RUTHERFORD

Bulletin 4

21 February - 7 March 1977

New Polarizing Filter For Thermal Neutrons

Some 4/5 years ago the idea for a new polarizing filter was thought up by a member of the NBRU. Since then the unit has succeeded in turning the idea into a promising new research tool.

To put the idea into practice however meant solving two principle problems. One, the growth of the crystal and equally important, the provision of a very low temperature environment to cool the crystal.

In order to grow the crystal it was necessary to purchase from the Oak Ridge Laboratory, USA, 70% of the then existing world supply of the isotropically enriched material $^{149}Sm_2O_3$ (samarium oxide). This had to be included in a single crystal of a deuterated paramagnetic salt and this solved the first problem.

The second problem, on the cryogenics, was overcome in collaboration with the Oxford Instrument Co Ltd who built the dilution refrigerator. (0.016K is rather on the cold side!).

The results achieved so far in the test programme are encouraging; the new tool should prove invaluable in research requiring high intensity beams of polarized neutrons and world reaction will be watched with interest. - Ed.

A filter method for polarizing 'white' thermal neutron beams, first proposed several years ago by the NBRU (Neutron Beam Research Unit), has operated successfully.

Thermal neutrons (wavelengths $\lambda \sim 1$Å) are strongly absorbed by ^{149}Sm nuclei, and when the nuclear spins are polarized, they will preferentially absorb one of the two possible neutron spin states in an incident beam, thus the transmitted neutron beam becomes polarized. The Sm material used as the filter must be carefully selected, and the suggestion made by the NBRU was to use a filter containing ^{149}Sm nuclei which are introduced as dope atoms into a single crystal of the deuterated paramagnetic salt, cerous magnesium nitrate (the resulting crystal has the complicated chemical formula $Ce_{1.89}{}^{149}Sm_{0.11}Mg_3(NO_3)_{12}\cdot 24D_2O$, which for convenience has been abbreviated to CSMN).

In order to obtain an effective neutron polarizing filter (this means having a large attenuation for one spin component and a low attenuation for the other), high ^{149}Sm nuclear polarization values are required ($\sim$80%), and this has been achieved by cooling a CSMN crystal to temperatures $\lesssim$0.016K in the mixing chamber of a ^{3}He/^{4}He dilution refrigerator, while applying a 0.5 Tesla magnetic field in the direction of the crystal's symmetry axis. The nuclear polarization is created statically by the high internal magnetic field which the ^{149}Sm nuclei experience from the magnetic electrons of the Sm atoms. This polarizing technique has obvious advantages over the alternative nuetron polarizing filter method which uses the spin-dependent scattering of protons in a dynamically polarized proton target, since it does not require any microwave 'pumping' to induce the required transitions between the nuclear spin levels.

The dilution refrigerator was built by the Oxford Instrument Co Ltd., and the NBRU undertook responsibility for growing the CSMN single crystal and designing its holder (which formed part of the dilution unit mixing chamber). Neutron measurements of the performance of the polarizing filter were made at the DIDO Reactor, AERE Harwell, during January. These measurements are now being analysed, and preliminary results of the polarizing efficiency and transmittance values are in agreement with those predicted theoretically.

NETWORK NEWS The whole object of computer networks is to allow computers to 'talk' to each other. It is good to be able to report that our two Network Units have started off well by resolving differences between DES and D of I protocols and are in frequent communication. Both circuit switch (ie telephone) and packet switching (ie internal mail) techniques are employed.

On a more serious note, the NCCN Secretariat has recently been involved in sending to computer mainframe, mini computer and terminal manufacturers a letter from its Committee Chairman, Dr Howlett, stressing the importance of formulating and adhering to standards in data communications. This letter notes the progress being made by BSI (British Standards Institute) and ISO (International Standards Orgnaisation) on HDLC (High-level Data Link Control) and also the recent adoption by CCITT (International Telegraph & Telephone Consultative Committee) of the virtual-call packet Recommendation X-25 (sorry!). (We did warn you about more acronyms!!).

