

Institute *of* Physics

PHYSICS

ON MERSEYSIDE

The newsletter of the Merseyside Branch of the Institute of Physics

Issue 8 September 2006

Branch committee members

Officers

Prof. M W Poole

Chair
Director of ASTEC
Daresbury Laboratory
email: m.w.poole@dl.ac.uk

Dr S D Barrett

Vice-chair
Department of Physics
University of Liverpool
email: s.d.barrett@liverpool.ac.uk

Dr A M Newsam

Secretary
Director of the National
Schools' Observatory
ARI, Liverpool John Moores
University
E-mail: amn@astro.livjm.ac.uk

Dr S L Bennett

Treasurer
Daresbury Laboratory,
E-mail: S.L.Bennett@dl.ac.uk

Committee members

Ann Marks (regions and
nations board
representative on Council)
Prof. M F Bode
Dr Marielle Chartier
Dr N Clitherow
D Cox
Dr M A Houlden
S Hughes (PHYSOC
representative)
Dr P James
Dr D Joss
Prof N Marks
Dr D S Martin
Prof P J Nolan

Co-opted members

L Hayhurst (Institute Teacher
Network)
Dr P Rowlands (Manchester
Branch)
D Bell (affiliated school)
Dr David Starling
Andrea Fesmer

Branch website:

<http://merseyside.iop.org>

Message from the chair

This is the first newsletter since our AGM in April and it gives me a chance to introduce myself as your new chair of the Merseyside Branch.

I must start by paying tribute to my predecessor, Ann Marks, who has stood down after completing a full stint in the role. Ann has brought enormous enthusiasm to the job and has worked tirelessly for all of our members – she will be a very hard act to follow.

Recognition from within the Institute of Physics has also come with Ann's election to Council as one of two representatives from the newly named Nations and Regions Board (replacing the old Chairs of Branches meeting). This also continues strong Merseyside representation and influence in high places as Ann will replace husband Neil there. Both Ann and Neil continue to bring their experience and expertise to your committee and I am very grateful for that.

We are also extremely fortunate in our other officers and committee members, all of whom contribute actively to our successes. I must thank retiring members for their services, especially David Martin as past secretary, but who continues now as a "back bencher". Andy Newsam takes over as an excellent secretary. We also welcome Steve Barrett as vice-chair – Steve has done almost every job on the committee and is a true stalwart who is already giving me strong support.

We hope that you find the newsletter format and content both interesting and informative,



Our new chair Prof. Mike Poole (right) with Prof. Max Irvine (left, Manchester chair) and Dr David Ward (centre, see Fusion article, p2).

but we would welcome feedback about this, together with any of your suggestions for additions and/or improvements.

This edition is an important source of information about our planned programme for the year ahead, for which I refer you to its centre pages. We are sure that you will enjoy the varied talks and we are pleased with our continuing strong links to the Manchester Branch, to the Liverpool Astronomical Society and to the Liverpool Medical Institute. We have also joined with the IEE for occasional events and we are exploring contacts with the Royal Society of Chemistry. Science is increasingly interdisciplinary nowadays and our professional activities should reflect this.

Einstein Year is now over but that is not the end of important landmarks in physics. This year the Liverpool University Physics Department is celebrating its

125th anniversary and next year is the 75th since the discovery of the neutron. Since the early years of the 20th century were the golden age of modern physics, we can look forward to many centenary celebrations in the near future. You can be assured that the branch will miss no opportunity to bring these to everyone's attention.

I would like to finish by urging you to participate in Institute activities in any way that you can – after all, this is your own professional body and should therefore reflect your views and needs. The committee is particularly anxious to encourage more of our industrial members to attend our meetings, and we would especially welcome representation by one of that group onto our committee – why not contact me if you are interested?

Mike Poole, branch chair

Job advert: full-time North West regional officer wanted

One national and four regional officers (one national officer (Wales), 17.5 hours per week; four regional officers (England), full time in the South East, Midlands and North West, and 17.5 hours per week in East Anglia)

Salary £30 000–35 000 p.a. (pro rata) plus excellent benefits

The Institute of Physics is seeking graduates, preferably in physics or physical science, with a good knowledge of the English/Welsh (as applicable) school, higher education and political system.

You will have experience of creating and sustaining stakeholder partnerships. You will be responsible for the development and management of policy and political debate in relation to physics education and funding, physics outreach activities, partnerships with other science and industry bodies/agencies, and the recruitment and retention of members.

For an application form and further information, contact: HR Department, Institute of Physics, 76 Portland Place, London W1B 1NT. Tel: 020 7470 4800. Fax 020 7470 4892. E-mail: recruitment-london@iop.org.

The closing date is **18 September 2006**. Interviews will be held on 25 and 26 September 2006 in London and will include a short presentation by the candidate.

The Institute is an equal opportunities employer

LMI: the Liverpool Medical Institution

The LMI was founded as the Liverpool Medical Library in 1779 and then moved to its new site in 1837. Its impressive facade looks out over the site that once held Chadwick's cyclotron, towards the Metropolitan Cathedral.

