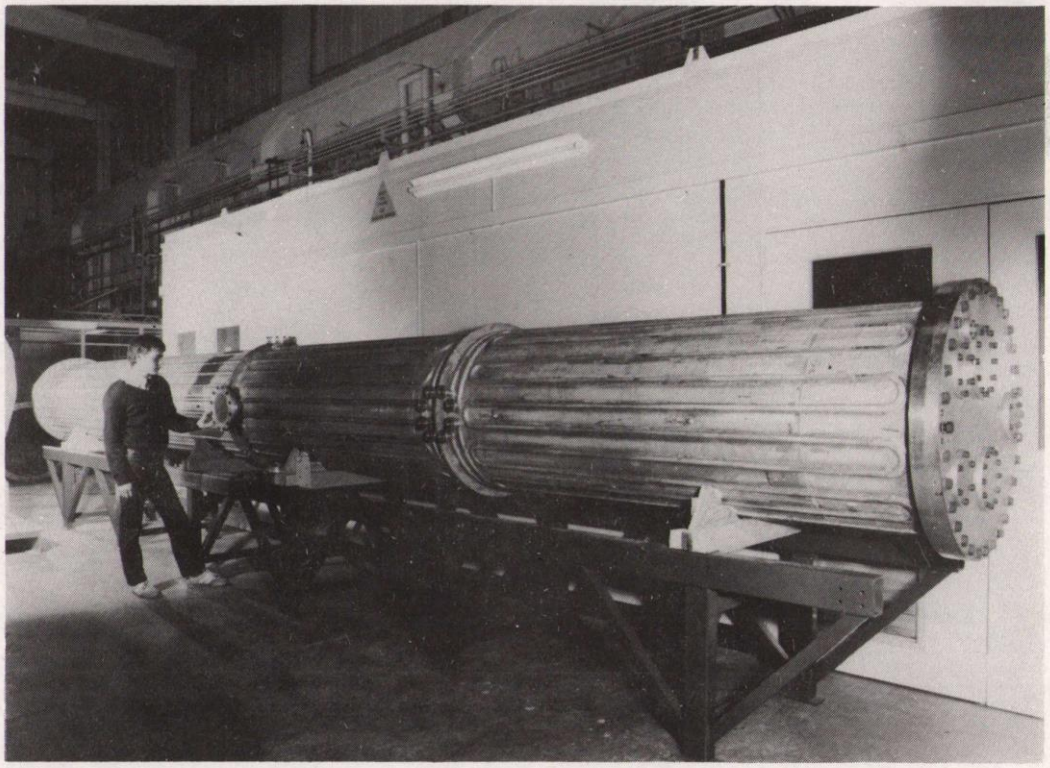
Bulletin
of the Rutherford Appleton Laboratory 10 Oct 1983 No.15

# One Kilometre Path in R25



*Stainless steel vacuum chamber for 1 km path length spectroscopy of atmospheric gases. The cooling channels can be seen on the vessel wall.* 83RG 1720.

In R25 heavy duty laboratory another RAL facility of major scientific importance is nearing completion. This is the G & R Division Remote Sounding Group's Spectroscopy Laboratory, designed initially to carry out visible and infrared spectroscopy of the various gases found in the Earth's atmosphere. This work is particularly important because spectroscopic techniques are by far the most commonly used for measuring the concentration of atmospheric constituents, especially in the middle and upper atmosphere, where the long term influence of atmospheric pollutents is considered to be most serious. Accurate Laboratory measurements on these gases is thus one of the corner stones of effective remote sensing.

In the upper part of the Earth's atmosphere, above 30,000 feet, the influence of the Sun's intense ultraviolet radiation is to provoke many series of complex chemical reactions which can lead to potentially disasterous end-products such as "acid rain", or depletion of the "ozone layer" which protects us from excessive damaging solar radiation.

The largest element in the new spectroscopy laboratory is a large (10 m long x 1m diameter) stainless steel vacuum vessel, which, from the use of multiple reflections from gold plated mirrors inside the cell, will be the equivalent of a 1 km tube; light entering the vessel through an input window will have to travel 1 km before reaching the exit window. This vessel is fitted with a labyrinth of cooling channels so that coolant can be circulated and the structure cooled to any temperature found in the Earth's atmosphere. The whole structure is contained within a larger vessel to give it the thermal insulation that is required for low temperature operation. This chamber is called a "White cell", named after one John U White who first conceived of the particular optical scheme which is used to obtain this long path length.

