

COMMON/CSCAL/IBM , NERR, NCH, NGAP, ISCAN, NBR, NGR, NSCANILYSEL, IYSEU, IYMAX, NTRACK, NSCAN, NES, NFAIL, MAXTR, MAXNON NBEGIN, NTK, NTRY, NMISS, NSSR, NFID, MAXMIM, NFIRST, NEND, JABCON, CFID/MFX(20,3), NFY(20,3), NFDX(10,3), NFX(31, NF) ABCON, CFID/MFX(20,3), NY(100,4), XN(2), YN BULLETIN NCF(100,2), JDX(4), JDY(4), IHS(4), ICV(2), BULLETIN NCF(16), IFS, NFS, FX, FY, JK, PIC, KPIC, NCUUNT, NBIN, MAXIV, MAXN, C 26 TB January 3, J-, J 9 JE, February YF 1976 DIMENSION NCTR(144), NGTK(20), CTR(112), GTK(12), MUDE(21)

STRETCHING THINGS A BIT

A technique first developed at RL for high-energy physics research is now being applied with great success in other areas by the NBRU and the Department of Engineering Science. First used in HEP for stretching thin aluminised Melinex films to make lightweight mirrors and spark chamber electrodes, the technique has now been adapted for three different devices used in neutron scattering.

In the first application, stretched Melinex films have been used to make neutron beam collimators - devices which restrict the divergence of the beam to a fraction of a degree. The basic principle used is that of the Soller collimator which consists of a set of equidistant, parallel plates which absorb neutrons. The degree of collimation is determined by the ratio of the distance between the plates to their length, and for a high degree of collimation one must use either very long plates or very small gaps between them. To keep the length of the devices reasonable, spacings of 1-2 mm are normally used. To obtain the best performance the plates must be very thin and very straight, requirements which have been difficult to meet in the past.

Excellent results have been achieved using stretched Melinex film glued to "picture frame" metal formers with a thickness equal to the required collimator plate spacing. The films are coated on each side with a paint loaded with gadolinium oxide, which, though very thin (the total thickness of painted film is about 0.050 mm) is nevertheless an efficient absorber of thermal neutrons. The frames are sandwiched between strong side plates and the ends cut off to leave a stack of collimator plates which are beautifully thin and straight. With gaps as small as $\frac{1}{2}$ mm, the result is a short, compact collimator.

Such devices are some 10% more efficient than the best methods reported so far and are much better than most collimators now being used. At the same time they are economical and straightforward to manufacture - when you know how. So far 18 collimators have been supplied to ILL and several more are on order, including five for use on the AERE reactors. Others are being designed for use at Riso (Denmark) and at Upsala (Sweden).

The second application is in devices for deflecting beams of long wavelength neutrons through angles of a few degress – useful because it results in a beam line which does not "look" directly at the reactor moderator and therefore contains much lower background levels of fast neutron and γ radiation. The basic principle used is that of the now well-established neutron guide tube. By coating a smooth surface with a suitable metal such as copper or nickel, slow neutrons incident at low glancing angles are totally reflected by a process analogous to total internal reflection of light. Thus two such surfaces facing each other allow neutrons to bounce back and forth between them and so be conducted over long distances with little loss. If these two surfaces lie on a curve, the neutrons can even be made to go round corners!

However because of the small critical glancing angles, the ratio of radius of curvature to spacing must be very large and is about 6 x 10^3 for neutrons of wavelength 10 Å on nickel. This means that for conventional guide tubes made by depositing nickel coatings on glass plates where the spacing is about 5 cm, the radius of curvature is about 300 m. To deflect a beam through an angle of

 5° requires a guide tube 26 m long. Guide tubes of this size - and bigger - are in routine use at ILL, but each one is a major engineering undertaking.

By using a stack of thin, copper-coated Melinex films separated by narrow spacers, a much more compact device can be built. For example a 5° "bender" with 11 films, 10 gaps each of width $\frac{1}{4}$ mm and a radius of curvature of 188 cm, has been successfully built with a length of only 16 cm. The films themselves are only .025 mm thick and so block off only 10% of the beam.

The device has been tested several times on the DIDO reactor at AERE using neutrons from the cold source with wavelengths from 4 to 12 Å. The measured transmission efficiency was about 50% compared to a theoretical value of 63% at 12 Å - a value which makes the device quite useful.

The next step is to produce a practical "bender" with many films capable of handling a neutron beam several centimetres wide, and a vacuum deposition technique has been developed to handle the rather unusual problems of depositing metal on to thin (and heat shrinkable!) plastic films.

