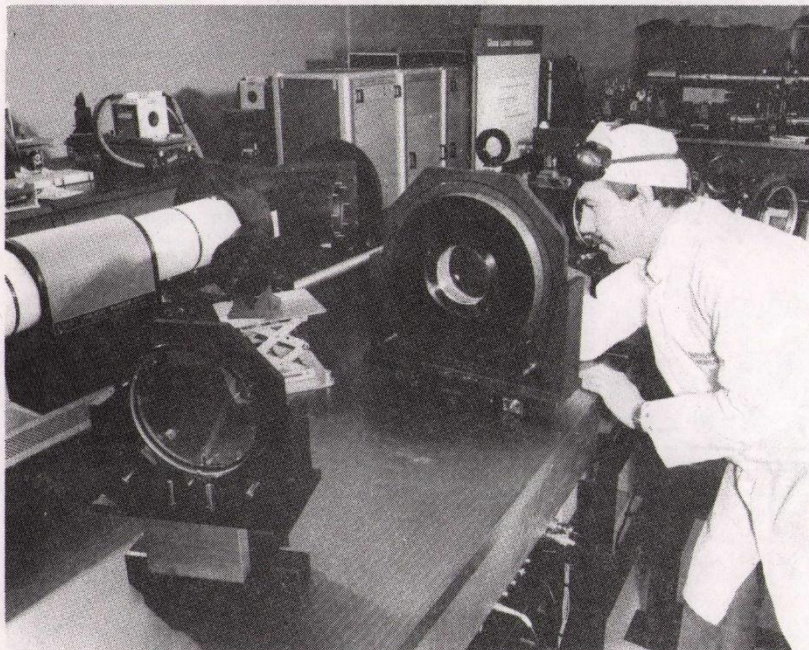


15 January 1979 No.1

Laser Gets the Green Light



A recent view in the laser area: the second harmonic crystal in its mounting is being adjusted for optimum output.

Laser beams are produced at a precise wavelength (or frequency). For several years it has been known that the wavelength of the light can be changed by passing the beam through a suitably orientated crystal of certain types of material. Scientists at the Central Laser Facility have used a special crystal to change the wavelength of the present (invisible) infra-red beam into green light. This will allow new experiments to be performed at a different wavelength - which is of fundamental importance in the study of laser-plasma interactions.

Successful Tests

Shortly before Christmas, a high intensity green beam was successfully produced at the Central Laser Facility. Radiation at a wavelength of 1.06 micron from the neodymium glass laser was converted to the 0.53 micron green second harmonic by passing it through an 11 cm diameter crystal of KDP (ie potassium

dihydrogen phosphate). Very high efficiencies were obtained with 50% of the incident laser radiation being converted to green light.

The simplified direct conversion of wavelength is possible because the very intense laser radiation has an electric field whose strength is comparable to the electric field holding the electrons to the nuclei in the atoms of the crystal. Beam propagation is then dominated by non-linear effects. With a crystal such as KDP, energy is coupled strongly from the fundamental beam into the second harmonic as long as the two waves can stay in phase. However in general the dispersion of the crystal makes this impossible. The solution is an elegant technique called 'phase-matching', where the crystal's natural bi-refringence is used to counteract its dispersion. For a carefully chosen direction of propagation and beam polarization through the crystal, the fundamental 'ordinary' ray and the second harmonic 'extra-ordinary' ray have the same value of refractive index.

The waves stay in phase for long distances through the crystal allowing high efficiency harmonic generation.

The crystal used is shown in the centre of the photograph. It has been specially cut at precise angles to its crystallographic axes in order that the phase-matching is automatically correct when the laser beam passes straight through it, perpendicular to the faces.

The new high power green beam will enable scientists at the Facility to study how the interaction of intense radiation with plasmas depends upon the illuminating wavelength used. A series of experiments is due to get under way in February.

Wavelength-Scaling

Wavelength-scaling experiments are of great topical interest. Recent preliminary results from a group in Paris suggest that when one goes from 1.06 to 0.53 micron, the resultant improvement in target performance may be greater than had been expected. However further careful measurements are needed because the interaction experiments are extremely sensitive to the exact details of the focussed laser-pulse - which leads to many pitfalls in trying to compare results derived from different types of laser. All other variables must be fully accounted for before the true wavelength dependence of the physics is revealed.

