Bulletin
of the Rutherford and Appleton Laboratories 23 Feb. 1981 No.4

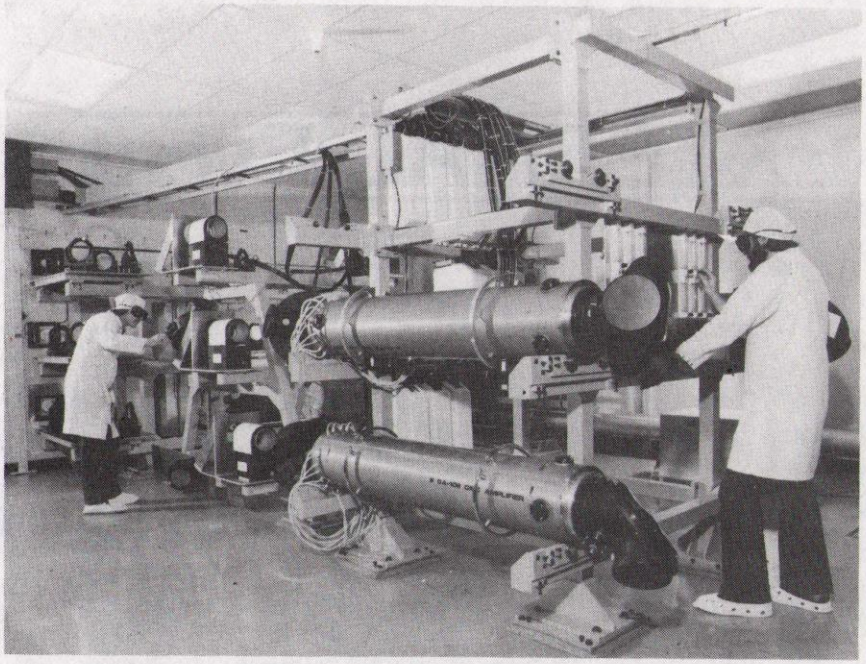
Enter VULCAN

RAL can now confidently claim to have the most versatile high power laser in the world. The most recent upgrade of the facility represents a quantum jump in overall performance, even though it is only the first phase of a two phase, £800,000 programme approved in 1978. All experimental facilities require progressive enhancement to meet the needs of their users and the performance of the RAL glass laser has been significantly increased by several upgrades during the past four years. The current one is, however the largest ever attempted.

A New Beginning

High power lasers consist of a large number of relatively small components so that dismantling and reconstruction are comparatively easy. The laser was totally removed in mid September to allow renovation of the air conditioning, floor tiles, etc and since then has been rebuilt in a new configuration using both old and new components. The latter have been assembled over the past 2 years as funds permitted, so we have been looking forward to the current upgrade for quite some time!

A primary consideration in the new laser layout, as shown in the schematic diagram, has been the need for versatility to meet the diverse needs of our university users. It will supply laser pulses to two target areas - a single beam area for laser-plasma interaction studies and a six beam area for compression of spherical targets - so that two user teams can operate in parallel. At the heart of the new laser are two oscillators generating low power pulses whose duration may be varied between 100 ps and 10 ns together with a "pulse stacker" to allow synchronous generation of long and short pulses. The oscillator pulses are then amplified through a sequence of amplifiers and other components on a path chosen by computer controlled mirrors, some of which are shown in the diagram. The beam lines are reminiscent of a railway marshalling yard and a display in the laser control room shows the chosen routes.



Assembling the laser disc amplifiers, which feed the six beam area. The rack will accommodate a further three disc amplifiers. 34737

Initial amplification is in rods up to 76 mm diameter (designated "A76") followed by "disc" amplifiers with a clear aperture of 108 mm. The latter are all double passed, input and output beams being distinguished by the use of Faraday isolators, the optical equivalent of microwave 4-port circulators. Each disc amplifier is capable of delivering 200 Joules in a 1 ns pulse. At the moment the six beam area is fed from three disc amplifiers by passive splitting but it is hoped to add three more amplifiers in the near future and the mechanical structure (photo) is designed to accommodate these.

Four Wavelengths

An important feature of the new structure is the provision of harmonic generators to allow experiments at four wavelengths (1st, 2nd, 3rd and 4th harmonics) in the single beam area and two wavelengths in the six beam area.

Experiments conducted here have shown that substantially enhanced compressive pressures can be obtained by using the second harmonic (530 nm wavelength, green light) of the primary laser frequency, this enhancement more than offsetting the reduction in intensity due to the of order 50 % efficiency of the harmonic generators. All major high power laser laboratories are now following our lead to shorter wavelengths but, for the moment at least, we have the only multi-green-beam facility in the world and its availability will add a new dimension to the facility's programme.

