Bulletin
of the Rutherford and Appleton Laboratories 9 Feb. 1981 No.3

Happy Birthday IUE

On 26 January the International Ultraviolet Explorer (IUE) satellite completed three years of outstandingly successful operation as an orbiting astronomical observatory. A joint venture of the Science Research Council, the 11-member European Space Agency and the American National Aeronautics and Space Administration, IUE has been used by over 600 scientists from all over the world.

The satellite was launched from Cape Canaveral, Florida on board a NASA DELTA 2914 rocket and was placed in a geosynchronous orbit over the Atlantic Ocean. Here the satellite drifts back and forth over the equator at a distance above the earth of between 25,000 kms (15,700 miles) and 46,000 km (28,800 miles). In this orbit the satellite ranges to about latitudes 29° North and South and is kept on station by occasional use of on-board hydrazine jets. It remains in constant view from the NASA station at the Goddard Space Flight Center, Washington and for at least 10 hours per day from the ESA station at Villafranca del Castillo (VILSPA) near Madrid, Spain.

On board, the 45cm diameter telescope focusses radiation from astronomical objects, e.g. planets, stars, onto a spectrograph. The resulting spectrum is recorded by an ultraviolet sensitive television camera for subsequent transmission to a ground station.

International Venture

The IUE observatory is an international operation. ESA, who provided the spacecraft solar arrays, finance and operate the Madrid ground station which is used by UK astronomers. NASA's contribution includes the provision of the spacecraft, the scientific intrumentation, satellite control and data acquisition computer programs.

The ultraviolet sensitive television cameras and associated image processing computer programs were provided by the SRC. Much of the design, development and construction of the cameras and image processing was carried out at Ditton Park in collaboration with University College, London. Chilton scientists are closely involved in management of the IUE project (Peter Barker is head of the project) and also provide two resident astronomers; one at VILSPA, Spain and the other at Chilton. The data, stored on magnetic tape, are kept in the World Data Centre at Ditton Park, and are availabe to all astronomers.

IUE observing time is shared: two thirds to NASA, one sixth to ESA and one sixth to the SRC. This one sixth share amounts to about 160 eight hour shifts in one year. It is always heavily oversubscribed by UK astronomers. The flexibility of the instrumentation is one reason why telescope time is so sought after. The design of the spectrographs is such that it allows the study of bright objects at very high spectroscopic resolution or - at the press of a button at the ground station- feint objects at a lower resolution. The high sensitivity of the UK designed cameras is another reason. They allow study of objects that to the the (ultraviolet) eye are very feint indeed, such as external galaxies and those enigmatic objects quasars.

Breadth of Research

A most impressive aspect of the IUE mission has been the great breadth of astronomical research carried out with the telescope. Spectroscopic studies have been made of most of the primary objects in the solar system, including Jupiter and Saturn, comets and asteroids. In stellar astronomy a large variety of studies have been made of stars of all types from the very young to the highly evolved. Extensive stellar winds have been detected in the hotter stars which are causing theoreticians to rewrite the theories of stellar evolution. The IUE has also proved successful in studying the corona and chromospheres of cool stars - a somewhat unexpected bonus.

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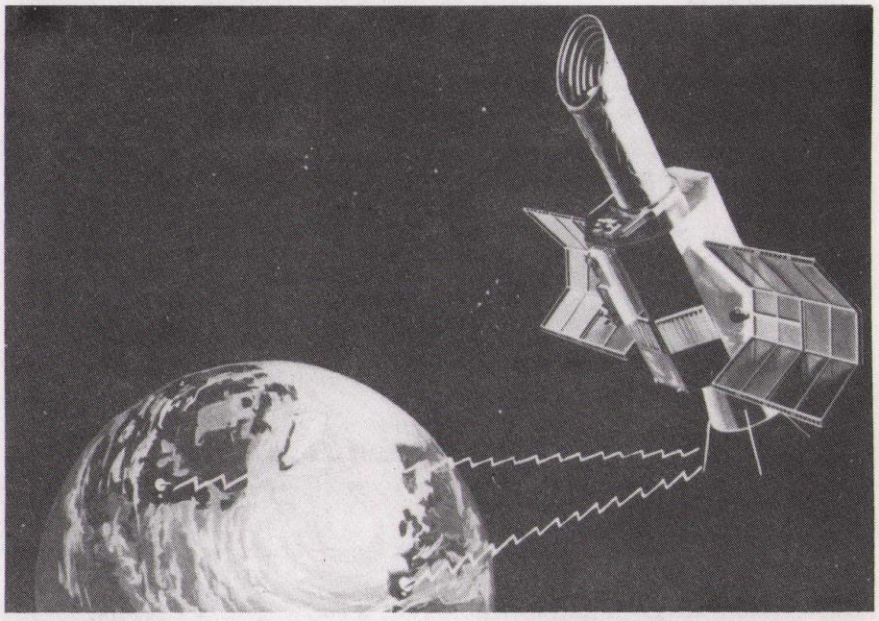