Scientists at the Central Laser Facility have one unique advantage in the present design of the main beam focussing lenses. Normally a different lens would be required at each wavelength studied. However due to the novel design of the Rutherford Laboratory optics, the doublet lenses can be operated fully corrected over a wide range of wavelengths, which will substantially reduce the difficulties of wavelength-scaling measurements.

(We thank Dr Malcolm White for this recent news from the Central Laser Facility)

INTERNAL Events

NIMROD LECTURE SERIES

R20. CONF.RM. NBRU - 1130 hrs

- 15 Jan: Dr C Savoy/Geneva.
"Intermediate Boson
Production in High Energy
Proton and Anti-Proton
Collisions".
- 22 Jan: Dr K Green/R.L.
"Results from ILL on the
Neutron".

- 29 Jan: Prof C Jarlskog/Bergen
'Grand Unification of
the Proton Lifetime'.

HEP LECTURE SERIES

R61 CONF.RM. - 1100 hrs

- 24 Jan: G C Branco/Bonn
'Weak Interactions of
Heavy Quarks'.

COMPUTING SEMINARS

COLLOQUIUM R27 - 1400 hrs

- 23 Jan: M J Burren/C & A Div.
Development Work in the
Applications Group of C & A
Division (ETHERNET, the
STELLA Project, and other
network and data
communications developments
at the Rutherford
Laboratory).

EXTERNAL Events

PHYS.DEPT.COLLOQUIA

J.J.THOMSON LAB. READING - 1700 hrs

- 15 Jan: Dr J G Jenkins/La Trobe
Melbourne
"Photoelectron Spectro-
scopy and the Electronic
Structure of Solids;
a British Inheritance
Largely Unclaimed.
- 22 Jan: Mr A Kaskly/Reading
"Optical Signal
Recognition using Matched
Filters.
- 29 Jan: Mr J Locke/Reading
"Neutron Scattering from
Molten Salts".

N.P.D. COLLOQUIUM

BLDG. 418 AERE HARWELL - 1515 hrs

- 18 Jan: Dr J Grover/NRDC
"Science and Security"
- 25 Jan: Dr Di Toro/Catania
'Yields and Angular
Distribution of Sub-
threshold Photofission.

THEOR.PHYSICS.SEMINAR

QUEEN MARY COLLEGE - 1615 hrs

- 15 Jan: Prof P Winternite/Montreal
& Saclay -
'On the Reconstruction of
Nucleon - Nucleon
Scattering Amplitudes from
Experiments and Possible
Violations of Isospin
Invariance".
- 22 Jan: Dr D S Gaunt (King's,
London)
'Recent Results for the
Ising Model".

Postgraduate Course

QUEEN MARY COLLEGE 1500-1700 hrs.
Starting 16 Jan - for approx 5
weeks on Tuesday afternoons.
Dr G L Sewell - 'The Many-body
Problem with
Realistic Forces'.

Christian Fellowship

The weekly meeting is now being
held on Thursday Lunchtime at
1230 hrs in the R2 Conference Room.
It is hoped that those who found
Friday Lunchtime to be inconvenient
will now be able to come along.

- 18 Jan: A study relating to the
very topical subject of
work and employment, will
be led by Frank Smith.
What are Christian
attitudes to strikes? Are
Christians indifferent to
Union activities? These
and other matters relating
to this often complex
subject will be studied
and discussed. All are
welcome.

- 25 Jan: The late Rev W.TH.Richards
was pastor of a large
Church in Slough. What
were the reasons for its
growth and impact upon
the town.
A recording of one of his
messages pointing to some
of the reasons will be
played at this meeting.