Many Improvements

Laser beams are not only used to heat and compress targets but also in some plasma diagnostic techniques and these, too, will be improved by the new laser layout. In particular increased power will be available for X-ray backlighting of compression targets - a technique pioneered here - and it will be possible to

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INTERNAL Events

NIMROD LECTURES
R61 CONF. ROOM - 1400 hrs

2 Mar - Dr P Cvitanovic/Niels Bohr Inst.
'Planar QCD'

9 Mar - Dr I P Jeffries/CERN
'A Measurement of g_A/g_V for the Decay of $\Sigma^- \rightarrow ne\nu$ at the SPS'.

LECTURE THEATRE - 1400 hrs

11 Mar - Dr R K Ellis/CERN
'QCD Treatment of Drell - Yan'.

HEP LECTURES
R61 CONF. ROOM - 1100 hrs

25 Feb - Dr P Cvitanovic/
'Planar Perturbation Theory'

4 Mar - Dr R Marshall /RAL
'Neutral Current Effects in e^+e^-(JADE)'

11 Mar - Dr Y Igarishi/Dortmund
'Greens Function Approach to the Breit Fermi Interaction in a Spherical Bag'

ASTROPHYSICS SEMINARS
R61 CONF. ROOM - 1400 hrs

25 Feb - Dr Michael Rowan-Robinson /QMC
'Theorectical Models of Infrared Sources'

11 Mar - Dr Max Pettini/RGO
'The Interstellar Gas: Ultraviolet Spectroscopy with IUE'

EXTERNAL Events

NPD COLLOQUIUM
CONF. ROOM H8 - HARWELL - 1530 hrs

5 Mar - Dr N E B Cowern/AERE
'Range Distributions: How not to Sweep Physics under the Mathematical Carpet'

COCKCROFT HALL - 1515 hrs

12 Mar - Dr G E Hunt/UCL
'Results of the Voyager Mission to Jupiter and Saturn'

THEORY GROUP SEMINARS
DARESBURY - 1400 hrs

2 Mar - Prof J Wilkins/Cornell
'The Present State of Valence Fluctuation Theory'

9 Mar - Dr A K Dhar/Daresbury
Title to be announced.

ELM. PART PHYS. SEMINARS
NPD - OXFORD - 1430 hrs

26 Feb - Dr S Wojcicki/CERN
'New Flavour Production in Headronic Interactions'

5 Mar - Dr J Wallace-Hadrill /CERN
'Triple Jets in ISR Proton -Proton Collisions'

PART THEOR. SEMINARS
NPD - OXFORD - 1430 hrs

27 Feb - M Chase/Oxford
'Structure Functions at Large X'

6 Mar - R Horgan/DAMPT
'Heavy Quarks in a Bag'

PHYSICS COLLOQUIA
CLARENDON LAB - OXFORD - 1615 hrs

27 Feb - Dr F W Taylor/Oxford
'Exploring the Atmosphere of Venus'

6 Mar - Sir Geoffrey Allen FRS/SRC
'The Dynamics of Polymers'

13 Mar - Prof N F Ramsey/ Harvard
'Dipole Moments & Parity Violating Spin Rotations of the Neutron'

THEO.PHYS SEMINARS
CLARENDON LAB-OXFORD-1615 hrs

5 Mar - Prof J G Taylor/King's College London
'Quantum Gravity: Lattices and Loops'

PHYSICS COLLOQUIA
HH WILLS LAB - BRISTOL - 1700 hrs

2 Mar - Prof W H McCrea/Sussex
'Chemistry in Cosmology'

9 Mar - Prof H Frohlich/Liverpool
'Theorectical Physics in Biology'

HEP SEMINARS
DAMPT - CAMBRIDGE - 1500 hrs

27 Feb - Dr R J Cant/Manchester
'Non-classical Imstantons?'

6 Mar - Dr B L Cambridge/RAL
'Some Perturbative QCD Phenomenology'

13 Mar - Dr E Corrigan/Durham
'Monopole Solutions of Ward Prasad Type'

PART PHYS. DISC. GP. MEETINGS
BIRMINGHAM - 1615 hrs

27 Feb - Dr K Peach/Edinburgh
'The Last Formation Experiment'

6 Mar - Dr R Barlow/Manchester
'Physics Results from the JADE Detector at PETRA'

THEO.PHYSICS SEMINARS
MANCHESTER - 1430 hrs

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

4 Mar - Prof P G Burke/Daresbury
'Resonances in Electron Collisions with Atoms, Ions and Molecules'

Library Notice

The contents pages card for NUCLEAR INSTRUMENTS AND METHODS has been lost. We would be grateful if those people who usually receive these pages would send a note of their name and building number to the Library R61.

Film Badge Notice

Period 3 commences Monday 23 February. Colour strip YELLOW. Please change your film promptly and ensure that ALL previous ones have been returned.

