaving gifts, and wishes to remind everyone that they are invited to call at "Brandelhow" where they will be most welcome.

Coming Soon



Quarks to Quasars

For those who remember last July, the epic film of the event has at last gestated from the photographic unit and will be shown on Wed 11 November and Thursday 12 November at 12.30 and 1315 hrs.

Photographed by Peter Hicks and produced by Roger Burdett, the film is a pictorial digest of some of the major projects of the Laboratory using the displays at Open Days to illustrate brief introductions by the senior staff involved. With the Press Conference as a frame to the film, the pictures were shot entirely (well almost) during that week.

There are no prizes for picking yourself out and we have tried to avoid all shots containing people doing embarrassing things in the corner of the frame.

From Richard Cooke

Richard Cooke, the young son of Leona Cooke thanks everyone at RAL for their contributions to the Memorial Fund to his mother. He writes to say that it has been well invested for his future. He sends his best wishes to everyone in the Lab who helped.

Bulletin

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Deadline for insertions:

INTERNAL Events

HEP SEMINARS

R61 CONF RM - 1100 hrs

- 11 Nov Prof L Castillejo/UCL
'A large Toroidal Quark Bag:
Explanation of the Judek
Effect'
- 18 Nov Dr I G Halliday/IC
'Structure of SU(2) Lattice
Gauge Theory'

NIMROD LECTURES

R61 CONF RM - 1400 hrs

- 26 Nov Dr G Myatt/Oxford
'Tests of QCD in Neutrino
Interactions' (Hawaii Review)

REMOTE SOUNDING SEMINARS

R61 CONF RM - 1530 hrs

- 10 Nov Dr C J Gibbins/RAL
'Ground-Based Measurements
of Mesospheric Constituents
from Haystack Observatory'

ASTROPHYSICS SEMINARS

R61 CONF RM - 1400 hrs

- 11 Nov Michael V Penston/RGO
'Complex UV Variations of the
Active Galaxy NGC 4151'
- 18 Nov Ken J Phillips/RAL
'Soft X-ray Solar Flare
Spectroscopy from SMM'

CONDENSED MATTER SEMINARS

CONF RM R3 - 0930 hrs

- 3 Nov R Cywinski/RAL
'Anomalous Resistivity in
Transition Metal Alloys (a
Neutron Scatterer's View)'
- 7 Nov W S Howells/RAL
'Structure and Dynamics of
Aqueous Solutions'

EXTERNAL Events

THEO. PHYS. SEMINARS

T.P.D L. Th. - HARWELL - 1400 hrs

- 2 Nov Dr B A Nash/ICI
'Flow Modelling in Industry'
- 10 Nov Mr A M Lane/Harwell
'Time Dependent Effects in
Nuclear and Atomic Physics'
- 17 Nov Prof F Nabarro/Cambridge
'Recent Developments in the
Physics of Dislocations'

NPD COLLOQUIUM

CONF RM H8 - HARWELL - 1530 hrs

- 19 Nov Prof H H Hopkins, FRS/Reading
'Videodiscs'

THEO. PHYS. SEMINARS

QMC - LONDON - 1615 hrs

- 9 Nov Prof L Castillejo/UCL
'A Large Toroidal Quark Bag
Model to Explain the Judek
Effect'
- 16 Nov Prof J B Pendry/IC
'The Evolution of Waves
in Disordered Media'

ELEM. PART. THEO. SEMINARS

NPD - OXFORD - 1430 hrs

- 6 Nov J Halliday/IC
'Monopoles and Mixed Lattice
Gauge Theories!'
- 13 Nov S F King/Oxford
'Composite Models of Quarks
and Leptons'

ELEM. PART. PHYS. SEMINARS

NPD - OXFORD - 1430 hrs

- 11 Nov Dr M Albrow/RAL
'Antiproton - Proton
Collisions at the CERN ISR'
- 13 Nov Prof B P Roe/Michigan
'New Results from the
Fermilab Beam Dump
Experiments'

PHYSICS COLLOQUIA

CLARENDON LAB - OXFORD - 1615 hrs

- 6 Nov Dr J E Midwinter/British
Telecom
'Digital Transmission on
Optical Fibres'
- 13 Nov Prof H Faissner/RWTH Aachen
'The Evidence for Axions'

SOLID STATE SEMINARS

CLARENDON LAB - OXFORD - 1430 hrs

- 5 Nov Dr G Jug/Oxford
'Renormalisation Group
Studies of Polyelectrolyte
Chains'

HEP SEMINARS

MANCHESTER - 1430 hrs

- 5 Nov Dr C Yanagisawa/RAL
'QED Tests with the JADE
Detector at PETRA'
- 12 Nov Dr G Ringland/RAL
'Technicolour and Its
Experimental Consequences'
- 19 Nov Dr R L Sekulin/RAL
'Bubble Chamber Holography -
Its Status and Prospects'

PART. PHYS. DISC. GP. MEETINGS

BIRMINGHAM - 1615 hrs

- 6 Nov Dr B Saitta/Oxford
'Transverse Properties of
Hadrons in Neutrino Charged
Current Interactions'
- 13 Nov Dr P Landshoff/DAMPT
'Status of Perturbative QCD'

PHYSICS COLLOQUIA

BRISTOL - 1700 hrs

- 2 Nov Dr D Walsh/Jodrell Bank
'Can a Sober Astronomer See
Double Through a Gravitational
Lens?'
- 16 Nov Dr E Atkins/Bristol
'Recent Advances in the
Structure and Interaction of
Polysaccharides'