The "sharp end" of the RAL spectroscopy facility is a commercial high resolution spectrometer, which is basically a Michaelson Interferometer with a moving mirror that travels 1¼ metres, giving an optical path difference of twice that distance. This very long path difference gives higher spectral resolution (discrimination between closely packed spectral features) than any other instrument of its kind, and can be used over most of the visible and infrared region. There are also a number of other short path length coolable cells that are already in use for high resolution spectroscopy.

*(cont'd on p3)*

# RAL Lectures

This additional lecture to the published series will be held on Thursday 13 October in the Lecture Theatre at 3.15 p.m.

HOW MUCH BETTER CAN

WEATHER PREDICTION BECOME?

by

Professor Edward Lorentz

Professor Lorentz has just been awarded the prestigious international Crafoord prize (jointly with Dr Henry Stommel of Woods Hole Oceanographic Institute) and will in fact be passing through England on his way home from the Presentation by H.M. the King of Sweden. For the past 15 years he has been interested in the fundamental limits to predictability in meteorology and has supplied the following abstract for his talk.

The instabilities of the atmosphere with respect to small disturbances and the inevitable errors in observing the present weather, impose a limit on our ability to predict the future weather. Numerical computation imply that we may someday forecast a week in advance as well as we now forecast 3 days in advance, but detailed 1 month forecasts appear to be impossible.

# SEAS at RAL

A party of International computer specialists were guests of the Atlas Centre on Thursday 29 September. The group, all attending the SEAS Anniversary Meeting '83 being held in Oxford, were given demonstrations of RAL's computer graphics capabilities. These included PERQ running GKS colour terminals providing molecule displays and Starlink terminals demonstrating their paces. In addition a guided tour of the central system was provided.

Organised jointly by Harwell and RAL the meeting attracted over 500 participants, sessions being held at St. Catherine's College, the St.Cross Building and, a novel venue, The Oxford Playhouse.

As is usual at SHARE European Association (SEAS) meetings there was a wide and varied programme to suit the needs of many different types of IBM Users. The 'Workshop' theme of the programme was Office Automation, and several sessions were concerned with the impact of IBM's personal computer, especially with its regard to its integration with main-frame systems.

A highlight of the meeting was a talk by Professor Fred Brooks, known as the 'father of IBM system 360' in which he presented a 'forward look' at office automation.

Included in the itinerary, as a relief from the 'chalk and talk' was a punt race on the Cherwell, from which Chris Osland emerged victorious and an end of course entertainment featuring Nola Rae the mime and Richard Stilgoe (or Digital Chores), who to mark Chris' win, composed a song explaining how the entire computer aided design capabilities of RAL had been tied up for weeks designing the winning punt's winged keel.

The university surroudings, the merciful weather and the free-flowing refreshments, combined with a full conference programme, once more ensured a most successful SEAS meeting. Next year's meeting is in Garmish at the time of the Munich Oktoberfest.

*Bob McLatchie, Chairman of the Local Organising Committee enjoying the evening with guests.* 83RC 4740.

# RAL TECHNOLOGY LECTURES

The next lecture in this series will be held on Thursday 20 October in the R22 Lecture Theatre at 3 p.m.

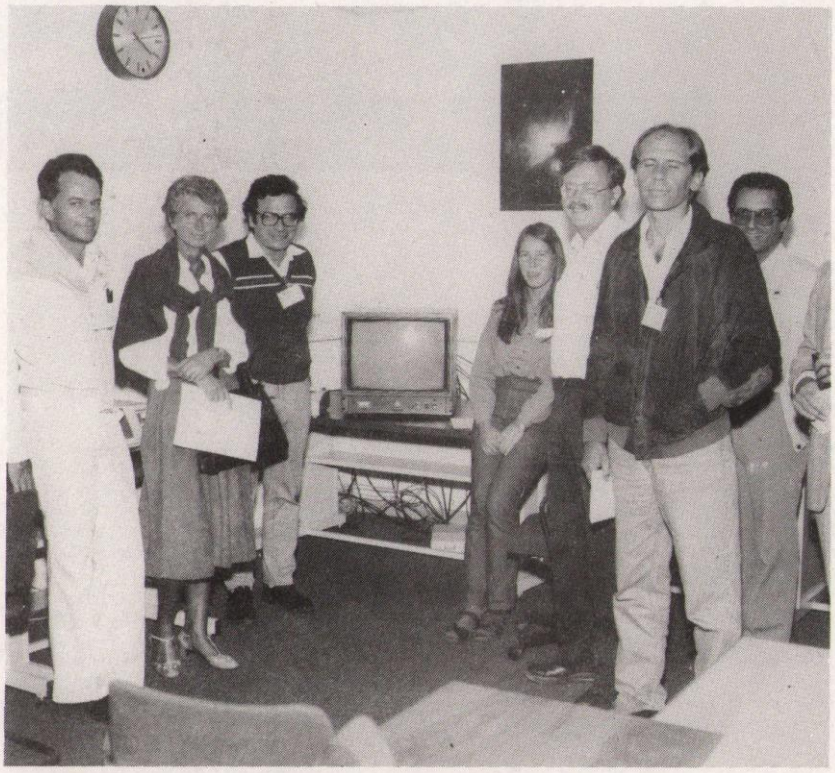
OPTICAL BISTABILITY and the PROSPECTS for ALL-OPTICAL SIGNAL PROCESSING and COMPUTING

