

J. Bayford

Bulletin

of the Rutherford Appleton Laboratory

18 Feb 1985 No.2

Soudan II Investigates the End of the Universe

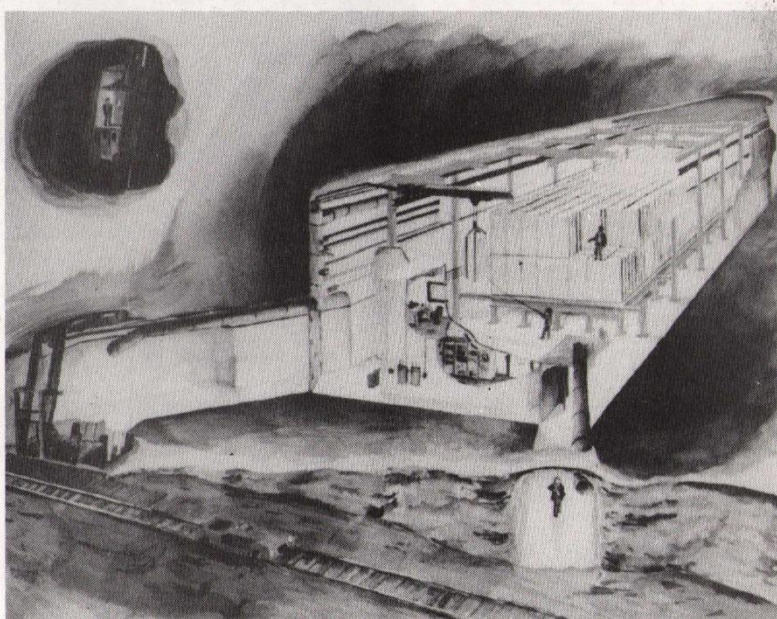
10^{32} years is a long time on anybody's timescale! For comparison it is only about 10^{10} years since the matter in the present Universe was formed in the Big Bang. However, particle theorists have speculated that the protons and neutrons that make up the apparently stable matter around us may in fact be unstable and decay away in this unimaginably long period, leaving nothing but radiation in the Universe.

This prediction is a consequence of theories that seek to extend the recent successful unification of the weak and electromagnetic forces that predicted the W and Z particles discovered at CERN, by the inclusion into the theory of the strong force that holds together the quarks inside the proton. The theorists predict that protons and neutrons will decay to a lepton (neutrino, electron or muon), and mesons (pions or kaons). Considerable experimental activity is going on around the world to detect these decays, including the Soudan II experiment, involving groups from RAL and Oxford University in the UK and Argonne, Minnesota University and Tufts University in the USA.

How do we measure such extremely long lifetimes? Clearly we cannot wait 10^{32} years for an individual proton to decay, but if we assemble 10^{32} protons then on average one will decay every year. Any 200 tons of material contains about this number of protons. Thus the experiment consists of making 1200 tons of steel plate into a fully active detector which can observe the particle tracks coming from the few decays per year that may occur in the steel.

Because we are looking for such a rare process, the detector has to be shielded from cosmic rays. This will be done by installing it 700 metres underground in the Soudan Iron Mine in northern Minnesota. The mine ceased iron production some 20 years ago and is now a State Park and tourist centre. A small experiment, Soudan I, is already taking data in the mine.

(cont'd over)

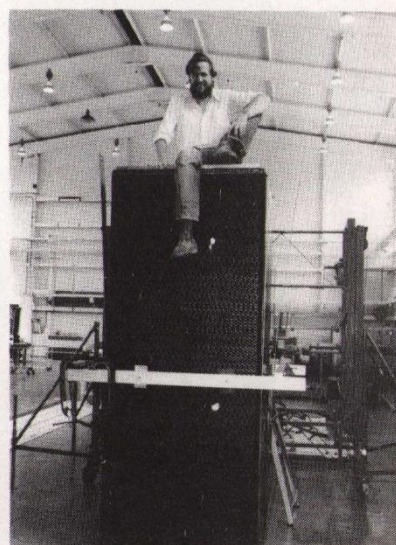


An artist's impression of the detector installed in the 12m x 14m x 60m cavern which is currently being excavated. (P. Hitchfield)



The shaft head of the mine, down which all the equipment has to descend.