It still takes a large collection of medical journals (though most are now available electronically) in its quiet and elegant Reading Room, available for private study and to those who still like to peruse the papers. It houses many old and valuable books, which are gradually being archived and made available to scholars via the Internet. It specializes in medical history.

There is a long tradition of education and its speedy assimilation. On 7 February 1896 the then Lyon Jones professor of physics (Oliver Lodge) produced a radiograph of a bullet on a hand. It was presented at a clinical meeting on the 13th and in May that year the first X-ray department in the UK was installed at Liverpool's Royal Southern Hospital. Other discoveries and applications by physicists (e.g. ultrasound, CT, and MRI) have been presented,



LMI's front (top) and entrance hall.

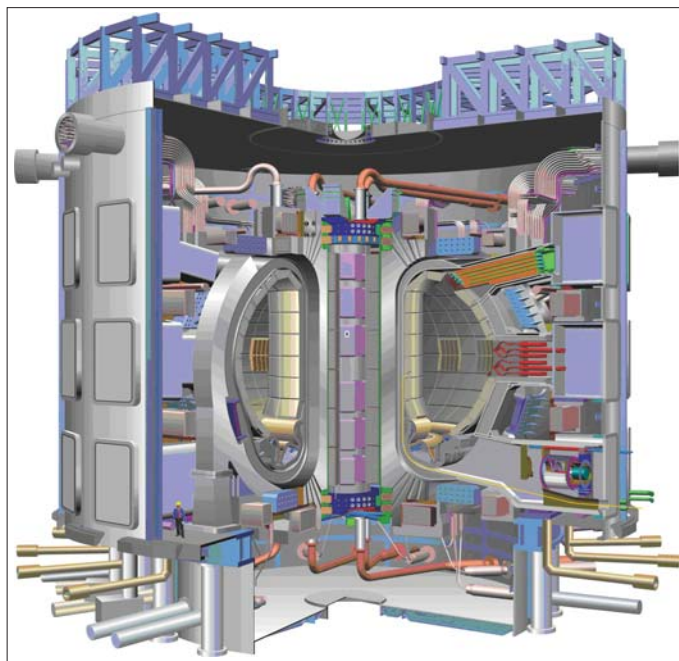
discussed, welcomed and adopted for patient treatment.

There are large and small lecture theatres and a spacious gallery for exhibitions and meals, enabling conferences and symposia to be held. A recent one honoured Herbert Frohlich and another in the future will be for Joseph Rotbalt.

Both the LMI and the branch have a wide-ranging lecture programme with joint meetings arranged, including one "home" and one "away fixture" each.

N Clitherow

Fusion research offers power for the future?



Artist's impression of the next development in fusion research – the ITER experimental reactor. The figure on the (left) indicates the scale.

A joint meeting of the Merseyside and Manchester branches was arranged for 23 May at Daresbury Laboratory, when Sir Christopher Llewellyn-Smith, director of Culham Laboratory, was programmed to talk about "Fusion". In the event, he was called away to Brussels on that very day for an urgent meeting concerned with the next major fusion project (ITER; see above). We are grateful to Dr David Ward, a senior member of the Culham staff, who at short notice delivered a highly informative lecture entitled "The path to fusion power".

From the beginning, Dr Ward emphasized the enormous challenge of meeting the future huge increase in global energy demand in an environmentally responsible manner. A "portfolio" approach is needed, which will include improved efficiency and renewables but where fusion is one of the few options for load-base power.

Fusion looks potentially very attractive, with unlimited fuel supplies, producing no carbon dioxide or other polluting gases, being intrinsically safe, and

having a good chance of being economically viable.

Dr Ward gave an overview of the current state of fusion research and described in detail the JET facility at Culham. This tokamak has generated 16 MW of fusion power – the same level of input needed to generate and ignite the tritium plasma. We are now ready to build ITER, the next generation gigawatt-scale tokamak (see image). This joint project, involving Europe, Japan, Russia, the USA, China, South Korea and India, is expected to have a capital cost of €4.5 billion. It would generate an order of magnitude more power than is needed to initiate the reaction and will point the way directly to the Prototype Power Plant (DEMO). Culham is now engaged in a fast-track study that aims to produce a minimal version of DEMO, which could contribute power to the grid by 2031 and generate commercially by 2044.

The large audience engaged in an enthusiastic question session, and a buffet in Daresbury's new atrium gave them further opportunity for discussion.

Neil Marks

Conference plans to honour Rotblat

On 20 October the historic Liverpool Medical Institution will host a one-day conference, War and Peace, on the life and work of Sir Joseph Rotblat, organized jointly by Liverpool Medical History Society and the university's Physics Department.

Rotblat came to Liverpool from Poland in 1939, attracted by the fame of Prof. James Chadwick and the potential of the newly built cyclotron. He stayed for more than 10 years, during which time he worked extensively on nuclear physics, before joining the Manhattan



Rotblat speaks at Liverpool in 2003.

Project in 1943. He was the only physicist to leave the project on conscience grounds and, after the Second World War, he helped to found the Pugwash Conferences, which led to his receiving the Nobel Prize for Peace, a rare honour for a physicist.