The whole object of the exercise is to ensure that the problems of setting up networks, with computers of different makes, are minimised. The task has involved sending letters to some 140 manufacturers in the U.K. to more than 60 editors of national and international computer and communications journals, to the press generally and will involve collating their replies. Hopefully, no one was missed off the list (itself a big compilation job) but if they were, the Secretariat is there to help.

INTERNAL EVENTS

NIMROD LECTURE SERIES
Monday 21 February
1130
Lecture Theatre

Signatures for Charm Production in e^+e^- Annihilation

Dr S Matsuda/RL

LASER DIV. SEMINAR.
Tuesday 22 February
1045
R61 Conference Room

The programme of laser-thermonuclear microsynthesis in Poland.

Dr S Kaliski/Polish Minister of Science

HEP SEMINAR
Wednesday 23 February
1100
R61 Conference Room

Scaling Violation and the Production of W's, Z's and Massive μ-pairs

I Hinchliffe/Oxford

RUTHERFORD LABORATORY LECTURE
Thursday 24 February
1515
Lecture Theatre

The Magic of Spin

Professor E R Laithwaite/Imperial College, London (See 'News' for details)

NIMROD LECTURE SERIES
Monday 28 February
1130
Lecture Theatre

Semi-leptonic Decays of New Particles

W Deboer/Munich

HEP SEMINAR
Wednesday 2 March
1100
R61 Conference Room

Nuclear SIZE Dependence of Inclusive Particle Production

I Soitis/Imperial College

HEP DATA HANDLING GROUP SEMINAR
Wednesday 2 March
1330
R61 Conference Room

Network Switching by Contention. - A Descriptive Talk on Systems such as the ALOHA Network at the University of Hawaii, and ETHERNET

J W Burren/RL

EXTERNAL EVENTS

ELEMT. PART. THEORY SEMINAR/NP LAB.,OXFORD - 1430 hrs.
4 Mar: Dr M Green/Cavendish - Dual green functions & granular strings.

THEORETICAL PHYS. SEMINARS/CLARENDON LAB.,OXF - 1615 hrs.
24 Feb: Dr A Bishop/QMC - Aspects of recent non-linear physics.
3 Mar: Dr D K Sinclair - Lattice gauge theories - high temperature expansions & phonon spin wave spectra in particle physics.

NUCLEAR STRUCTURE SEMINAR/NP DEPT., OXFORD - 1430 hrs.
21 Feb: Dr D W Sciama - A relativist looks at high-energy collisions.

HEP SEMINAR/CAVENDISH LABORATORY, CAMBRIDGE - 1500 hrs.
2 Mar: N Booth/Oxf - High energy muon scattering at Fermilab.

HEP SEMINARS/DEPT. APPL. MATHS & THEOR PHYS. CAMBRIDGE - 1500 hrs.
24 Feb: D H Perkins/CERN, Oxf - Deviations from scaling in inelastic lepton-nucleon scattering.
3 Mar: J Pati/I.C. - Unification-liberation of quarks & leptons.

PHYSICS DEPT COLLOQUIA AT READING UNIV - 1700 hrs.
28 Feb: Dr D T Pegg/Queensland - Spin relaxation in large molecules.
7 Mar: Dr P S Dobson/Birm. - TEM of defects in degraded GaAs laser and lamps.

THEOR. PHYS SEMINARS/MANCHESTER UNIV - 1430 hrs.
23 Feb: Prof B H Bransden/Durham - Equivalent exchange potentials in atomic scattering problems.
2 Mar: Prof H E Hall - Orbital solitary waves in the ^{3}He A phase

HEP SEMINARS/MANCHESTER UNIV - 1415 & 1615 hrs.
24 Feb: J Thomson/Daresbury - The CERN muon collaboration : future plans.
2 Mar: G Weber/DESY - Recent e^+e^- results from DORIS

DEPT OF MATHS, COMPUTER DIV. SEMINAR/CITY UNIV. - 1330 hrs.
22 Feb: R Davenport/LSE - The problem of distributed data bases.