P. Hitchfield.



Dave with detector.

P. Hitchfield.

Soudan II (cont'd from P1)

The detector itself uses a novel and technically advanced long drift scheme that was developed at Oxford. A prototype has been built by the Oxford and RAL groups and was successfully tested last year. Currently the first full scale module of the detector, comprising 257 x 1 metre sq corrugated steel sheets stacked to form a 5-ton module 2.5 metres high, is being constructed in R12.

The third photograph shows Dave Cockerill adding his weight to the compressive force required to produce a stable structure. The honeycombe structure of the holes in the steel matrix can be seen. Inside the holes in the complete detector will be laid two million, 1 metre long plastics tubes. Ionisation, deposited in the tubes by the passage of tracks from a proton decay, is drifted under the influence of an electric field along the tube to be registered on a conventional wire chamber, bolted to the face of the module. This structure produces a much more uniform detector geometry and provides more information than in other experiments.

Up to 256 similar modules will be constructed over the next three years at RAL, and at Argonne in the USA, to make up the complete 1200 ton detector. After assembly in R12, the RAL modules will be transported the short distance to R7, where they will be tested in cosmic rays before being shipped to Duluth in the Great Lakes, which is about 100 miles from the mine.

For further information, contact Peter Litchfield, Ext.6265.

Electronic Loan Pool

Due to structural work being undertaken in the R18 Electronic Loan Pool, issues and receipts from this store will only be available from 10.30am to 12.30pm each day. Users requiring these facilities should contact R9 Stores, Ext.5474, for service. These arrangements will apply for the next few weeks until building alterations are complete.

Request

Would the person who borrowed from Brian Diplock a book entitled 'Heat Exchangers' by S Kakao please return it to him or the library as soon as possible. Thanks.

Found

A number of postage stamps have been handed to Personnel. Please apply to them on Ext.5501.

All Party Space Committee



Members of the All Party Space Committee in the AMPTE Control Centre. The committee visited RAL on Monday, 28 January to make an extensive tour of all space projects on site.

Pictured from left to right, Dr John Harries, Head of Geophysics and Radio Division; Mr Robert Marshall, MP for Arundel, Lord Renwick and Dr Duncan Bryant (AMPTE Project Scientist). Mr Robert Jackson, MP for Wantage, was also in the party. (85 RC 1381)

The RAL Art & Craft Exhibitions

Exhibitors and visitors alike will have enjoyed our previous four exhibitions - 1979, 80, 81 and 83, but because of other commitments, both Jenny Coates and myself (Myra Gilbert) - as Chairman and Secretary respectively - will be unable to participate in organising future exhibitions.

On behalf of all four previous committees, we would like to thank the exhibitors for the exceptional standard maintained throughout the exhibitions, and the staff who have shown a generous interest in visiting the exhibitions; a special thank you to the Heavy Gang, the Light Gang, Stores (Furniture), Scientific Admin, various sections of EBW, the Security Wardens, the Recreational Society and AERE Grounds Department for their invaluable assistance, and to Management for permission to stage the exhibitions.

Myra Gilbert

Trade Exhibition

Fluke (GB) Ltd. will be holding a 1-day exhibition in R12 Conference Room from 10 a.m. to 4 p.m., on Thursday 7 March.

On display will be their range of measurement and data acquisition equipment, digital multimeters, etc.

Film Badge Notice

It is period 2. Colour strip BLUE STRIPE. Please be sure you are wearing the current dosimeter and return old ones to Jenny Coates, R12.

NEXT FILM ISSUE:

Monday, 25 February

RAL TECHNOLOGY LECTURES

The next lecture in this series will be held on Thursday 28 February 1985 at 3 p.m. in the Lecture Theatre.