At the same time he moved into the newly developing field of medical physics, which he continued with great distinction at St Bartholomew's Hospital. Although he left Liverpool in 1950, he returned on many occasions, the last time in 2003, when, as many of us recall, he

gave a brilliant lecture aged 95.

This conference will bring together speakers who will recall his contributions in nuclear physics, medical physics and the movement for the abolition of war. There will also be an exhibition of photographs and other material, together with video and sound recordings. Delegates will be presented with a hardback book containing all of the speakers' contributions plus much additional material.

Details and application forms for this event are available from Adrian Allan, Sydney Jones Library, University of Liverpool, PO Box 123, Liverpool, L69 3DA (tel: 0151 794 2093; e-mail: ara@liv.ac.uk).

Peter Rowlands

Talk explores the planets beyond our solar system



An artist's impression of a Jupiter-like extrasolar planet.

On 6 April there was a joint meeting between the branch and the Liverpool Medical Institution (LMI; see p2) – one of the oldest medical societies in the world.

Prof. Horne from the University of St Andrews talked about "The quest for extrasolar planets". Over the past decade, astronomers have been discovering planets that orbit other stars beyond our solar system. With roughly 150 extrasolar planets now known, we are beginning to understand how planetary systems, both similar to ours and radically different, have come into being.

New techniques and upcoming space missions are expected to reveal small, rocky, Earth-like planets, if they exist, and to show which of these, if any, have oceans of liquid water and oxygen-rich atmospheres, indicating the presence of life.

The possibility of life on extrasolar planets produced a number of questions from physicists and medics alike in the audience. A vote of thanks was given by Mr Farqueson, president-elect of the LMI.

Steve Barrett

Astronomical Society shares anniversary

2006 is also the 125th anniversary of the Liverpool Astronomical Society. Congratulations from the Merseyside branch! Several branch members took up the kind invitation to attend the British Astronomical Society Liverpool weekend, which celebrated the anniversary.

Liverpool Physics Department is 125

Lodge and early times

Liverpool's Physics Department came into existence on 25 June 1881, when Oliver Lodge was appointed as the first Lyon Jones Professor of Experimental Physics and Mathematics.

Lodge was allocated £500 for apparatus and the council was "prepared to find £100 a year, for a Demonstrator whenever Professor Lodge may require one". Lodge was the first academic appointed after the principal of the new university college because of regulations for the London external MB degree, not due to the importance of physics. The funding for the chair was transferred to the Medical Faculty. Consequently the Lyon Jones Professor has ever since been a member of the Medical Faculty Board. Lodge, who was six foot four in height, was described by his contemporaries as "a magnificent lecturer; his manner and style were of the first order, and his expositions derived further force from his impressive personality".

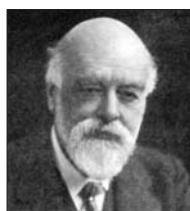
The university college was established in the (vacated) lunatic asylum, which was on the site of the present Victoria Building, and the physics laboratory had to be created out of the padded cell in the

wing running along Ashton Street.

Teaching began there in January 1882. The students followed courses for external certificates and degrees, most notably London University external degrees. The University College Calendar for 1882–1883 shows that a "general course in physics" started in the autumn term and covered "Temperature, Expansion of solids, liquids and gases, Thermometry, Liquefaction, Vaporisation and Condensation, Calorimetry, Combustion, Conduction and Radiation, Relation between Heat and Work".

According to the calendar, "A complete course of physics will be given in the course of the year, as far as can be understood without much mathematical knowledge". The prospectus for 1882 states that "Day and Evening Classes are open to male and female students alike...except Medical Classes, which are for men only."

As the Lyon Jones Professor of Experimental Physics and Mathematics, Lodge initially gave all of the lectures in both subjects. Therefore, in addition to giving four or five lectures per



Sir Oliver Lodge.

day, he was single-handedly setting up and supervising the new laboratories. As the only physicist in the new University College, he established a line of research in magnetism and

electricity, so it was perhaps not surprising that the first experiments to gain international recognition were in those fields.

With the foundation of the Victoria University, with its own degrees, Liverpool joined Owen's College, Manchester, in November 1884, setting joint papers for degrees at the Victoria University.

Lodge was elected FRS on 9 June 1887. In the autumn of 1892 the Victoria building opened and the Physics Department expanded to fill the northern half of the old building. Doors bearing the inscriptions "Professor Lodge" and "Physical Laboratory" indicated that the whole of the north wing was devoted to physics.

Do come on 23 November (see p4) to hear more up-to-date accounts of the life of the department.

Ann Marks with extracts from Peter Rowlands

Merseyside Branch programme

Venues and times for talks

Unless stated otherwise, talks start at 6.30 p.m. (NOTE NEW TIME) with refreshments available from 5.30 p.m.

UoL = University of Liverpool
www.liv.ac.uk/UniversityPrecinct/precmap.html.

(SSRC) Surface Science Research Centre = building #47 on map.

(CLT) Chadwick Lecture Theatre = building #42 on map.

DL = Daresbury Laboratory, near Warrington www.clrc.ac.uk/Activity/ACTIVITY=DLMaps.
LMI = Liverpool Medical Institution, 114 Mount Pleasant, Liverpool.