Trade Exhibition

Leybold-Heraeus Ltd will exhibit high vacuum equipment and plant in the R12 Conference Room on Tuesday 10 March from 11.30-15.30 hrs. The exhibition will consist of turbomolecular pump units, cryo-refrigerator pumps, microprocessor controlled mas spectrometers, gas analysers and leak detectors."

Satellite and Oceans Experts at RAL

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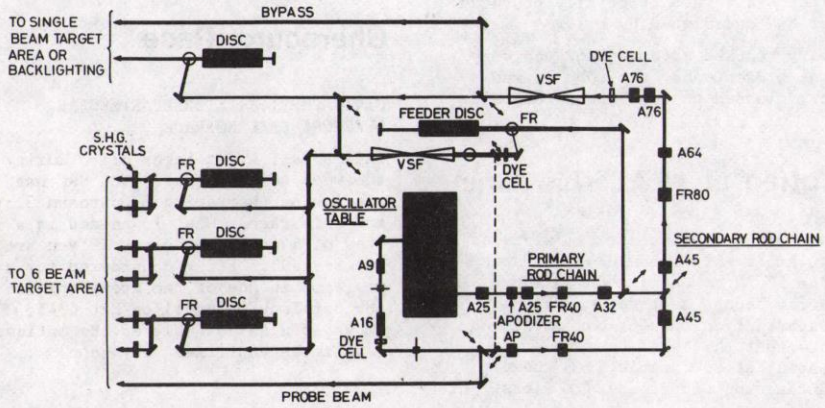
An important step in the planning of a 20-year World Climate Research Programme (WCRP) took place during the week 26-30 January, when many of the world's leading experts in satellite remote sounding, oceanography and climate research met at the RAL Chilton site to discuss the coordination of plans for future satellite observing systems and ocean experiments. The meeting had been called by the Joint Scientific Committee of the WCRP, together with the Coordinating Committee on Climate and the Oceans, and was chaired by Professor John Houghton, Director Appleton.

Representatives of and scientists from many countries including the USA, the USSR, Japan, Canada and France were present, with the UK represented by SRC and NERC scientists. Several international agencies also sent participants. The meeting was highly successful, the wide-ranging discussions on the ocean-climate system and its observation, taking place. By the end of the week a draft report was produced recommending action on scientific studies, instrument development, data processing, and international coordination. The report will be presented to the Joint Scientific Committee of the WCRP in March.

We were delighted to be able to act as hosts to such a distinguished group of visitors, and believe that the holding of this meeting in the UK and at RAL is some indication of the potential role of the Laboratories, the SRC, and NERC in this growing and exciting, field of research.

VULCAN *continued*



Laser layout diagram. The two oscillators can feed either output from the table. FR; Faraday Rotator. VSF; Vacuum spatial filter. SHG; second harmonic generators (single beam harmonic generators not shown).

obtain both 2-dimensional "time frozen" and single-dimensional time dependent X-ray pictures of targets during compression. The increased power in the back-lighting channel will permit the generation of harder, and hence more penetrating, X-rays which will be necessary to probe the higher compressed densities expected from using green light.

Baptism of Fire

The total rebuilding of the laser that has taken place over the past four months has provided an opportunity to redesign and replace many standard components that have proved unreliable or otherwise inadequate and in the future this may prove to be the most important, if least visible, feature of the reconstructed laser. In any case the laboratory now has an excellent laser, well matched to the needs of its users. Further enhancements are, of course, planned but these will build on the new foundation now established. The RAL laser is now entering a new phase and we believe it deserves a name. Ladies and Gentlemen, will you welcome VULCAN, named after the Roman god of fire and patron god of workers with fire which, after all, is what plasma physicists are.
Versicolor Ultima Lux Cohaerens pro Academica Nostra!

"The latest multicolour coherent light for our academics."

We are indebted to Dr Alan Gibson for this information.

RAL Lectures

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

"CERN - ITS AIMS AND ACHIEVEMENTS"
by
Sir John Adams, FRS

Starting with the reasons for setting up an international research laboratory for high energy particle physics in Europe soon after the end of the Second World War, the lecture goes through the major decisions taken at CERN during the 27 years since its foundation and compares what happened at the Laboratory with the aims of its founders. The lecture is neither very scientific nor very technical, but emphasises more the history of a rather successful European venture which is still evolving.