REMOTE SENSING OF THE EARTH FROM SPACE

by

Dr D T Llewellyn-Jones
Geophysics and Radio Division
RAL

The ability to observe the Earth from space and to make precise measurements of geophysical parameters on a systematic and global basis, covering remote and familiar regions alike, is one of the most spectacular and intriguing achievements in space science during the past two decades. This is because of the considerable potential benefit of observations from space to such economically important activities as weather forecasting, shipping, fisheries, and off-shore operations, to say nothing of the prospect of revolutionising scientific areas such as oceanography, climate research, and geodesy.

In recent years precise measurements of geophysical parameters have been made over the oceans, the landmasses, the polar-ice caps, and of the atmosphere; giving ever-increasing levels of accuracy coupled with temporal and spatial coverage that is inconceivable with ground-based measurements. This has paved the way for the incorporation of satellite observations into routine operational activities such as weather forecasting.

Examples will be given of recent specific achievements in remote sensing, the technological developments that have made them possible, and the benefits, both scientific and economic, that are emerging and are promised from this new field. Some important new missions, especially those to which SERC is contributing, will be described. These included advanced optical, infra-red, and micro-wave sensors, which are to be used for making precise measurements of the atmosphere and the Earth's surface.

Thanks

Ray Smith of Repro Section R3, would like to thank all his colleagues who so generously sponsored him in the Rifle Shoot in aid of 'Guide Dogs for the Blind' and 'The Spastics Society'. The total raised was £116.

Award for Linda



Working in Repro, Linda Tipper usually gets more brickbats than acclaim, but on Friday, 25 January, Linda proved her expertise. At Watford College she was presented with the David Peverill Award for best student on the City & Guilds 517 Course (Small Offset & Reprographic Technique).

For those of you who have never had the pleasure of meeting Linda, it is she who makes the plates for the Bulletin - amongst a few dozen other things!

This is the second Award won by the staff of Repro Section in the past three years and they are confidently expecting the third in the future.

Congratulations from all your colleagues, Linda. We always knew we were in good hands!

Christian Fellowship

Meetings of the RAL Fellowship are held each Thursday at 1230 pm in the R2 Conference Room. All are very welcome.

The programme for the next six weeks appears below.

22 February Musical Fellowship
Steve Walters (Harwell)
Music Room R58

28 February Tape presentation
Richard Heenan

7 March - Bible Study - Jimmy Darius

14 March - Prayer Meeting M.Wyard

21 March - Visiting speaker

28 March - Easter meditation -
Chris Biddlecombe

AMPTE Obitt

The UK satellite (UKS) of the Active Magnetospheric Particle Tracer Explorers (AMPTE) mission has developed a problem after five months of faultless operation, in which about 70 per cent of the science has already been obtained.

On 16 January the Operations Control Centre at Rutherford Appleton Laboratory lost contact with the satellite, which until then had been functioning normally.

Extensive checks of ground equipment and operating procedures eliminated the possibility of this problem being due to a fault at the ground station and in the following days various means, including the use of NASA's Deep Space Network, were used to try to re-establish communication with UKS, but so far these efforts have been unsuccessful. The spacecraft engineering team is continuing to examine and implement strategies which may help to determine and circumvent what is believed to be an electronics problem on board the satellite. It is nevertheless possible that the UKS mission has terminated prematurely.

Even so, the UKS has been an outstanding success, enabling UK scientists to add an extra dimension to the world's first studies of injections of tracer particles into the solar wind (the stream of ions and electrons which flow from the Sun).

The probable loss of the UKS at this stage is disappointing, but full attention will now be focused on the analysis and interpretation of the very substantial set of results. It is too soon to attempt to evaluate fully the scientific gains that will stem from the mission, though a highly significant factor that has already emerged is the remarkable similarity between events triggered by the particles injected into the solar wind, and the phenomena created by natural obstacles in the solar system such as magnetised and unmagnetised planets and comets. The UKS has been a major milestone in UK scientists' efforts to understand the mysteries of the far-from-empty space between the Earth and Sun.

Meanwhile, AMPTE's remaining two satellites, the West German Ion Release Module and the American Charge Composition Explorer, continue to work well and add to the considerable wealth of data and discoveries already provided by the three-satellite AMPTE mission. UK scientists will continue to be involved with the future results from the mission.