22 September 2006

*UoL, CLT, 12.00 noon

Dr Neil Jackson

University of Liverpool

A new horizon: ATLAS at the CERN LHC

A new high-energy frontier will be accessible with the completion of the Large Hadron Collider at CERN next year. Liverpool is heavily involved in the ATLAS experiment, which is designed to search for new physics. This talk will describe how ATLAS will detect the interesting events leading to new discoveries and the challenge of dealing with huge data samples.

This special lunchtime event for undergraduate freshers will be followed by a buffet lunch. All members are welcome.

5 October 2006

UoL, CLT, 6.30 p.m.

Prof. Peter Weightman

University of Liverpool

Physics of life

In this lecture I will explore the contribution that physics can make to the understanding of living things. Physicists can play an important part in establishing the essential characteristics of life, as demonstrated by the influence that Schrödinger's book *What is Life?* (1944) has had on generations of physicists.

To begin with we live in a universe that has properties that are finely tuned to allow the emergence of life. However, that is a necessary but not sufficient condition for life to arise and our universe is also governed by

thermodynamics, the second law of which maintains that, overall, the entropy of the universe will increase. For living things the second law is a sentence of eventual decay, disorder and death, and we know that ultimately that is the fate of any organism. However, in the context of the second law one might be surprised by the extent to which, locally at least, we have witnessed increasing order and complexity as the universe has evolved. While such a development is not, of course, forbidden by thermodynamics, its degree is surprising and this lecture will include some idle speculations as to why this is.

Peter Weightman has won the 2006 Institute Mott medal and prize for his outstanding work on the electronic structure of materials and his development of Auger spectroscopy.

14 October 2006

Physics olympics

See Education programme (p8).

17 October 2006

DL, 6.30 p.m.

Nuclear: renewable debate

Speakers to be announced

Joint meeting between the Merseyside and Manchester branches. We will be joined by members of the Institute of Electrical Engineers. All who attend the meeting are welcome to a buffet after the discussion.

20 October 2006

LMI

War and peace

Organized jointly by the Liverpool Medical History Society and the university's Department of Physics.

A one-day conference on the life and work of Sir Joseph Rotblat – an event to celebrate his life and work.

Details and application forms are available from Adrian Allan (e-mail ara@liv.ac.uk).

See Rotblat article (p3).

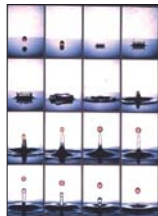
7 November 2006

UoL, SSRC 6.30 p.m.

Dr Bill Proud

Cavendish Laboratory, Cambridge

History of high-speed photography



A drop of red liquid falling into a pool of blue liquid, on the first bounce the red drop is still separated from blue liquid

This lecture covers the main developments in the history of high-speed photography and includes many examples of the techniques used. From a late-19th-century bet concerning horses to atomic explosions, these techniques have aided the understanding of the wider world. From capturing images over 15 minutes to 10 nanoseconds, this area is strongly linked into that of technical advance. When asked to “show me the evidence”, these studies have allowed this to be easily done.

23 November 2006

UoL, CLT, 6.30 p.m.

Celebration of the 125th anniversary of the Department of Physics at Liverpool University

Prof. Erwin Gabathuler, Dr Geoff Court, Dr Peter Andrews and more

We are delighted that retired members of the department have agreed to speak about their memories and experiences within the department. We will especially welcome Prof. Gabathuler and Dr Court, as they are both past chairs of the branch. Dr Andrews has also kindly agreed to speak, and his knowledge of the history of science will enliven his talk. This will be an opportunity for reminiscing and we invite brief extra contributions from the floor of the meeting.

Please pass on an invitation to this event to all of your colleagues who have had contacts with the department. The evening will finish with a buffet, to which all who attend are invited. If you plan to bring friends, please contact the honorary secretary, Dr Andrew

Newsam, to help with estimates of numbers for catering.

11 December 2006

* UoL, CLT, 2.00 p.m.

Dr Andy Newsam

Astrophysics Research Institute, LJMU

Extragalactic planets

Sixth-Form Christmas lecture – all members are welcome.

See Education Programme (p8).

16 January 2007

UoL, CLT, 6.30 p.m.

John Porter Memorial Lecture

Dr Gillian Wright, MBE

Royal Observatory Edinburgh

The James Webb Space

Telescope

The James Webb Space Telescope (JWST) is a 6.5 m deployable infrared telescope that will be launched in 2013 as the successor to Hubble. It will search for the first galaxies that formed in the early universe, connecting the Big Bang to our own Milky Way galaxy. JWST will peer through dusty clouds to see stars forming planetary systems, connecting the Milky Way to our solar system.

The observatory will be equipped with four state-of-the-art instruments and is being developed by NASA, ESA and the CSA. One of the instruments, MIRI, is being built by an international partnership led by UK scientists and engineers. In this talk I will describe the science goals of the mission, the challenges in building it and what the UK is contributing.

6 February 2007

UoL, SSRC, 6.30 p.m.