by

Professor S D Smith, FRS
Herriott-Watt University, Edinburgh

The discovery in 1976 of giant refractive nonlinearity in semi-conductors has not only transformed nonlinear optics from intensity regimes of megawatts per square centimetre to watts per square centi-metre, but also facilitated the realisation of small, fast, all-optical signal processing devices. Combining such nonlinearity with feedback leads to a family of devices based on the concept of optical bistability. These include memories, logic gates and amplifiers. The basic physics and future prospects of such devices will be considered.

*FOR YOUR DIARY: The next lecture will be on Thursday 17 November by Dr R Newport, RAL and will be entitled "UK/NL Millimetre Telescope".*



*Visitors at Starlink.* 83RC 4728

## 1 km Path in R25

*(cont'd from p1)*

This combination of a long path length coolable absorption cell and high resolution spectrometer makes the RAL facility unique and unrivaled. This is reflected in the fact that the Chemical Manufacturers' Association - an international body with an obvious interest in atmospheric physicists getting it right - has awarded RAL a significant contract which will contribute to the development of the facility in return for some measurements which are now being made on atmospheric constituents.

## Unique Facility

An extra dimension was added to the RAL programme in response to a request from colleagues at Oxford University working in planetary sciences. The atmosphere of Jupiter is the subject of a NASA space mission called "Galileo" which will pass close to the planet in the latter half of this decade. This will result in detailed observations which will add to previous ground-based measurements and, in recent years, data from the "Voyager mission".

It turns out that the planet Jupiter has a considerably more hostile atmosphere than ours. Comprising mainly methane, hydrogen, and ammonia at very high pressures and low temperatures. In order to make the kind of measurements that are needed for this work the long White cell has to contain up to 5 atmospheres of inflammable gas at temperatures as low as -170°C - a truly lethal environment!

This project, which grew out of the Appleton Laboratory programme at Ditton Park, is a "natural" for the merged Laboratory, combining as it does the original Appleton Laboratory programme of Atmospheric Spectroscopy with the special engineering expertise in large scale vacuum technology, low temperatures, and also handling of hydrogen gas, that has developed in support of the earlier Rutherford HEP programmes.

The project is now looking forward to a very busy future in collaboration with groups from Reading, Strathclyde, Oxford and Westfield College, amongst others. Gases to be studied include water vapour, which still defies many attempts to make systematic measurements in the infrared, to carbon dioxide, whose global concentration may be increasing to our detriment, through a long list of upper atmosphere "nasties" which include HCl, $HNO_3$, NO and $NO_2$, to name but a few, to a simulation of the Jovian atmosphere which is about as hostile an environment as most of us care to imagine!

*(We are indebted to David Llewellyn-Jones for this insight into a fascinating area of the Laboratory's programme).*

# Prof Houghton Says Farewell

*Alan Gabriel, John Houghton and John Harries admire the gifts.* 83RC 4638

John Houghton will never forget RAL, at least not without effort, for at a farewell ceremony held on Friday 23 September the gifts with which he was presented were significantly connected with his time at Chilton.

Prior to presenting these mementos, Drs Alan Gabriel and John Harries spoke appreciatively of Professor Houghton's leadership. John had joined the Lab as Director Appleton and Deputy Director Rutherford in September 1979, at the beginning of the 'not altogether easy' merger of the two Laboratories. However, the period had been one of great activity in the fields of Space-Astronomy and Geophysics and despite economic cutbacks, RAL teams were playing a major role in many international programmes.

John Harries spoke on behalf of all when he said "It is a pleasure and honour to have worked with you and we shall remember and miss your clear direction, constant support and warm friendliness. We wish you every success in the future".

Professor Houghton was then presented with, a plaque featuring the SERC logo made by Terry Adams on the Computer Numerically Controlled (CNC) milling machine - itself a special feature of RAL's Workshops; a framed photograph of delegates to the 1981 meeting of the World Climate Research Programme's Joint Scientific Committee which John chaired and whose deliberations led to RAL's participation in the growing field of climatic research; an artists impression of the ATSR experiment mounted on the ERS 1 satellite due for launch in 1987 and a 35mm compact camera (an Olympus XA2/A11 for the camera buffs).