Stop Press

WHAT'S NEW

5 March - Cancelled

LUNCHTIME MUSIC
Lecture Theatre - 1230

25 Feb Emerson, Lake, & Palmer
'BRAIN SALAD SURGERY'

CRIB

Lecture Theatre - 7.0 pm

20 March - Tournament
Entries to T Morgan Ext 563
or P Craske Ext 232

Indoor Sportsday 1981

This year's Sportsday will again be held on Friday 24 April at The Oasis Leisure Centre, Swindon followed by a meal and disco at Central Office. Entries are invited for the following events:-

Event	Contact	Ext.
Volleyball - Teams of 8 6 male, 2 female	J Ellis	6369 434
Badminton - Mixed pairs	R Wolfendon	264
Badminton - Mens pairs	R Wolfendon	264
Squash - 2 male, 1 female	R McClure	538/ 331
Table Tennis - Team of 3	J Varley	6363/ 6302
Bridge - Pairs	P Craske	232
Cribbage - Pairs	T Morgan	563 563
Chess - Individual	P Craske	232
Darts - Team of 5	A Forster	6300

All names must be in by 20 March at the latest, and entries are limited in nearly all events, so get your name in quickly.

On the Chilton site, further information can be obtained from Mrs M R Shepherd (Atlas) Ext 6394, H Shah (Appleton) Ext 6384/524 and P Craske (Rutherford) Ext 232.

Obituary

Mr. R. L. Halton who died recently at the age of 61 was well-known and appreciated at Ditton Park, where he had worked since 1968. Prior to joining SRC staff, most of Ron Halton's working life had been spent with Local Authorities in London. He served in the Royal Field Artillery from 1939-1945. He was for many years a Shop Steward for the T. & G.W.U. on whose behalf he was an active and considerate Trade Union representative.

A craftsman, he appreciated craftsmanship in others and there remain examples of his own artistic talents which so often lifted his work above the immediate needs of the painting, signwriting and display jobs which came from his shop.

Goodbye to Henry

Friends and colleagues of Henry Pettit gathered together on Wednesday 11 February in the R18 mess room to wish him well in his retirement.

Opening the proceedings Roy Tolcher thanked Henry for his 19 years of service and wished him all the best for the future.

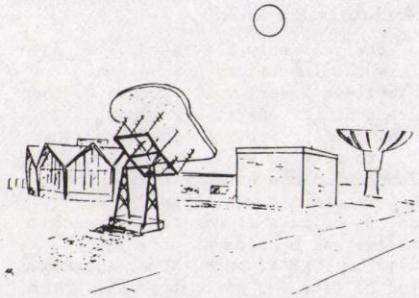
Events then took an intellectual turn, when Jim Lawler mentioned that Henry was a bit of a Character, and proceeded to quote various definitions, ending with his own version - someone who makes a lasting impression 'Henry you have certainly done that', he concluded laughingly.

On behalf of all Henry's colleagues Jim presented him with a quartz battery clock and a card especially produced for him and signed by all.

Henry thanked everyone for the very fine present and said that he was very pleased to have known them all.

Coffee at - RAL This Time

The coffee morning for all wives of RAL staff will be held on 10 March from 10.30 am until noon in the Coffee Lounge next to the R22 Restaurant on the Chilton site. We hope that this will be more convenient for people from the Wantage and Didcot areas. Please join us if you can.



Train of Thought

A lovely warm evening in late summer, the river flows lazily by with now and then the splash of a fish. The peace is shattered by a sharp blast of a Great Western steam whistle as 14XX class tank loco and auto-coach rumble across the bridge to stop in the station. After a few shouts and the banging of doors the train moves off into the oncoming night heralded by the new moon.

Fact or fantasy, a mixture of both maybe. This scene could be a reality, (that is to say without the new moon and the fish who have a job to swim in a resin river), on the new layout being built by the Rutherford and Appleton Laboratories Model Railway Club. The layout is to 4mm scale '00' gauge.

A second layout is to be built by the 'N' gauge gang, those chaps who run high speed demented mice disguised as trains. Fear not, they are quite harmless. A further layout is being planned by the club loonies which will be an American narrow gauge logging line with high trestles (bridges). Yee Ha! (American for ecstatic bliss).

If you would like to join our band of intrepid heroes in the world of model railways why not come along to the clubroom in R58 or contact Ray Roberts, Ext:6280.

Cherbourg Race

CIVIL SERVICE INTERDEPARTMENTAL OFFSHORE SAILING RACE

This annual event takes place during the week 4-11 October. The SRC has options on chartering 3 Contessa 32s for this race. What is needed is a crew of 6 for each boat. If you are interested in being considered for a position in one of the crews, please contact Tony Damerall on Ext 6346, R1 as soon as possible as the options have to be confirmed very soon.

Art & Craft Exhibition

The third Art & Craft Exhibition is to be held in the R12 Conference Room on Tuesday 30 June, Wednesday 1 July and Thursday 2 July, during the lunch periods. It is hoped that staff of the Laboratories will be willing to exhibit their work on these days.

Application forms will be available beginning of April. For further information please contact Jenny Coates Ext 430 or Myra Gilbert Ext 6143.

Bulletin

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