Dr Andrew Taylor OBE

Rutherford Appleton Laboratory

Neutrons

2007 is the 75th anniversary of Sir James Chadwick's discovery of the neutron. In celebration we have invited Dr Andrew Taylor, director of ISIS, the UK national neutron source, to speak to us. He was awarded the 2006 Institute Glazebrook medal and prize for his work in the field of neutron science.

22 February 2007

UoL, SSRC, 6.30 p.m.

Calendar of events for 2006–2007

Dr Andrew Hodgson

University of Liverpool

Skating on thin ice

Joint meeting with the Royal Society of Chemistry.

Water, ubiquitous both on Earth and in space, is such a familiar molecule that its significance is often overlooked, yet it plays a key role in almost every individual aspect of our lives. Its unusual properties stem from the remarkably strong intermolecular hydrogen bonds, which allow it to remain liquid over a wide temperature range and to form an astonishing variety of solid ice phases.

I will discuss several areas where recent experiments have given us a new understanding of its behaviour at interfaces, including the catalytic role that ice surfaces play in stratospheric and interstellar chemistry, and just how water behaves when it is in contact with a container.

8 March 2007

DL, 6.30 p.m.

Prof. Jocelyn Bell Burnell, CBE

University of Oxford

Pulsars and extreme physics

Pulsars were discovered



The Crab Pulsar lies at the centre of the Crab Nebula [NASA]

35 years ago. What do we know about them now and what have they taught us about the extremes of physics?

With an average density comparable to that of the nucleus, magnetic fields of around 10^8 T and speeds close to c , they have stretched our understanding of the behaviour of matter. They serve as extremely accurate clocks with which to carry out precision experiments in relativity.

Created in cataclysmic explosions, pulsars are a (stellar) form of life after death. After half a billion revolutions, most finally die, but amazingly some are born again to yet

another, even weirder, afterlife. Pulsar research continues to deliver exciting, startling and almost unbelievable results.

22 March 2007

*UoL, SSRC, 6.30 p.m.

Prof. Philippe Chomaz

University of Ganil, France

The origin of the elements

Atoms are the microscopic building blocks of the universe. From Mickey Mouse's balloon to the stars, helium atoms are absolutely identical. They are classified in a hundred different elements in the famous Mendeleev table. Some elements are abundant, such as carbon, while some are rare, like gold. Some are cheap and some expensive, but the real question is where do they come from?

In this talk, Prof. Chomaz will show how lab experiments on exotic atomic nuclei are helping our understanding of this fundamental question.

The atomic nucleus theory predicts that more than 5000 different types of atom can exist. On Earth, only 291 different sorts can be found, from hydrogen to uranium. The 4709 or more remaining nuclei are called exotic. They can now be abundantly produced in powerful particle accelerators. Their study holds the key of the mystery of the origin of elements in the universe.

Philippe Chomaz is a well known science personality in France and we are delighted that he has agreed to travel to Liverpool to speak. This will be our annual public lecture, so do invite your friends and family.

March 2007

†Travelling schools lecture

Dr Pete Vukusic

University of Exeter

The science of light and colour

See Education Programme (p8).

19 April 2007

UoL, CLT, 6.30 p.m.

Revd Dr John Polkinghorne

University of Cambridge

A scientists approach to religion

Science achieves its great

success by limiting what it seeks to explain. If we are to understand fully the world in which we live, we will need to supplement the insights of science with those derived from other sources, including religion. The deep intelligibility of the universe, and the anthropic fine-tuning of the constants of nature, are too remarkable to be regarded as mere brute facts. Science cannot explain what it has to treat as given, but religious belief offers an understanding of these facts. Both religion and science seek truth through motivated belief, though the kinds of motivation differ in the two cases.

19 April 2007

The 2007 Branch AGM

This will take place after the meeting on 19 April.

Members are invited to submit nominations, for positions of either officers or ordinary members of the next committee, to the honorary secretary, Andrew Newsam. Each nomination must be proposed by two branch members and be accompanied by the consent of the nominee.

3 May 2007

LMI, 6.30 p.m.

Prof. Bleddyn Jones

University Hospital Birmingham

Particle beams for cancer therapy

The discoveries of the electron, proton and neutron by Thomson, Rutherford and Chadwick placed the UK at the forefront of scientific research. Advances in physics were applied rapidly within the new NHS (e.g. megavoltage X-ray radiotherapy). The Clatterbridge cyclotron, designed for neutron therapy, was the first hospital-based proton therapy unit in the world, and it achieved success in the treatment of ocular melanoma.

Protons and charged particles, such as carbon ions, deposit energy far more selectively than X-rays or neutrons due to the Bragg peak effect. There is a marked reduction in radiation dose to normal tissues: tumour

dose escalation is possible in clinically awkward situations, (e.g. proximity of a cancer to the brain, spinal cord, kidney, bowel). Good quality of life and organ function have been demonstrated following proton and ion treatment abroad. Reduced total energy deposition should reduce the risk of second cancer induction.

There is a rapid expansion in proton and ion facilities in advanced countries, with the notable exception of the UK. Would Thomson, Rutherford and Chadwick have tolerated this?