Earlier in the week at Div. Heads meeting he had been presented with a copy of a Station Marine Barometer, circa 1860, made by Mr Malcolm Bell of R25 Workshop, whose disability of being deaf and dumb was clearly no handicap in producing a most beautiful instrument, of which John was obviously very proud.

In reply Professor Houghton said that he had appreciated the loyalty of Appleton staff during the merger and the helpfulness of Rutherford personnel. "Now I doubt if you can tell a Rutherford man from an Appleton man, they both look very much the same to me", he joked. Thanking everyone for the generous gifts he had received, he wished everyone a successful future in a field where new and exciting horizons were opening up continually.

## Cricket

Looking forward to next season, we plan to run a six-a-side Evening League, so now's the time to think about entering. It will be for RAL only and can be entered on a Building or Division basis. Enquiries to the Club Secretary R Newman Ext: 5538.

# Les Barker Retires

A fitting farewell for their retiring colleague Les Barker was organised by Engineering and Building Works Division on Friday 30 September, for it was held in the new R68 Conference Room - a proper setting for a function arranged by the Division that had designed and built it.

Roy Tolcher, making the presentation, spoke warmly of Les' contribution to the Lab over the past 22 years. Looking back through the history book of Les' record, it was, he said, more difficult to know what to refer to, rather than not; Les had a remarkable record, strewn with words like, trustworthy, hardworking, forthright, reliable, keen, energetic. He was going to be very difficult to replace. Les joined the Lab in 1961 working in the Supply Group. He later moved to Engineering Services Dept on Outside Manufacturing. In 1971 he was sent to Cranfield for 10 weeks on a works-study course - and returned to impress and frighten us with 'buzz' words like activity sampling, work-rate, incentive bonus schemes and so on. Fortunately "works-study" came to nought at Rutherford and in 1972 he joined Roy to help sort our problems with mechanical services. Two specific areas of work were worthy of special note, steam consumption and the site gas mains.

At that time billed steam consumption was about 150m lbs/steam a year. Les instituted whole series of tests to establish what was happening and many measures to improve the situation were implemented. It is sufficient to say that consumption is now at a level of about 75m lbs/steam a year with a saving to the Laboratory of getting on for £½m every year. Les made a very significant contribution to this work. The site gas mains at the time leaked very badly and again Les' proposal to install plastic lines was accepted and proved very successful.

*Les (left) and Roy (right) show off the model and card.* 83RB 4726

"As a mark of our esteem" continued Roy "we would like you to accept these mementos from all your friends and colleagues. Thank you for all the service you have given to us and to the Laboratory. We wish you and your wife Elsie a long, happy and healthy retirement".

Les' gifts, a card depicting scenes from his life prepared by Peter Bradley, a Pentax camera and flashgun, a tray incorporating photographs of buildings and plant constructed by the Council Works Unit and a model of the SERC logo specialy designed and made by Mike Anthony of the R18 workshop, were obviously a delight to him.

Thanking everyone for them and for the happy (and occasionally turbulent) time he had enjoyed at RAL, Les said that he had not yet decided what he would do in retirement - his wife hadn't told him yet - but a trip to Australia was planned, he would continue to bowl and fish and later hoped to get involved in some service to the community. He wished everyone success in the future both individually and as a Division, inviting all to join him later for a valedictory (I looked it up - Ed) drink.

# Bravery Award

John Illingworth of Technology Division has been awarded The Royal Humane Society's Testimonial on Parchment, bravery certificate. At a presentation ceremony at Oxford Town Hall on Tuesday 13 September, John received the award from The Lord Mayor of Oxford Mrs Janet Todd.

On a cold dark night, last October, John waded into the River Thames, near his former home and rescued a young man from drowning.

Staff at RAL would like to express their admiration and offer their congratulations to John for this courageous act.

## Hospital Savings Assn.

A representative of the Hospital Saving Association will be in the R22 Coffee Lounge during Lunchtime on Tuesday 11th October. The HSA is a non-profit making organisation which provides financial help during hospitilisation, out-patient treatment and also with dental and optical care. Enrolment forms can be obtained from Miss M E R Waters in the Salaries Office, Building R20.