Goodbye to All These

RAL retirement presentations tend to be warm, friendly, somewhat ribald gatherings - more so when there is a double bill. Alf Brown and John Thomson of SNS Division were given such a send-off on Thursday, 31 January when a fair proportion of the Lab seemed to be in attendance to wish them well.

As is almost inevitable with RAL's 'elder statesmen', both were ex-Nimrod men, gravitating to NIRNS via Harwell.

'Alf' Brown

Of Alf Brown there is little more that can be said that is not (like Alf himself) well known, his career being well reported in the *Bulletin*, when he was honoured with the British Empire Medal.

The diverse tasks he has accomplished have included testing and installation of the Nimrod vacuum vessels, being R2 workshop foreman, working on targets and alignment, on support facilities for nuclear physics teams and since 1978 in his latest role, in control of the site heavy gang. None of us will forget their work on the "Night of the Blizzard".

"Alf has always been a competent, enthusiastic and very practical man" said David Gray, who was making the presentation of a 'Work-mate', a very large (both in size and amount) cheque and a prized Ray Roberts' card. He was very pleased that Alf's worth had been recognized by the award of BEM and he wished Alf good health and a happy retirement in which to pursue his many activities, especially his sterling work for the Royal British Legion.

"Ladies, gentlemen and friends", replied Alf, causing much laughter, "I have enjoyed myself hugely at RAL. I look forward to retirement but it is going to be such a change. Thanks very much for the gifts and for coming to say goodbye. Thank you".

John Thomson

John Thomson arrived at Rutherford in 1961 as an estimator in the Supply Group, but by 1963 was working on Nimrod developing and maintaining plant and equipment. The following year he was promoted and as a Mechanical Duty Tech. was on shift looking after both machine and experimental equipment. Later he too became an R2 workshop foreman, where his attention to detail and careful preparation of jobs were noted. John



A happy gathering. Pictured from left to right, David Gray (Head, SNS Division), Mrs. Brown, Alf, John, Mrs. Thomson, and Gordon Grossart. (85RB1405)

was involved in dismantling the PLA, refurbishing it for 70MeV, in charge of Nimrod Divisions building of muon chambers for CERN, in the dismantling of Nimrod, and finally supervising survey and alignment work on SNS, a task where again his attention to details and careful preparation came into its own and ensured smooth installation and the required accuracy.

"His quiet style of leadership has, I'm sure, won him only friends and his technical competence has been a great strength to the Laboratory", said Gordon Grossart who had been allowed the privilege of this presentation. He thanked John for all his work and on behalf of all friends and colleagues wished him a healthy and happy retirement. "It has been a real pleasure to work with you over the years" was the sentiment he expressed for all.

John's gift from his friends included a clock, and a magnificent chess set, for which he thanked all who had contributed. He had made many friends at the Lab, but was looking forward to 365 days annual leave allowance. "But I am not getting away from bar charts", he said, "Ivy, my wife, has lots lined up and my brief is simple - start on Monday - 1st progress meeting Tuesday! Thanks, and the best of luck for the future".

'Bert' Aldred

It was the turn of the coffee lounge to sport wall-to-wall friends on Friday, 1 February. 'Bert' Aldred is also a well-known RAL man, having been Stores Manager since 1964. To put it kindly, stores organisation to that point was not all it should be and Bert's appearance on site was designed to put right the shortcomings.



Bert Aldred (facing) receives the congratulations of Jim Valentine (Lab Secretary). (85EE1382)

"Despite all the changes the Lab has undergone since then" said Jim Valentine, "Bert has mastered them and his standing is as high as it was in 1965. I would like to thank Bert for the sterling work he has put in over the last 20 years. The words that come to mind are 'professionalism' and 'dedication'".

Thanking everyone for the card, malt whisky, crystal tumblers and cheque with which he had been presented, Bert expressed his appreciation at the number of people who had come to say 'cheerio'. His success, he said, had been in no small part due to a conscientious, hard-working staff, the goodwill of users and the co-operation of other service departments.

"I have been fortunate in life, always enjoyed employment and came through the war unscathed, I therefore intend to donate the cheque to a service charity." An intent which met with universal approval.