OVERSEAS Visits

L Phillips to DESY 8-26 Jan for
Installation of JADE experiment.
R Croucher and J Summers to DESY
15-26 Jan - JADE experiment.
H G V Hawthorne, J F Wells,
K J Miles and K Stanley to CERN
15-26 Jan to work on EMC and Nall
Experiments.
C M Fisher to CERN 15-31 Jan to
work on Nal3 experiment.
G E Elliman to CERN 15-26 Jan to
work on EMC and Nall Experiments.
A Dobbs and M Dobbs to CERN
21-26 Jan to work on CCOR MWPC.
V C Cloke, J K M Gill, G G Hicks
and N G Thomason 24-27 Jan to
study control and interlock
philosophies.
H K F Yeung to Copenhagen 21 Jan-
3 Feb to attend "Abstract Software
Specification" course.
B G Brady to CERN 24-27 Jan for
Discussions on RF Low Power Drive
Systems.
H Roskell to DESY 22-25 Jan for
general discussions.

B-Slim Club

Christmas is over, and we are
getting/have got fat - join us on
Thursdays in the NBRU Conference
Room R20 from 1200-1330 hrs, to
lose that unwanted 7lbs or 7 stones
before your summer holidays.
Now is the time to begin.
Make 1979 your year to B-Slim.
Contact AERE. Ext 2051 M/s Rosier
or SRC Ext 484 J Banford

Film Badge Notice

It is Period 1. Colour Strip
ORANGE for beta-gamma films.
Please make sure you are wearing
the correct badge and all old ones
are returned.

Anyone requiring a new holder
please contact Mrs J Coates,
Building R2, Ext 430.

Please note next Film Badge change
29 January.

Undelivered Mail

Would Mr K Philips (or near offer)
who is expecting a letter from
Ronald Ward of Bexleyheath, please
collect from Room 23 building R20.

Supper Dance

A Supper Dance is being arranged
at Cosener's House on 9 February
- 'eats' at nine. Tickets
available at £3.75 from Pat.Ext 423
and Kay Ext 6603. There are no
bar facilities, so bring your own
bottle - All are welcome.

Sales to Employees

The Sale of scrap metal/plastics
as set out in RLN 12/75 will be
made on 19 January in R40 stores.

One LEP Ahead

The European particle physics community has been making plans for the next high energy accelerator project. Studies over the past 3 years have come out in favour of an electron-positron colliding beam machine of higher energy than the newly commissioned PETRA rings (which eventually will accelerate electrons and positrons up to about 19 GeV) at the DESY Laboratory in Hamburg, and the PEP machine (of a similar energy) which is under construction at SLAC in California. The new European machine is commonly known as the LEP (Large Electron-Positron) project.

Early thoughts by the European Committee for Future Accelerators (ECFA) were for a LEP with 100 GeV electrons/positrons, producing a total energy of 200 GeV in the head-on collisions. An early phase of the project could aim for 70 GeV rings with a later upgrading of the machine.

A LEP Summer Study held at Les Houches in September 1978 worked upon the design of a machine with 80 GeV per beam, which could be later upgraded to 120 GeV using superconducting RF cavities. The machine envisaged would have a diameter of 10 km! The first stage up to 70 GeV would cost just over 1000 million Swiss francs and requires about 200 megawatt to power the magnets. The physics experimental programme is also under intensive study.

ECFA has asked CERN to examine the possibility of building LEP at the present CERN site. This has been done and looks quite feasible. The machine could be built underground, extending towards the Jura Mountains. There would be eight (intersection) regions around the machine where the electrons and positrons collide; the particle physics experiments are mounted at these places. The construction programme could start from the end of 1981 and would take about 7 years to complete.

A further meeting of the LEP Working Party met at Rome in November 1978, and we are grateful to Dr Peter Landshoff for the latest news:

The thinking about the LEP machine has already developed since the study meeting in September. The Rome meeting was attended by 150 physicists (out of the 200 physicists in the LEP Working Group).

In response to pressure from the particle physicists, the machine physicists are studying the possibility of upgrading the energy to about 85 GeV per beam with copper cavities, or eventually some 130 GeV when the cavities are replaced with superconducting ones. This would require a ring of larger radius, so that three of the intersections would be under the Jura

Mountains if the machine is built on the site adjoining CERN. Access to these would be by nearly-horizontal tunnels instead of vertical shafts. It is now proposed to tilt the machine so that the two intersections furthest from the Jura would be only just below ground level, making possible the provision of larger experimental halls.