## Christian Fellowship

Christian Fellowship
Programme - October to November

Oct 13 Prayer Meeting - Phil Green

20 Bible Study - John Hogston

27 Taped Presentation - Chris Biddlecombe

Nov 3 Prayer Meeting - Meyrick Wyard

10 Discussion - Trevor Lucas

17 Bible Study - Martin Steel


# Bulletin

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Deadline for insertions:

# INTERNAL Events

ASTROPHYSICS SEMINARS
R61 CONF RM - 1400 hrs

Oct 19 Dr A G Lyne/Jodrell Bank
'Distribution of Pulsars'

HEP SEMINARS
R61 CONF ROOM - 1100 hrs

12 Oct Dr J Wheater/Oxford
CONF RM 1 'Continuum Limit of $\phi^6$ Scalar Field Theory in 3-dimensions'

19 Oct Dr A Edwards/Wuppertal
'Measurements of Nucleon Structure Functions and EMC Effect'

27 Oct Prof P Landshoff/Cambridge
CONF RM 2 'Small $p_\perp$ Physics Revisited'

RAL LECTURES
LECTURE THEATRE - 1515 hrs

3 Nov Dr P E Clegg/QMC
'Far Infrared Astronomy'

13 Oct Prof E Lorentz
'How Much Better Can Weather Prediction Become'

CONDENSED MATTER SEMINARS
R3 CONF RM - 1300 hrs

18 Oct V Heine/Cambridge
'Origin of Incommensurate Structures in Insulators'

25 Oct M Cooper/Warwick
'Compton Scattering Studies of Electron Momentum Density in Transition Metals'

RAL TECHNOLOGY LECTURE
LECTURE THEATRE - 1500 hrs

20 Oct Prof S D Smith FRS/Herriot Watt
'Optical Bistability and the Prospects for All-optical Signal Processing and Computing'

# EXTERNAL Events

THEO PHYS SEMINARS
TPD - Bldg 424.4 HARWELL - 1400 hrs

18 Oct Dr C M Sayers/AERE
'Surface Waves and Absorbate Vibration Modes'

ELEM PART THEO SEMINARS
NPL - OXFORD - 1430 hrs

14 Oct Dr M Gross/Oxford
'Deconfinement'

21 Oct Dr J Ellis/CERN
'Phenomenological Supergravity'

28 Oct Dr S Chadha/RAL
'The Use of Chiral Lagrangians for Proton Decay'

PHYSICS COLLOQUIA
CLARENDON LAB - OXFORD - 1545 hrs

14 Oct Dr J D Silver/Oxford
'GUT Monopoles'

21 Oct Prof W D Knight/Berkeley
'Magnetism of Metallic Polymers in a Molecular Beam'

HEP SEMINARS
DAMTP - CAMBRIDGE - 1500 hrs

14 Oct N McDougall/Oxford
'Chiral Symmetry Breaking and Topology'

21 Oct C T Sachrajda/Southampton
'Baryon Wave Functions and Nucleon Decay'

28 Oct P Orland/I.C.
'Expansions Around Monopole Configuration in Yang-Mills Theories'

HEP SEMINARS
CAVENDISH LAB - CAMBRIDGE - 1500 hrs

12 Oct Dr J R Carter/Cornell
Dr C P Ward/Brighton
'Reports from Conferences'

19 Oct Dr N Booth/Oxford
'Superconducting Detectors: a New Experimental Approach to the Solar Neutrino Problem'

26 Oct Dr R M Brown/RAL
'Status of Hyperon Semi-leptonic Decays'

PART PHYS DISC GP MEETINGS
BIRMINGHAM - 1615 hrs

14 Oct Dr M Miller/UCL
'The Solid Neon Calorimeter: Technique and Usefulness'

19 Oct Dr T Jones/UCL
The IMB Nucleon Decay Search

THEO PHYS SEMINARS
QMC - LONDON - 1415 hrs

13 Oct Prof M Moore/Manchester
'Schrodinger's Cat - Its Last Meow'

20 Oct Prof O Penrose/Open U.
'Kinetics of Phase Transitions'

27 Oct Prof D J Wallace/Edinburgh
'Prospects for Lattice Gauge Theories'

## Trade Exhibition

There will be a mobile trade exhibition by Wallis Electronics Ltd of high voltage power supplies on Thursday 20 October from 10.00-16.00 hrs in R12 Conference Room.

## Missing

Avometer model 8 Mk 2, Serial No. 53199-C-167 is missing from lab 1,12, R2. Would anyone knowing its whereabouts please contact John Ellis, Ext. 5494/6303.

If any-one knows the whereabouts of a Portable Tektronic 60 MHz Oscilloscope Type 2215 No. RLLP 2181 (S/No.200131) please inform John Varley R25 Ext.6516. This item, an RAL Loan Pool Instrument, has disappeared from the Clean Room G119 R25.