PHYS & GEOPHYS, COLLOQUIA/BRISTOL UNIV - 1700 hrs.
21 Feb: Dr H C Walton - Recent progress in protein crystallography.
28 Feb: Prof R K Bullough/UMIST - Solitons in physics - spin waves in ^{3}He.
7 Mar: Prof P T Matthews/Bath - The new particles.

THEOR. & HEP SEMINARS/SOUTHAMPTON U. - 1430 hrs.
25 Feb: Dr C Isham/IC - Quantized Chiral Kinks.
4 Mar: Dr P G H Sanders/Oxf - Weak neutral currents in atomic physics.

NP DIV. COLLOQUIUM/CONF.RM.HANGAR 8 AERE - 1530 hrs.
3 Mar: Mr P Threadgold/BP Ltd - Bore hole logging in oil well exploration.

RUTHERFORD LABORATORY LECTURE

As announced in Bulletin 3, we have a return visit from Professor Eric Laithwaite of Imperial College, London. No one who attended his talk on 29 November 1973 will even forget the spectacle of pieces of metal flying around the stage of the Lecture Theatre - in many directions.

Professor Laithwaite has kindly supplied the following summary of his talk, to be given at 1515 on Thursday, 24 February in the Lecture Theatre.

THE MAGIC OF SPIN

"Gyroscopes" is a word that, introduced into a casual conversation (for example with a mechanical engineer), invariably invokes the remark, "I never did really understand gyroscopes!" The lecturer shares that sentiment, but then he never really understood electromagnetism either, despite 30 years of professional study in that topic. What he did learn, was that the two topics were strangely related, inductance and precission in particular. The concept of reactive momentum and other breathtaking revelations then follow directly!

WRONG NUMBERS GALORE

The Laboratory telephone number is Abingdon 21900

There is a lady with telephone number Abingdon 29100 who is getting telephone calls at the rate of 3 or 4 per day for Abingdon 21900. It seems that members of the Laboratory are giving out the wrong number to their colleagues/business acquaintances. All personnel should take great care when giving the Laboratory telephone number to people outside the Lab. to avoid causing a nuisance to public subscribers especially those having a similar number.

REMEMBER ABINGDON 21900

OVERSEAS VISITS

Mr M D Percival, to DESY, Hamburg, 16-17 February for design consultations on PETRA experiment "TASSO".
Dr B Alper, to CERN, 18-24 February to work on WA3.
Dr J J Thresher, to CERN, 18-25 February, to work on Proposal 140 & to have discussions on the European Hybrid Spectrometer.
The Director, to CERN, 22-23 February, to attend CERN Scientific Policy Committee Meeting.
Messrs. D A Gray, G H Rees & J R M Maidment, to DESY, Hamburg, 22-28 February to attend ECFA Study Week on e^+e^- Storage Rings beyond PETRA energies.
Dr G Manning, to DESY, 23 February - 1 March to attend ECFA Study Week.
Dr J M Valentine, to CERN, 23-25 February for discussions.
Dr W Venue, to CERN, 23 February - 2 March to work for WA24 & hold discussions on SPSC scheduling.

MISSING EQUIPMENT

The following item of equipment has been reported missing:-

Avometer Model 8, Ser. No. 116983-C.

Anyone with information on the present whereabouts of this item is asked to contact Inventory Section, Ext. 570.

Missing from Building R2 - NORBAR torque-wrench. Anyone with information on the present whereabouts of this tool should contact Mr J Hirst, R34, Ext. 584.

JOHN RUTHERGLEN MEMORIAL FUND

An appeal is being made for a Fund in memory of Professor J G Rutherglen who was killed in a motor accident at Geneva last August when he was just at the beginning of a year's leave of absence in which he was to work at the new Proton Synchrotron at CERN. The appeal is being made over the signatures of colleagues of Professor Rutherglen's in the CERN and Daresbury Laboratories, including Dr Adams, Director General of CERN and Professor Ashmore, Director of the Daresbury Laboratory. With them are joined the professors in the Natural Philosophy Department of Glasgow. The fund will be used to endow an award, probably annual, to a post-graduate student in High Energy Physics. The award will be made by a Committee of Professors from Glasgow and other Universities associated with the Daresbury/CERN programme. Anyone wishing to subscribe to the appeal, and not already directly approached, is invited to send a contribution to the Treasurer of the Fund, Dr K M Smith, Department of Natural Philosophy, University of Glasgow.