15 May 2007

UoL, CLT, 6.30 p.m.

Prof. James MacDonald

University of Strathclyde

An electricity grid for the 21st century

If we are to be able to benefit from the numerous possible small sources of energy that could be available in the future, radical changes are required to the National Grid. A parallel may be drawn with the changes from mainframe computers to PCs networking together. Solving this problem is a real challenge.

Joint event organised by the Manchester Branch and will be followed by a buffet. All who attend the talk will be welcome to the buffet.

May/June 2007

Visit to Spaceport

We are planning an evening visit to the Spaceport Astronomy and Space Visitor Centre next to the Seacombe ferry terminal. The details of the event will be confirmed next year, but current plans include a special tour of the centre and a chance to relax while admiring the stunning views across the Mersey from the Spaceport balcony.

28 June 2007

Annual Liverpool Physics Teachers' Conference

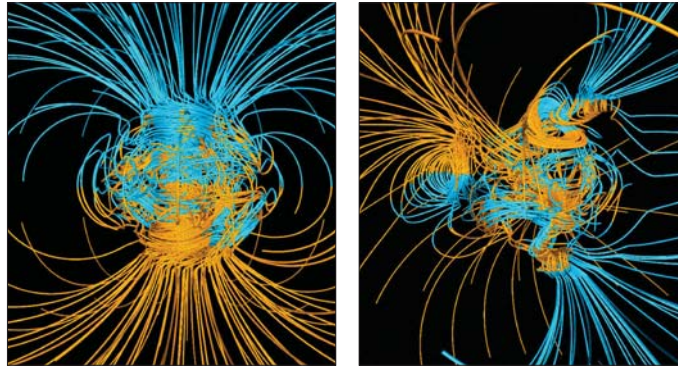
See Education Programme (p8).

* Talks marked with an asterisk will be of interest to sixth-formers considering pursuing scientific careers. The lecture marked † is primarily for those aged 13–16.

Geomagnetic reversals: one of life's big mysteries

On 2 March, Prof. John Shaw of the University of Liverpool Geomagnetism Laboratory talked to the branch about the perplexing mysteries of the Earth's magnetic field. The talk was attended by a mixture of undergraduate students and staff of the university, and other members who wanted to hear about what we do (and don't) understand about how the Earth's field behaves. Following the talk, a lively session of questions from the audience confirmed that this is a topic of great interest to all.

For the past 100 years we have been aware that the Earth's magnetic field reverses where the north (south) magnetic pole moves to the south (north) geographic pole. Geomagnetic reversals have been identified as recordings in rocks that have been dated and correlated on a global and geological timescale. The phenomenon of geomagnetic reversals has been used extensively as a geological and archaeological dating tool and as a means of locating the



The Earth's normal gravitational field (left) and at an interim stage during reversal (right). Because of the limitations of current computers it is not possible to run the modelling program with the correct parameters for the viscosity coefficients of the outer core. Nevertheless the theoretical model data have strong similarities to the record obtained from geological samples in that the field appears to be non-dipolar during the reversal and consequently weaker at the Earth's surface. As computing power increases and our analysis of the geological magnetic record improves, the mysteries of reversing geomagnetic field will become clearer.

relative positions of the continents in the past.

But what do we know about these reversals? How does the shape and strength of the field change during a reversal? What happens to the magnetosphere during a reversal? And when is

the next reversal due?

There are two approaches to studying geomagnetic reversals. The first is to sample as many rocks as we can find that record the intermediate geomagnetic field (neither normal nor reversed) and then determine

how the direction and strength of the field changes as the geomagnetic field reversal progresses. If we can do this for a single reversal at several places on the Earth's surface simultaneously then we can build up a picture of what the geomagnetic field looks like during a reversal. As the reversal process can be quite short (~5000 years) it is very difficult to find suitable records.

At Liverpool University with NERC funding we are using an innovative microwave technique to look at the most recent reversal, the Matuyama/Brunhes boundary (0.78 Ma) recorded in lavas in various parts of the world (Guadeloupe, Iceland, Hawaii, Chile and La Palma; see <http://www.liv.ac.uk/geomagnetism>). Results so far indicate that the intermediate field is very weak (~10% of the normal/reversed field) and probably not the simple dipole shape of the present-day field.

Glatzmaier and collaborator Paul Roberts of UCLA have taken a different approach and developed a computer model of the geodynamo. After running it for a period of 2000 hours on a supercomputer they managed to obtain data from a single reversal (see <http://www.psc.edu/science/Glatzmaier/glatzmaier.html>).

Steve Barrett

Young children can learn from physicists

Have you ever considered visiting primary schools to excite young children's interest in physics? Sessions should be fun for the children, explain the numerous basic concepts clearly, support the curriculum and provide support for teachers.

To do this successfully takes careful preparation, which requires far more time than busy people have available. A team from Sheffield University under the leadership of Prof Gillian Gehring has developed a website of well tested material that is hosted by the Institute of Physics. You can find the site from the homepage of the new Institute site by choosing the "Engaging the public" option. On the next webpage the Physicists and Primary Schools Project is listed as a link at the



Children exploring the contents of a black bag during a class session.

top of the column on the left.