An artists impression of the International Ultraviolet Explorer in its geosynchronous orbit above the Atlantic Ocean. The telescope mirror sits protected in the body of the satellite but the telescope tube can be seen extending upwards from the spacecraft. On the top of this tube there is a sun baffle which is designed to minimise the amount of scattered sunlight entering the telescope. Note also the solar panels and the spacecraft antennae, the latter being used to transmit the ultraviolet images to the two ground stations. 34747

INTERNAL Events

ASTROPHYSICS SEMINARS
CONF ROOM R61 - 1400 hrs

11 Feb Dr Geoffrey T Bath/Oxford
'Accretion Power in Astrophysics'

18 Feb Dr Karel A van de Hucht/Utrecht
'Very Hot Stars and Binary/ Systems'

NIMROD LECTURES
R61 CONF RM - 1400 hrs

9 Feb Prof F M Pipkin/Harvard & CERN
'Studies of b quark using the Cornell e^+e^- Storage Ring'

23 Feb Prof D Schildkneckt/Bielefeld
No Title

LECTURE THEATRE - 1400 hrs

16 Feb Dr E Uggerhøj/Aarhus
'Channeling'

HEP LECTURES
R61 CONF RM - 1100 hrs

11 Feb Dr D Caldi/Max-Planck Inst.
'The Importance of Being Topographically Excited'

EXTERNAL Events

THEOR PHYS SEMINAR
COCKCROFT HALL-HARWELL-1400 hrs

17 Feb Prof M Gowing FBA/Authority Historian
'Britain, America & the Bomb'

PART. THEO. SEMINARS
NPL-OXFORD-1430 hrs

13 Feb D Caldi/Max-Planck Inst.
'The Importance of Being Topographically Excited'

PHYSICS COLLAQUIA
CLARENDON LAB-OXFORD-1615 hrs

13 Feb Sir David Phillips FRS/Oxford
'Dynamic Properties of Proteins'

20 Feb Prof N Fortson/Washington
'Parity Non-Conservation in Atoms'

THEO.PHYS SEMINARS
CLARENDON LAB-OXFORD-1615 hrs

19 Feb Dr T W Marshall/Manchester
'Of Dice and Gods'

THEO.PHYS SEMINARS
MANCHESTER - 1430 hrs

11 Feb Prof J Griffin/Maryland
'Two-dimensional Random-Walk Description of Nucleon Transfer in Deep Inelastic Collisions'

18 Feb Dr Q K K K Liu/Minnesota
'The Seven Nucleon System and the Solar Neutrino Puzzle'

ELEM PART PHYS SEMINARS
NPD - OXFORD - 1430 hrs.

11 Feb Prof F Pipkin/CERN & Harvard
'What has been learned about b-quark Properties from CESR?'

19 Feb Dr K Winther/CERN
'Some Recent Results in Neutrino Physics Obtained by the Charm Collaboration'

THEO.GROUP SEMINARS
DARESBURY - 1400 hrs

9 Feb Dr A Bray/Manchester
'Metastable States in Spin Glasses'

16 Feb Dr NC Sil/UCL
'Transition to Rydberg States by Charge Transfer'

NPD COLLOQUIUM
CONF RM H8-AERE-1530 hrs

12 Feb Dr D N Stacey/Oxford
'Throwing light on Nuclei -Measurements of Isotope Shifts'

THEO PHYS SEMINARS
QMC - 1615 hrs

16 Feb Dr G P McCauley/Birmingham
'Confinement by Entanglement?'

23 Feb Dr S Lovesey/RAL
'Dynamic correlation in one-dimensional magnets: a Review of the Theory and Computer Simulation Data'