A larger machine would necessarily be more expensive. It might perhaps be built initially with some missing RF, so as to run at a maximum energy of about 60 GeV, which would be enough for a Z^0 factory.

The ECFA LEP Working Group is divided into 20 specialised study groups, which met in Rome. Many of the participants in these came away with specific tasks to perform before the next meeting in Hamburg in April of 1979.

Particle physicists view the possibility of this new giant research facility with great enthusiasm, since it is expected to produce new (and even unexpected) phenomena at the higher energies which will have a strong bearing on the fundamental ideas of particle physics research.

Goodluck Judyet Al



Judy Williams left the Laboratory on December 11th after nearly 4 years as secretary to George Kalmus and the Bubble Chamber Research Group. At a farewell ceremony held in front of a packed audience in the R61 conference room, she was presented with an electric cooking pot and some perfume by George Kalmus on behalf of all of her friends in the Laboratory.

Judy will be missed by all of her colleagues for her friendly and cheerful nature and in particular by those in the Bubble Chamber group for all of those attributes which made it a pleasure to work with her!

We wish her all the happiness in her future job as mother and hope that her experience gained at R.L. of dealing with difficult people will stand her in good stead.

A Few words from Judy

Just to say a thousand thanks to everyone for their good wishes for myself and junior and for the marvellous presents. I have enjoyed every minute at Rutherford and am amazed at the number of folks I've met! I hope that those I haven't managed to see personally will regard this as a personal thanks. I shall let you know when the baby arrives and will visit you sometime.

Lastly my very best regards to the Bubble Chamber Research Group - and especially to George Kalmus who has been a super boss!

Folk Club

The RL Folk Club met for the first time in several years on the night of Friday 1 December. Despite it being a very cold night it was a very enjoyable evening with Paul Weaving (our main guest) not only singing some very fine songs, but some very humorous ones as well.

For those of you who have never been to a Folk Club and are wondering what it is all about then perhaps a few more details are in order. We meet in the restaurant coffee lounge and we listen and watch people performing anything connected with folk music, songs, dances, or plays. We organise the evening into 2 parts with a break in the middle for refreshments. Each part is arranged with some floor singers (people who just turn up on the night to sing) and a main guest. The songs vary from solo ballads to rousing chorus songs where everyone joins in and we try to raise the roof.

The next meeting of the club will be on Friday 2 February, and the main guest will be Telephone Bill and the Smooth Operators. This group are known nationwide and they provide a very enjoyable evening's entertainment.

The evening will start at 8 pm prompt and there will be a licensed bar and food available. Floor singers get in free and everyone is welcome to attend.

Tickets are available on the door at £1.20 or in advance at £1.

So why don't you come and join us for a really good night out.

Tickets from:

Steve Halliday R25 Room 1.23 Ext 492
Steve Cox R25 Room 2.34 Ext 407
John Ellis R2 Room 3.04 Ext 6689
George Pullinger - Ptkbn 4 - Ext 6661

Horticultural Society

The AERE Horticultural Society has been in existence since 1947 and serves as a focal point for a once a year get together of staff from AERE and the Rutherford Laboratory (both working and retired) and friends in gentle competition.

I was recently asked by a puzzled observer "what is the attraction of being Secretary of the AERE Hort. Soc. - why do you bother to do it"? I no longer work for either AERE or the Rutherford Laboratory and the answer could easily be "because nobody else wants the job"! but there is more to it than that. I believe that friendly competition which shows off people's natural skills is as important to the quality of life as academic competition. It also allows non-competitors the pleasure of seeing the fruits of other people's labours and even acts as a spur to encourage non-participants to join in.

There is no doubt that Flower Shows cause a few people a lot of work but give many people pleasure. How many times have I heard the cry "Oh! I haven't any time" or "They'd laugh at my efforts, I'm no good at that sort of thing". The few addicts who always enter are our life-blood but the real gratification comes when one has spent ages persuading a reluctant, would-be exhibitor that it is worth 'having a go', and then he or she wins a cup and beats the 'expert'. The comment they always make after winning is "I'm glad that you twisted my arm".