The site will soon feature 10 presentations covering different areas of the curriculum. Each session offers fun activities and

games that engage the whole

class, as well as novel demonstrations. These are clearly described with details of the apparatus used and safety

notes. Possible misconceptions are explained so that these can be carefully corrected. Also a well illustrated PowerPoint presentation has been provided for each session that can be downloaded. The website is extensive and includes detailed guidance notes collected from those who are experienced in going into schools.

Do look at the site. The team would like to hear your feedback after your first visit. If you think that a workshop to discuss the material would be helpful or if you would like more information, contact Ann Marks (e-mail: pips@amarks.co.uk). The team members are Prof. Gillian Gehring, Prof. David Mowbray, Dr Susan Cartwright, Dr Richard de Grijjs, Dr David Lidzey and Ann Marks.

PHYSOC grand finale: May 2006

It has been a very busy final month for PHYSOC, starting with the much anticipated PHYSOC May Ball. A joint venture with Mathsoc, the May Ball was the largest event of the year, with 100 people, including lecturers from the Physics Department, coming together at the Adelphi Hotel in Liverpool. Photographs were taken before the main course, which was delicious – lamb in Madeira wine sauce. Then, after profiteroles and a couple of after-dinner speeches, disco time. Soon everyone – including the lecturers – was dancing. Overall the night was a great success, so my thanks go to everyone there for making it a night to remember.

After the ball and the slight pressure put on us by the exams, it was time for our most important event of the year – the trip to Geneva and CERN for 20 students, including me and my committee. We started organizing the trip at the start of last year as it was an event that was purely on our wish list.

We were all very excited when we met at Liverpool airport and worked out how to navigate the

check-in desks. Two hours later we arrived at Geneva airport to be puzzled by the Swiss bus system. Finally we got to CERN, where our contact, Dr Vosseveld, showed us to our accommodation and gave us information, including things to do and places to eat (a big “thank you” goes to him).

Next morning, after a quick breakfast, it was time to head into Geneva on a sightseeing trip. Particular favourites for me were the Jet d’Eau and the United Nations building. In the afternoon it was back to CERN for the trip that we had organized. We were taken to a conference room where we were given a very in-depth lecture about CERN and the Large Hadron Collider (LHC). We had asked for a tour that would be beneficial to undergraduate physicists and we got exactly that. I learned a lot of new information about the projects, despite already knowing quite a lot about them. After the lecture we were split into groups and taken on a tour of the ATLAS detector. This was very interesting but most impressive



PHYSOC's committee at the ball.



PHYSOC on the tour of ATLAS.

was the size and complexity of the project – from the 100 m deep well in the cavern to the superconducting toroidal

magnets, visible inside ATLAS, everybody thought it was amazing. We even got a brief description of the role that Liverpool University is playing in making the detector, which was really good to hear about.

After the tour ended we looked round Microcosm, a great little exhibition about the work at CERN, and then bought our CERN hats, t-shirts and mugs. Then it was time to go back into Geneva to find out what we could do there in the evening. We enjoyed a game of oversized chess in the park with live bands playing. The trip had been a great success and we had all learned a lot – particularly about CERN and the LHC. It raises the possibility of another trip next year, although perhaps it would be good to see a different international laboratory. This will be a task for the new PHYSOC committee and their president, Stephen Hughes. But now my committee and I would like to say goodbye and thank you to everybody who has helped us over the last year. **Dan Porter**, PHYSOC president 2005/2006

PHYSOC barbecue rounds off a great academic year



PHYSOC barbecue on the roof of the Oliver Lodge.

With the academic year coming to an end and the final exams taking place, it was time for the new committee of PHYSOC to undertake their first major event – a barbecue on top of the Oliver Lodge laboratory and open to anyone wishing to attend.

With a range of fine barbecue cuisine and even finer alcoholic beverages, the only thing on people's minds was the weather as the sky filled with dark

clouds. Thankfully the main battle was against the wind, which sent most things flying.

The overall outcome was unbelievable, with people purchasing tickets at the door. Special thanks go to Dr Dickson for his help during the event. To show our appreciation, we presented him with a gift (which no physicist should be without) of an Albert Einstein action figure. Being the last time out

together for most people, it was hard to imagine the long break ahead before we are reunited in late September. It was a brilliant end to a fantastic year.

Plans for freshers' week include serious activities, such as a three-legged pub-crawl with each fresher strapped to a second- or third-year student to ensure connections between the years. Then there will be the lunchtime freshers' lecture (see p4), organized by the Physics Department and the branch, plus a free lunch. Finally, there will be a typical “sports day” with the physics of egg-and-spoon races.

Stephen Hughes, PHYSOC president

The branch newsletters are published by Institute of Physics Publishing, Dirac House, Temple Back, Bristol BS1 6BE, UK.

Printed by Warners (Midlands) plc, Bourne, Lincolnshire, UK.

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

The Institute of Physics, 76 Portland Place, London W1B 1NT, UK. Tel: 020 7470 4800. Fax: 020 7470 4848.