HEP SEMINARS
DAMTP-CAMBRIDGE-1500 hrs

13 Feb Prof G Mack/DESY
No Title

20 Feb Dr C Sachrajda/Southampton
No Title

PART PHYS DISC.GP
BIRMINGHAM - 1615 hrs

13 Feb Dr J Fry/Liverpool
'Preliminary Results from NA5 on Hard Hadron Scattering Processes'

20 Feb Dr F Close/RAL
'Filling Cavities with QCD'

PHYSICS COLLOQUIA
BRISTOL - 1700 hrs

16 Feb Prof S D Smith/Heriot-Watt
'Spin-flip Raman Lasers'

23 Feb Prof H O Berktay/Bath
'Underwater Ultrasonics'

SHEP SEMINARS
SOUTHAMPTON - 1430 hrs

13 Feb Dr G Mack/DESY
No Title

18 Feb Dr S Frank/Southampton
'Pion Electron Scattering at 300 GeV'

IUE (continued)

Exciting discoveries have been made in the interstellar medium. Perhaps the highlight here is the detection of a very hot but highly tenuous halo of gas around our galaxy, as well as a possible halo associated with a nearby galaxy, the Large Megellanic Cloud. This work has significance to the long standing question of the origin of the multiple absorption lines in the high redshift quasars and indicate that part of these could be produced in the halos of intervening galaxies.

In extragalactic astronomy, IUE has made major contributions. Much international collaboration has gone on to obtain good data on faint objects. The faintest and most distant quasar yet obtained with IUE has a magnitude of 17.5 and a redshift 3.2 It has also studied the "twin" quasar which is believed to be a double image formed by an intervening galaxy acting as a gravitational lens. The ultraviolet specta are quite consistent with this picture.

These are just a few of many research topics covered by IUE over the last three years. We look forward to more discoveries in the future.

We thank Chris Blades for this interesting history of IUE's first succesful years.

RAL Wiggler for Daresbury

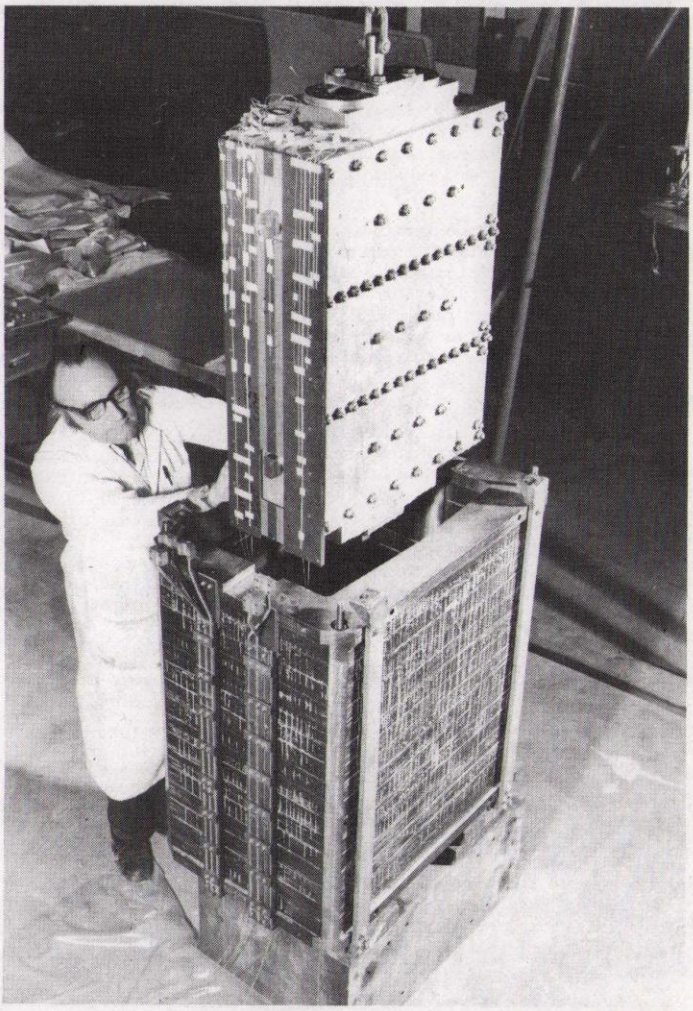
A superconducting Wiggler magnet designed and built at the Rutherford and Appleton Laboratories has just finished a very successful test. The magnet, the first of its type in the world, will be installed in the electron storage ring of the Synchrotron Radiation Source (SRS) now being commissioned at the Daresbury Laboratory.