The third application is in the field of polarized neutron experiments. Though the neutron is an electrically neutral particle, it possesses a magnetic moment and can be polarized utilising magnetic scattering—the interaction of polarized neutron beams with the magnetic moments of the atoms in solids—big advances in the understanding of the structure of magnetic materials has been made. The Polarized Neutron Diffractometer, D3, built at the Laboratory for use at ILL, is an instrument used for this type of work. In 1969 American workers demonstrated that when the polarization of the neutrons scattered from a specimen is measured, new information about magnetic materials is obtainable and this new technique is called polarization analysis.

This opened up a new dimension in neutron scattering which can be applied to spin dependent scattering in both non-magnetic and magnetic materials. Though early work was done with neutron wavelengths of about 1 Å, where polarized beams can be produced by Bragg reflection from a magnetic crystal, attention is now turning towards long wavelength applications requiring coarse wavelength resolution and new devices for polarizing and analysing beams are needed. One method is to reflect the beam from a mirror coated with a film of magnetic material so that neutrons of one spin direction are reflected and those of the other are transmitted. By constructing a stack of thin plastic films with coatings of an iron-cobalt alloy, a compact polarizer can be made having adequate transmission and high polarization efficiency. The neutrons transmitted by the magentic coating must not be subsequently reflected at the coating - plastic film interface underneath or they would contaminate the polarized beam. This can be avoided by proper choice of plastic film.

One example of the use of such a long wavelength polarizer would be in the study of magnetic defects which can have a profound effect on the properties, eg structural strength, of materials. Long wavelength polarization analysis using polarizing benders as the polarizer and analyzer would enable the separation of magnetic scattering from nuclear scattering in for example, magnetic alloys containing dilute paramagnetic impurities.

INTERNAL EVENTS

NIMROD LECTURE SERIES Monday 26 January 1130 Lecture Theatre

High Statistics Study of Particle and Antiparticle Elastic Scattering and C = -I Exchange.

Dr M Davier/Orsay

HEP SEMINAR
Wednesday 28 January
##00
R61 Conference Room

Asymptotic Behaviour of Chiral Non-Symmetric Structure Functions in non-Abelian Gauge Theories.

R Horgan/Oxford

HEP DATA HANDLING SECTION SEMINAR Wednesday 28 January 1330 R61 Conference Room

Languages I have known.

C Osland/RL

SAFETY FILM SHOW Wednesday 28 January @ 1230 Thursday 29 January @ 1315 Lecture Theatre Make Light of Lifting, a 17 minute colour film, showing the right-and wrong- ways of using the body to handle heavy weights. 25% of all industrial injuries occur during the handling of materials. Many of these are injuries to the back caused by lifting and moving loads incorrectly and the penalties are great. This film demonstrates correct techniques for lifting and moving boxes, sacks, drums, cylinders etc. Even if you only move the dustbin weekly - Make Light of Lifting it!

NIMROD LECTURE SERIES Monday 2 February 1130 Lecture Theatre μ-ψ Physics from Old Ideas

Dr Chan Hong-Mo/RL

HEP SEMINAR Wednesday 4 February 1100 R61 Conference Room

 $K p \rightarrow \Lambda \pi$ in the Formation Region using Barrelet Zero

A de Belleton/College de France

FILM SHOW Thursday 5 February 1240 Lecture Theatre The History of the Motor Car, Part 3, The Vintage Years, a 27 minute colour film. Some years ago we showed the whole of the series, however, apart from those who would like to see the film again, there are a lot of newcomers to the Lab since the previous showing who may like to be transported (temporarily) to the motor racing scene of 50 years ago.

FILM SHOW Friday 6 February 1240 Lecture Theatre

The Chemistry of OII, a 13 minute colour film of a more technical nature. Simple organic chemistry is explained and is then used to explain the separating and conversion processes in an oil refinery.

SEMINAR IN COMPUTING Friday 6 February 1100 R61 Conference Room

IBM's New Time Sharing System - VSPC

J Cable (IBM (UK) Ltd)

Virtual Storage Personal Computing (VSPC) is a multi-access time-sharing system designed to be complimentary to T.S.O. In many ways it is similar to ELECTRIC but with the addition of interactive compiling and execution. VSPC provides interactive Basic, APL and Fotran; overall its facilities are less sophisticated than than those in TSO but it can handle more simultaneous users on a given machine.

NIMROD SCHEDULE

Cycle 2 3.2.76-24.2.76

No change from Cycle I See Bulletin 1/76 for details

EXTERNAL EVENTS

OXFORD UNIVERSITY

SEMINARS ON THEORETICAL HIGH ENERGY PHYSICS/NP DEPT - 1430 hours.