ROAD RESURFACING

Some Harwell roads, including Fermi Avenue, Curie Avenue and Rutherford Avenue will be resurfaced in parts during the next few weeks.

Particular care will be necessary in the week beginning February 21, when part of Street Sixteen will be closed completely for three hours. Traffic heading east on the one-way system will be diverted to remain on Rutherford Avenue, where a two-way system will be in operation temporarily between Street Sixteen and Street Ten. Traffic lights may be in operation on the bends near Street Sixteen.

TEMPORARY CLOSURE OF WHITE ROAD

White Road runs from the A34 at the Horse and Jockey to the A417, (the Rowstock/Blewbury road). To allow the construction of a roundabout near Chilton Village, part of this road will be closed to all traffic, for two weeks beginning on Monday February 28, 1977. Throughout this period -

1. Southbound traffic should join the A34 at the Frome Road bollards, as normal. Left turns on to the A34 at the bollards are not permitted during outmuster.
2. Traffic which normally uses White Road will be diverted via Rowstock Crossroads. This traffic should join the northbound traffic using Library Road.
3. Access to Upper Farm Lane from Downside will be closed during outmuster.

Drivers are reminded that under the Oxfordshire County Council (Chilton) (Prohibition of Driving) Order 1976, the roads leading to Chilton Village may be used only for access or emergency purposes.

Delays to all traffic are inevitable while White Road is closed, especially during inmuster and outmuster, for which the road constructors apologise. Good progress is being made with the new road as a whole, which should remove main road traffic from the AERE SRC frontage this year.

FILM BADGE NOTICE

Period 3 commences Monday 21 February. Colour Strip - BLUE for $\beta\gamma$ films and neutron packs.

Six monthly TLD dosimeter change for people with surnames commencing I, J, K and L.

Please change your dosimeter promptly and return all old ones.

CHRISTIAN FELLOWSHIP

Chris Biddlecombe, again in the chair for the meeting on Friday 18 February as the Fellowship gets further to grips with what the Apostle Paul wrote to the Church at Colossi. A free-to-all, audience participation exercise in the relevance of the Bible today.

On Friday 25 February, Mr Chris Richards of the Strict Baptist Missionary Society, Abingdon, will be the speaker. The Missionary Society was founded (not in Abingdon - Ed), by William Carey in the 18th century and now operate broadcasting studios at Abingdon for a world-wide radio ministry.

Dr Brian Meardon will lead the meeting for prayer and intercession on Friday 4 March.

All the above meetings commence at 12.30 in the R12 Conference Room and all are welcome to attend.

CHESS NEWS

With 8 rounds completed and 1 round to go, Peter Craske has established a winning lead being 1½ points ahead of his nearest rival Jim Riddle.

Latest scores:-

Peter Craske	-	8 points
Jim Riddle	-	6½ points
Peter Hemmings	-	6 points
Bob Maybury	-	5 points
Roy Culliford	-	4½ points

Complete results in the next issue.

REC. SOC. DANCE

The next Rutherford Laboratory Recreational Society dance will be held on Friday 11 March, 8 till 1, dancing to DATELINE.

Tickets from: Val Goodwin - R1, Peter Craske - R2
David Evans - R34.

Don't forget, get your tickets early. £1.20 including buffet supper.

A.G.M

Rutherford Recreational Society

Wednesday 9 March - 12.30 p.m.

Lecture Theatre

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Editor: H F NORRIS
Room 42 Building R20
Rutherford Laboratory
Chilton Didcot Oxon OX11 0QX
Abingdon (0235) 21900 Ext 484