The storage ring will generate intense radiation, from visible wavelengths right down to hard X-rays in the angstrom region, but as usually happens, there are experimenters who want to work at still shorter wavelengths. The wiggler magnet has been built to satisfy their requirements. As its name suggests it will cause a short period wiggle of the electron beam in one of the machine straight sections. The superconducting coils will produce a bending field of 5 Tesla compared with 1.2 Tesla for the normal ring magnets, and the wiggle will generate usable radiation intensities down to about 0.1 Å.

The geometry of the storage ring imposed many constraints on the design of the superconducting magnet. The total length available for the three pole magnet and its cryostat assembly was only 1.2 metres while the machine beam pipe dictated the vertical aperture of the system. The vertical aperture was one of the major factors limiting the magnet performance and integration of the machine beam pipe with the magnet cryostat was necessary to reach a suitable solution. In a wiggler magnet the integrated magnetic field must be zero in order to avoid net deflections of the electron beam. The computer code GFUN 3D was used to optimise the configuration of superconducting coils and iron shield for minimum field errors.

The magnet poles are generated by an assembly of racetrack type superconducting coils arranged with straight sections transverse to the particle beam. The complete magnet system consists of 16 racetrack modules, each wound from superconducting wire and impregnated with epoxy resin. These coils were mounted in a specially machined support structure of high strength aluminium alloy. At maximum field the support system must withstand a force of greater than 30 tonnes to protect the beam pipe. The complete coil assembly and force support structure are mounted within an iron yoke/shield weighing approximately 1.5 tonnes. This complete assembly will be maintained at a temperature of 4.35°K in a specially designed horizontal cryostat. To cooldown and maintain this operating temperature, a fully automated refrigerator has been installed at the Daresbury Laboratory and is now being commissioned.

Before welding the magnet/yoke system into its final cryostat it was necessary to test the complete magnet performance in some detail in a conventional cryostat. Cooldown to liquid helium temperature took some 5 days and consumed 3000 litres of liquid nitrogen and 1000 litres of liquid helium. The magnet showed some "training" (a phenomenon whereby the operating level of superconducting magnets increases with successive energisations) but after 5 quenches a central field of



Assembling the Wiggler Magnet into the laminated yoke. 34531

5.5 Tesla was reached giving an operating margin of near 10% over design field. Measurements of the magnet field integral showed a performance very close to that predicted by the computer code GFUN 3D. Dipole field errors could be easily corrected and the measured harmonic errors are within the correction capability available in the SRS ring.

Following this successful proving test, the magnet will now be assembled into the horizontal cryostat for final testing and installation at the Daresbury Laboratory.

Our thanks to E Baynham and R Stovold for this interesting information.

RAL Lectures

The next lecture in this series will take place in the Lecture Theatre on Thursday 19 February at 3.15 pm.

LIQUID CRYSTALS AND THEIR APPLICATIONS
by
Dr C Hilsum FRS
RSRE Malvern

Though the foundations of the physics of liquid crystals were laid over 50 years ago, these materials have found widespread use only in the last ten years. This talk explains the properties of the three types of thermotropic liquid crystal, and shows how these properties have become exploited. The main field of application is in flat panel electronic displays, and here the nematic crystal is most commonly used. Typical applications are in watch and calculator displays, but more complex alpha-numeric displays are now on the market. The problems in making flat panel television displays will be discussed.

A newer form of display with a clearer appearance is based on the cholesteric crystal, with a special dye dissolved in it. Rapid progress has been made recently with this display. The third liquid crystal type, the smectic, is used in projection displays. Displays several feet square have been made. A variety of novel instruments have been invented to capitalise on the electro-optic effects in liquid crystals and some will be described.

The talk will be illustrated by a number of demonstrations.

Golf

Three teams have entered for the Bateman Catering Silver Cup. We wish them good golfing. There was not time to circulate the information about this competition to all members before the application date.