30 Jan: Zwerg Rule Violations as a Consequence of Dual Unitarization - Dr Chan Hong-Mo/RL

6 Feb: Green Functions and Quantization on Curved Space-Times - Dr M Brown/Oxford.

ELEMENTARY PARTICLE PHYSICS SEMINARS/NP DEPT - 1430 hours.

29 Jan: Partial Wave Analysis of Three Pions - Dr S Orebi Gann/.C.

5 Feb: Report on the Amsterdam - CERN - Nijmegen-Oxford (high statistics) K p Bubble Chamber Experiment at 4.2 GeV/c - Dr P Grossmann.

THEORETICAL PHYSICS SEMINARS/CLARENDON LAB - 1615 hours

29 Jan: The Pauli Principle and the Scattering of Complex Nuclei - Dr H Friedrich.

5 Feb: Superfluid Helium 3 and the Renormalisation Group - Dr D R T Jones.

DARESBURY LABORATORY

THEORY SEMINARS/CONFERENCE ROOM 3 - 1400 hours.

26 Jan: Complex Angular Momentum and Molecular Collisions - J Connor/Manchester. 2 Feb: Theory of Electron-Photon Coincidence Experiments in Hydrogen and the Alkalis-

M R McDowell/Royal Holloway College.

9 Feb: Application of Model Potential Methods to Atoms with Two Valence Electrons - C Laughlin/Nottingham.

QUEEN MARY COLLEGE

THEORETICAL PHYSICS SEMINARS/PHYSICS LECTURE THEATRE - 1615 hours.

26 Jan: Semi-classical Quantisation of Bound States - Prof I.C. Percival/QMC. 2 Feb: Canonical Quantum Gravity - Dr C J Isham/Kings College.

9 Feb: Linear and some Non-Linear Solitons - Prof R F Streater/Bedford College.

MANCHESTER UNIVERSITY

HIGH ENERGY PHYSICS SEMINARS/4TH FLOOR SEMINAR ROOM - 1600 hours.

29 Jan: S * +1 KN Phase Shifts in the 'Resonance Region - B R Martin/UCL.

5 Feb: New Results on Hypercharge Exchange Reactions at High Energy - C Damerell/RL.

CAMBRIDGE UNIVERSITY

HIGH ENERGY SEMINARS/CAVENDISH LAB - 1500 hours.

28 Jan: Clustering Effects at High Energies - Dr T Ludiam/Yale. 4 Feb: Exploding Black Holes - Dr G W Gibbons/DHMTP.

HIGH ENERGY PHYSICS SEMINARS/ROOM A, SILVER STREET - 1500 hours. 29 Jan: Regge Cuts in \emptyset^3 Field Theory - Dr | T Drummond/Cambridge. 5 Feb: (Very Provisional) - title to be announced - Dr | Barlels/Hamburg.

READING UNIVERSITY

PHYSICS DEPARTMENT COLLOQUIA/J J THOMSON LAB - 1700 hours.

26 Jan: Water. Has the Liquid a Structure? - Prof J B Hasted/Birbeck College

2 Feb: The Spin-Flip Raman Laser - Prof S D Smith/Heriot Watt U. 9 Feb: Atom Scattering from Surfaces - Prof J L Beeby/Leicester.

EVENTS AT AERE, HARWELL

THEORETICAL PHYSICS DIVISION SEMINARS/CONF.RM.BUILDING 8.9 - 1415 hours.

30 Jan: The Discreet Charm of Coloured Quarks - Dr J M Charap/QMC.

6 Feb: Nucleation Theory as Applied to the Irradiation Environment - Prof K C Russell/

M.I.T.

NUCLEAR PHYSICS DIVISION COLLOQUIA/CONF.RM., HANGAR 8 - 1530 hours.
29 Jan: Operational Numerical Weather Prediction - Dr W A McIlveen/Met Office Brackhell

5 Feb: Ion Beams for Implantation & Analysis - Dr G Dearnaley/NP Div.

RUTHERFORD LABORATORY BULLETIN

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Editor: H F NORRIS

Deadline for Insertions 1000 hours Wednesday 4 February

Room 42 Building R20 Rutherford Laboratory Chilton Didcot Oxon

Abingdon 21900 Ext 484

FILM SHOWING A small group of Department of Trade AT LEIPZIG officials visited the Rutherford Laboratory recently to look for material to

exhibit at the forthcoming Leipzig Spring Fair. From a shortlist of new developments from the Nuclear Physics Apparatus Group, the DTI selected the new 'Film-Wire' technique, and a large exhibit highlighting this work will be seen at the Fair.