For Example

We usually only see a list of names and awards in the local paper and in the bulletins but very often there is quite a story attached to the name. At the 1978 Show several instances come to mind. Mrs Ann Wheatley has just moved to Chilton Village and works part-time in the Social Club. Now Chilton Village does not have an annual Flower Show so Mrs Wheatley was very pleased when she found that she could compete in the AERE Show. This lady and her two small children entered in over 30 classes. This, in itself, is an achievement because one has to be very keen and dedicated to produce and stage that number of exhibits. For her superb efforts

she won the cookery tray and the Ladies Cup. She also encourages her children in the skills of cookery and handicrafts - I'm sure they will not grow up bored teenagers!

Mrs Beryl Cross is also a first-time competitor at the AERE Show; she works in the Harwell Reprographic Section and competed in the Floral Art Section. For her efforts she won the Sister Hickman Culham Cup, shared the Marjorie Le Cren Basket, received the Worshipful Company of Gardeners' Certificate in Floral Art, and also the Flora Certificate and a year's subscription to the Flora magazine. On top of this her 'best exhibit' was photographed to be entered in a National Flora Photographic Competition - we are still waiting for the outcome.

One cannot talk about the AERE Flower Show without mentioning Mr Henry Rose, our staunchest supporter. Henry retired in August after 25 years gardening on site and as Head Gardener at Cosener's House, Abingdon. Henry's record for winning cups and awards is awe-inspiring. This year he entered nearly 40 exhibits and won 10 cups, once again proving what an excellent gardener he is. We hope that, despite his retirement from official gardening, he will continue to support the AERE Show.

Despite Disability

On a more sombre note we must remember that some exhibitors do make the effort to compete despite serious physical disabilities. One lady told me this year that eventually her condition will mean that she will need to use a wheel-chair but so far she still works full-time and with a little encouragement makes the effort to compete for, and win, cups. She says that making things to enter competitions gives her an added interest in life.

Outings and Activities

Apart from the Annual Show the Society offers other activities such as coach trips to places of gardening interest (the Chelsea Flower Show, Wisley Gardens). We also occasionally organise non-horticultural outings to potteries and glass factories and even medieval banquets! During the Autumn, Winter and Spring period the Society arranges for well-known experts to give illustrated lectures (which, unfortunately, are not well supported despite wide publicity).

The main financial benefits are derived by members from obtaining discounts from local shops and garden centres and also from discounts obtained through bulk buying i.e. seeds, pots etc. (always subject to sufficient demand).

Advice and Bargains

Members may also obtain professional advice from the Royal Horticultural Society and loan books either from our local library (H7.12, Ext.2312) or from the RHS library. Because we are affiliated to the RHS and the Nat. Rose Society we obtain 4 free passes which may be used by members throughout the year to attend the national shows and visit the Gardens at Wisley, St. Albans and Springfields. For 25p per annum I think members get good value for their money. If you are interested in joining please contact me, Mrs Wendy M Dance, H7.12, Ext.2312.

The Lecture on Tues 23 January at 7.30 pm in R61 Conference Room is entitled "Trees and Shrubs for Small Gardens. It will be given by Mr O J Clayton of the Royal Horticultural Society. Entrance Fee 25p members, 30p non-members, coffee will be available. Please note change of venue, cars should be parked in the BLUE car-park.

Mr Clayton pointed out that there is now a special Garden for disabled people at Wisley complete with 'wheel chair' routes!

SEED ORDERS:- Mr J Hogston Building 424 (Harwell) Ext 2718 is co-ordinating bulk orders of Dobies Seeds, the next order will be placed by 19 January and the last order will be sent on 17 February. We have also received catalogues from Thompson & Morgan who are offering us 25% discount on orders over £10.

Missing

Tape-winder. Inv. Item No. 5445
Inventory holder Mrs J D Bryant
R26 Ext. 6640

Removed from Ladies Cloakroom, R20 on Tuesday 9 Jan between mid-morning and noon, pair ladies hand-stitched sheepskin gloves, fawn, new at Christmas. Please contact Miss M E Fry, Personnel, R20



RUTHERFORD LABORATORY

BULLETIN

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