This year teams will be invited to enter for the SRC Golf Tournament and the C.S.S.C. Competitions, in addition we will run our own Rutherford Match-play Championship (present cup holder Dr G Manning). We also look forward to the opening of the site six hole course.

A date for your diary, the SRC Golf Tournament is to be held, this year, on Friday 19 June 1981 at the Swindon Golf Club, Ogbourne St. George. Further details nearer the date.

Our colleagues joining the site from Ditton Park and Culham are reminded they are welcome to join this active section of the Sports Association.

Thanks

Peggy Hull, would like to thank friends and colleagues, both from SRC and Harwell stores who contributed to her retirement present, card and flowers. 'I met and worked with some very nice people during my years at the Labs, and take with me some very happy memories,' she writes.

Harry Hurst also wishes to express his thanks to all his colleagues for their kindness and good wishes. "The plaque and the salver with which I was presented will be a permanent reminder of 17 years of interesting and happy association with the Laboratories.

My apologies to all those to whom I was unable to bid farewell, - will they please accept the wish for the deed!" he writes and concludes, "Wishing all the staff at RAL - and its many 'far-flung' outposts - a happy and successful future."

Coffee at Cosener's

Since the Cosener's House is very busy this year we have had to book our Coffee Mornings well in advance on whatever days were available. The dates we have fixed are as follows:

Friday 6 Feb - Cosener's House
Tues 10 March - Coffee Lounge, RAL
Wed 1 April - Cosener's House
Wed 3 June - At the home of
Mrs Judith Gibson
Dunston Lodge
Letcombe Regis.

The Coffee Mornings take place from 10.30 am till noon and pre-school children are welcome.

In an effort to attract people from the Wantage/Didcot area you will notice that two Coffee Mornings have been arranged away from Abingdon in the hope that wives in those areas may find it easier to join us. If you have any problems with transport please telephone one of us because many people have offered to provide transport for those who have difficulty.

We hope to see many of you during the next 6 months.

For more information please ring

Ann Corbett Abingdon 20434 or
Mary Rousseau Wantage 3676

Horticultural Society

An extra-ordinary AGM of the Horticultural Society will be held in Room 1 of the Harwell Social Club on Monday 16 February at 1230 hrs. All members and prospective members are urged to attend.

Obituary

Friends and colleagues of Jean Garner will be saddened to learn of her death on 22 January.
Jean came to RL in November 1972 and worked in General Administration (Typing support); in March 1973 she was seconded to Mr P J Bowles (the then Chief Engineer) for two years. Jean resigned from the Laboratory in August 1979 to pursue other interests. Our very deepest sympathy to husband Basil and sons Stewart and Jonathan.

Lunchtime Music

WEDNESDAY 11th FEBRUARY AT 12.30 p.m.
LECTURE THEATRE

1. VICTOR BORGE "Borgering on Genius" (excerpt)
2. THE GOONS "Lurgi Strikes Britain"

As a departure from our usual fare we are offering as a main course half an hour of 'Goonery' from Sellers, Milligan and Secombe preceded by a fifteen minute aperitif of the contrasting, gentle humour of Victor Borge.

Though both were first performed some years ago this classic comedy has matured with age in spite of its frequent exposure.

Trade Exhibition

There will be an exhibition by Sealectro Ltd of multi-pin connectors, microwave devices, RF connectors, coaxial cable, cable assemblies, etc in Conference Room R12 on Wednesday 11 February from 10.00 to 16.00 hours.

Edwards High Vacuum will be exhibiting rotary pumps, cryo-cooled diffstak, vacuum instrumentation, valves, couplings and vacuum fluids in their mobile exhibition van on site outside R20 on Wednesday 25 February from 1000 to 1600 hours.

Leybold-Heraeus Ltd will give a presentation of high vacuum equipment and plant in the R12 Conference Room on Tuesday 10 March from 10.30-15.30 hrs. This will consist of a display of turbo molecular pump units, cryo-refrigerator pumps, microprocessor controlled mass spectrometers, gas analysers and leak detectors, and a seminar to explain the use and application of these products.

Anyone wishing to attend the seminar should contact Mrs Sheila Davidson, Scientific Administration Group, R20 (Ext 6114) for a place allocation.

Bulletin

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