Visit the branch website: <http://merseyside.iop.org>

EDUCATION PROGRAMME 2006–2007

Many of the talks in our main programme of events (pp4–5) will be of interest to sixth-formers and are marked with an asterisk. Those suitable for students in years 10 and above are marked by a dagger.

14 October 2006

Liverpool Physics Olympics 2006

The Liverpool Physics Olympics, part of Physics Olympics Worldwide, is run jointly by the University of Liverpool and the Institute. Teams of students are invited to take part in a day of events that require teamwork, problem solving and a little physics. Although the event is staged as a competition, it is designed to be great fun.

See <http://www.liv.ac.uk/physics/olympics/index.html> for more details and examples of past challenges. To enter a team, e-mail ajb@ns.ph.liv.ac.uk.

11 December 2006

Chadwick Lecture Theatre, University of Liverpool 2.00 p.m.
Dr Andrew Newsam
JMU Astrophysics Research Institute

Extragalactic planets: extreme ET?

Sixth-form Christmas lecture

The “bending” of light by gravity has long been understood, and using so-called “gravitational lensing” to study otherwise invisible objects in our galaxy is now common. However, the development of new kinds of robotic telescopes makes it possible to study lensing effects deep in the core of our neighbouring galaxy, Andromeda. Here I describe how the most ambitious extragalactic lensing project to date may even make it possible to find extragalactic planets.

To book places, contact David Cox (e-mail: david.cox@blueyonder.co.uk).

February/March 2007

Paperclip Physics

Teams of students are invited to explain a simple principle of physics to a panel of judges, including a non-scientist, using only objects that can be found in the home. Communication, teamwork and originality are the key to success. Dates for the Merseyside heats will be announced later in the year. The winners go on to the North West Regional Final, which will be held at Daresbury Laboratory in March. The winning team at the

final will receive substantial individual prizes. Application forms should reach all schools early in the autumn term.

March 2007

†Travelling schools lectures



Pete Edwards who gave the 2006 Schools Lecture explains a point.

The 2007 lecture will be presented by Dr Pete Vukusic of the University of Exeter and will be about the science of light and colour. Vukusic has a PhD in optical physics from the University of Exeter and spent a while as a teacher before returning to Exeter as a research fellow to investigate structural colour in natural systems. He was awarded a five-year personal fellowship from BBSRC and is now a permanent lecturer at the University of Exeter. In 2004 he won the L’Oreal Art and Science of Colour International Prize.

In 2007 we will be holding

these lectures in schools in various regions of Merseyside so that local schools can walk there. For more information, or if your school would like to host a lecture, contact Lucas Hayhurst, Institute of Physics Merseyside Teacher Network Coordinator (e-mail: lht@blueyonder.co.uk).

28 June 2007

The Annual Liverpool Physics Teachers’ Conference

This popular and informative free event for physics teachers will be held at the University of Liverpool. Speakers cover a range of topics, interspersed with discussions and hands-on activities, and opportunities to question a panel of physicists. Attendance has increased in recent years, so this is recognized as a leading UK teachers’ conference – on your doorstep. Feedback from other years indicates that the events provide a very good opportunity to update, network, and try new experiments and software.

For details and downloads see <http://www.liv.ac.uk/~iop/PTC/index.html> or contact Dr Steve Barrett (e-mail: s.d.barrett@liverpool.ac.uk).

Education report

At the AGM, three teachers joined the branch committee for 2006/2007. This will strengthen branch links with schools and we look forward to new developments as the year progresses.

David Cox has numerous years’ experience as a physics teacher and will be known to many as the retired head of science at Holly Lodge. He is keen to continue in physics outreach in the region and gave invaluable help at the two teachers’ conferences in June.

David Bell teaches physics in Litherland and is an enthusiastic member of the Physics Teachers’ Network on Merseyside, which has more than 400 members.

Lucas Hayhurst is head of physics at SFX and on the local branch committee of the ASE. He will be our only Institute Merseyside Physics Teacher

Coordinator now that Ann Marks needs to step down from her parallel role because she has been elected to Institute Council. Lucas will continue to organize activities to support the teaching of physics on Merseyside and welcomes new ideas from teachers. There are more than 30 coordinators across the UK and Ireland now and they are making a difference with their support for teachers and their innovative ideas for teaching physics.

The Key Stage 2 and 3 Teachers’ Conference on 22 June attracted over 70 teachers and PGCE students, and there were about others 20 involved. The conference is organized by the Physics Teachers’ Network Coordinators, one of whom travelled from Newcastle to give a workshop on the physics of toys. The 2006 Liverpool Teachers’ Conference reached a record attendance as it was



A geophysics workshop (left) and David Featonby (right), a Network Coordinator, discussing the physics of toys at the Teachers’ Conference.



joined by those who had been taking part in the Physics Enhancement Programme. (This increases the number of physics specialist teachers trained each year by widening the degree base from which they can be recruited and providing continuing support in their early teaching years.) The two

conferences draw support from across the UK and are seen as major national events with a total attendance of over 170. We would like to thank the Department of Physics at Liverpool University for hosting both days, and all those who took part and made the events so worthwhile.