'Film-Wire' was developed for use in spark chambers so that they could be made smaller and lighter than most conventionally-built units. Traditional methods for constructing spark chambers often require many individually-tensioned wires to be used, and maintaining these wires in position requires very large and bulky frame-

In the RL 'Film-Wire' method, fine wires can be bonded down close together very accurately on large polyester sheets, so providing large areas of conducting material in which the positions of the wires are known with great precision. This material is very easy to handle and can be stored and, when required, incorporated into equipment with a minimum of additional installation.

Because the wires are continuous, sheets of 'Film-Wire' can be cut and stuck together to form a braid-like cable to connect with external electronics, so minimising the need for complex and unreliable soldering. As well as being made with the top surface conducting, 'Film-Wire' can also be produced with polyester insulation on both sides, but in both cases the insulation is very easy to remove, when required.

Although the use of the new technique is presently confined to the manufactute of apparatus for use in particle physics experiments, important extensions are seen in the aerospace and communications industries.

MISSING EQUIPMENT The following item of equipment has been removed from R2 Electrical

T.M.K. Multimeter, Ser No 0115080. Anyone with information on its present whereabouts is asked to contact G Hackett, Ext 322. CERN FOLLOWSHIPS The following awards - Fellowships, Senior Fellowships, Corresponding Fellowships, Visiting Scientists Appointments and Travelling Fellowships are available to suitably qualified UK scientists and technologists to enable them to work at CERN. Further information from Mrs R Jeans Ext 510.

QUEEN ELIZABETH 11 Up to ten fellowships may be FELLOWSHIPS IN PHYSICAL awarded each year for full-AND BIOLOGICAL SCIENCES time research by young Up to ten fellowships may be scientists of exceptional

promise and proven capacity for original work. These are post-doctoral awards tenable in an Australian university or approved research institution normally for two years. Further details from Training Section, Building R2O, Ext 266.

SAD NEWS It was with regret that we learnt of the death of Jock Weatherburn recently. Jock who retired a few months ago, worked at the Laboratory for twelve years, firstly in the Electronics Group and then with Stores

The collection that was made will be donated, at the wish of Mrs Weatherdown, to the British Heart Foundation. We extend our deepest sympathy to his wife and daughter.

OVERSEAS VISITS Dr C M Fisher and Dr R W Newport to CERN, 22-27 and 23-27 January respectively, for discussions and meetings on the rapid

cycling bubble chamber project.

Dr M W Johnson, to ILL Grenoble, 25-30 January, for discussions on future computing systems and to give seminar

on deconvolution methods.

Mr D Jones, to Brussels, 28-29 January, to attend meeting of European CAMAC Association's Information Working Group. The Director, to Rome, 29-31 January, to attend Advisory Committee for PETRA Research Programme.

Dr W G Williams and Mr J Penfold, to ILL Grenoble, 1 - 6 February, for tests on Polarizing Mirrors.

SOCIAL NEWS

RECORD SOCIETY The theatre and musical comedy are featured in the Record Society concert which commences at 1240 on Tuesday 2.7 January with songs from "The Boy Friend", sung by members of the original cast. Presented by the Players Theatre.

The following Tuesday, 3 February at 1240 - "Copland Conducts Copland" - Appalachian Spring, The Tender Land played by the Boston Symphony Orchestra.

Not many orchestral pieces by American composers ever manage to make a real dent on the steely facade of what we call the standard orchestral repertoire. Aaron Copland's celebrated suite from the Martha Graham ballet Appalachian Spring is one of the handful that have made the grade; moveover, it has made the grade as few of the others that have succeeded can claim. Both concerts are in the Lecture Theatre.

CHRISTIAN FELLOWSHIP All are welcome to a continuation of the study on the Epistle of Paul to the Colossians. The first two studies led by John Thomas have proved both interesting and stimulating. The meeting, on Friday, 30 January, commences at 1230 in the RI2 Conference Room.

The first Friday in the month is set aside for prayer and all are welcome to join with us in the RI2 Conference Room at 1230 on 6 February.

I.P.C.S MEETINGS

- 1. General Meeting at 1300 hours on Wednesday 28 January in the Lecture Theatre Subject - 'SRC's Man Power Proposals' Speaker - J H Aram, Chairman, Staff Side SRC Whitly Council.
- 2. General Meeting at 1300 hours on Wednesday 4 February in the Lecture Theatre Subjects - The Attack on Inflation and, TUC Affiliation Speaker - invited speaker from NEC.
- All members invited to both meetings.