Bulletin

Editor: Jean Banford
Building R1
Rutherford Appleton Laboratory
Chilton, Didcot, Oxon OX11 0QX
Abingdon (0235) 21900 ext 5484

INTERNAL Events

HEP SEMINARS

R61 CONF.ROOM - 1100 HRS.

20 February J Coughlan/RAL
'The Composition of the
Hadronic Final State
Resulting from Deep
Inelastic Muon-Proton
Scattering'

27 February D Adamova/Prague-RAL
'A Model of One-photon
Transitions in Heavy
Quarkonia'

NEUTRON DIV. SEMINARS

R3 CONF.ROOM - 1330 HRS.

26 February L J Challis/Nottingham
'Phonon Spectroscopy of
Magnetic Ions in Crystals'

5 March E Howells/Durham
'Durham University
Industrial Research
Laboratories'

12 March A Howie/Cambridge
'Study of Localised
Inelastic Scattering
Events by Electron
Microscope'

ASTROPHYSICS SEMINARS

R68 CONF.ROOM 12 - 1400 HRS.

20 March Dr Colin Coleman/Oxford
'Active Galactic Nuclei'

NIMROD LECTURES

R61 CONF.ROOM - 1400 HRS.

18 February M B Green/QMC
'Superstring Theories,
Quantum Gravity and
Beyond'

JOINT THEORY SEMINARS

R3 CONF.ROOM - 1330 HRS

21 February J D Lawson/RAL
'Radiation, Antennas and
Accelerators'

EXTERNAL Events

PHYSICS COLLOQUIA

CLARENDON LAB - OXFORD - 1615 HRS.

22 February Prof O V Lounasmaa/Helsinki
'Magnetoencephalography -
a Non-invasive Method of
Basic and Applied Fusion
Physics Research'

1 March Dr R S Pease/Culham
'Recent Results of
Controlled Nuclear
Fusion Physics Research'

8 March Prof A F G Wyatt/Exeter
'Quantum Evaporation from
Liquid Helium'

SEMINARS IN PLASMA SCIENCE

DEPT.ENG.SCI - OXFORD - 1615 HRS.

26 February Dr B Minakov/Oxford
'Electron Beam Amplification
in Travelling Wave Tubes'

5 March Dr B M Annavatone/Oxford
'MHD Effects in Weld
Pools'

12 March Prof P Cutler/Oxford
'Conductive Fluids in
Strong Electric Fields'

ELEM PART THEOR SEMINARS

NPD - OXFORD - 1430 HRS.

22 February D A Ross/Southampton
'Renormalisation Group
Invariance of Instanton
Calculations'

1 March E J Gardner/Edinburgh
'Random Lattices'

THEO. PHYS. COLLOQUIA

SOUTHAMPTON - 1430 HRS.

22 February P Watkins/Birmingham
'New Results from UAI'

15 March B Buxton/GEC Hurst
Research
'Recent Ideas on the Use of
Stochastic Optimisation
of Techniques in
Computer Vision'.

TPD SEMINARS - HARWELL

TPD - Building 424.4 - 1400 hrs.

26 February Dr T Mullin/Oxford
'Buckling in Viscous
Flows'

In addition three video recordings of
lectures produced by the Open
University for the Alvey Directorate
on the subject of Intelligent
Knowledge Based Systems will take
place on:

5 March 'IKBS - Setting the Scene

12 March 'Logic Programming'

19 March 'Building Complex Expert
Systems'

Missing

The following items are subjects of
loss reports. Please relay information
to enquirers:

Delta 500 VDU
Serial No: 40535
T.Broome, Ext.6255

Large milk heater - from R25 kitchen
Inventory No: X003325
Accommodation, Ext.5263

Avo Multimeter (Digital)
Inventory No: R013230
Serial No: 0031763
D A Pepler, Ext.6345/6714

Fluke Digital Multimeter - Type 8024B
Serial No: 3216018
Asset No: R018977
P Horton, Ext.5541

'Texas' Calculator - Type T159
Serial No: 2256574
Inventory No: R010013
J Wells, Ext.5424

Casio Calculator - Type FX6100
M.Sproston, Ext.5668/5489