

ACCELERATED DREAMS

Dr Suzie Sheehy, Rutherford Appleton Lab, Oxford
at the IOP, London 16 May 2012



Above. Dr C Isenberg and Dr Suzie Sheehy

The lecture took us on an historical journey where particle accelerators entered the stage of human enterprise. Accelerators are devices that propel charged particles to high speeds whilst containing the particles in well-defined beams. The technology has multiple uses, from the fields of biomedical research and therapeutics, to the elucidation of the fundamentals of the universe and for aircraft industry, such as wing design. Accelerators consist of three basic components: a source of elementary particles, a tube pumped to a partial vacuum in which the particles can travel and a means of speeding up the particles.

Many scientific innovations and technological appliances for domestic usage appeared in the 1920's. Amongst them was the electrostatic van de Graaf accelerator. Electrostatic accelerators use static electric fields to accelerate particles. The accelerator builds up a potential between two electrodes by transporting charges on a moving belt. The conceivably kinetic energy for particles in these devices is limited by electrical breakdown.

Continued page 6.

Branch committee

Dr Barbara J Gabrys CPhys FInstP, Chair
E-mail barbara.gabrys@materials.ox.ac.uk

Leonard Lewell CPhys MInstP, Secretary
E-mail londonse@physics.org

Dr Mark Telling CPhys MInstP, Treasurer
E-mail mark.telling@stfc.ac.uk

David Parkes CPhys MInstP
Berkshire Centre representative
Email ; IOP.lectures@awe.co.uk

Stephen Elsmere
Berkshire Centre representative
Stephen.Elsmere@awe.co.uk

Prof. R Mackintosh CPhys FInstP
Milton Keynes Centre representative
E-mail r.mackintosh@open.ac.uk

Dr Diane Crann MInstP
Hertfordshire Centre representative
E-mail d.crann@herts.ac.uk

Bob Boutland CPhys MInstP
Education representative
and online newsletter editor
E-mail rh.boutland@physics.org

J A Belling MInstP
REMS visit secretary
E-mail john.a.belling.secrems@gmail.com

Dr Fei Chen MInstP
E-mail fei.chen@cranfield.ac.uk
Outreach Representative

James Kneller
E-mail ap09010@QMUL.ac.uk
Student Representative

Prof. P I P Kalmus OBE CPhys Hon.FInstP
E-mail p.i.p.kalmus@qmul.ac.uk

Lee Crouch
Regional officer South East
E-mail lee.crouch@iop.org

Non-Committee
Dr C Isenberg
Kent Centre Representative
E-mail c.isenberg@kent.ac.uk

Page 2: REMS Capital Ring Walk 12. **Page 3** (Additional report): REMS at RES & the Paper Trail. **Pages 4 & 5** REMS visit to Holland: **Page 6:** New Chair for the History of Physics Group. **Page 7:** Communicators Group Summer Meeting Details. **Page 8:** REMS Visit Bush House. **Page 9:** New Chief Executive **Page 10:** REMS Walks: Hampstead Heath. **Page 11:** The WOOFYT visits St John's Church. **Page 12:** BPhO team to compete in the International Physics Olympiad in Estonia in July.

REMS CAPITAL RING WALK 12 A wet but enjoyable walk



On 28 April Reinalt Vaughan-Williams took us from Highgate to Stoke Newington. Margaret Stedman was not well enough and we wish her a good recovery. The first part was along a gentle downwards slope of an old railway track. Light rain was falling all day and though the trackway was gravel there was mud in places. We passed through an old station (Crouch End) and a brick embankment where we were surprised to see a spriggan emerging. This one is by Marilyn Collins.



Above Spriggan: Photo from Mike Quinton

“Spriggans were depicted as grotesquely ugly, and were said to be found at old ruins and barrows guarding buried treasure and

generally acting as fairy bodyguards. They were also said to be busy thieves. Though usually small, they had the ability to swell to enormous size, they were sometimes speculated to be the ghosts of the old giants.” (From Wikipedia.)



This part was about 2 miles and where the track joined the main line near Finsbury Park our path was through the park to the New River, a waterway completed in 1613 to bring fresh water to London from Ware in the Lea Valley to the New River Head in Islington. Here the path was green with lots of lovely mud – OK for those who were booted-up but not otherwise. This led to Clissold Park in Hackney with the tall spire of Stoke Newington Church (St Mary’s). Clissold House is a good Georgian building. Lunch was in the Rose & Crown, a traditional pub



with all the food and beer that REMS like. That left us with the walk through Stoke Newington and its surprising cemetery to the station. Crossrail and the Olympics have closed parts of the next two walks so these have been postponed to next year.

George Freeman

The branch newsfeed and calendar are at <http://london.iop.org>

Visit to Renewable Energy Systems and the Paper Trail

On Thursday April 12th some 23 members of REMS visited, first, Renewable Energy Systems (RES), and after lunch the Paper Trail museum which commemorates the first continuous paper making machine commissioned in the Gade valley.



At RES we learned of the planning and design processes which are required for both on shore and off shore wind farms. The company specialises in this field, and explained the case for this energy source and how it is set to contribute significantly to our future energy needs. Wind speeds in and around the British Isles are well suited and allow turbines to run at an efficient level for most of the time. The spread of wind across the territory means that some part of the installed capacity will always be delivering, with modern weather forecasting enabling the “spinning reserve” to be no more than that associated with other forms of electrical generation. Even if the output from wind generation exceeded the total demand of the grid, such as might occur in the early hours of the morning, it is expected that the excess will, in future, be used to charge the

improved batteries employed in transport applications, or to mechanically pump a lake of water to a higher reservoir, for use later in the day.

After the talk we enjoyed a tour of the site, during which we learned of the other carbon neutral energy sources being used to power the entire site. These include the growing of bio fuel for the main boiler, plus solar cells producing both heat and electrical power. These, along with the small on-site wind turbine, provide all the energy required on site, together with an excess fed to the grid.



At the paper trail we visited the original Frogmore Mill where the first machine was built to the design of French engineer Louis Robert, with finance provided by the Fourdrinier brothers, with the final modifications and commissioning being carried out by an English engineer, Bryan Donkin. Modern paper making machines still work to the same principle. This 1803 machine is still in full working order, and could be run, subject to a heritage grant or similar, to cover operating costs. At the museum we were also given demonstrations of hand worked single sheet paper production on the original machines which had remained at Frogmore, together with a demonstration of hand type setting and printing.



Tony Manning

The REMS visit to Holland 18 to 23 April 2012

This trip was the latest in an ad hoc series of visits. We had been to Geneva, Toulouse, Grenoble, Bath and Darmstadt and this time to the Dutch Resort of Noordwijk an Zee. Judging by the number of hotels and restaurants it is clearly a holiday resort. We were there the week after Easter so the Resort was quiet, windy, showery and decidedly out-of-season. Why should we have chosen this location and timing? Firstly it is close to ESTEC the European Space Agency's technical facility which hosts their enormous environmental test facilities. So the first day we went to see the space museum, have an insider's tour of the test facilities and lunch in their canteen. Scientific duty done we were then free to explore what else the area has to offer.

A short coach trip away is the famous Keukenhof gardens. Word had got out that we were coming and to our amazement found that they had given our name to a tulip. The site, which is only open from late March to May, is a show case for spring bulbs, predominantly tulips.



The web site promises 4.5 million tulips of 100 varieties and 15 km of paths. After exploring the gardens and taking the obligatory boat trip we met our first challenge: - how to find our own back to the hotel in Noordwijk by public transport. In the event there was a regular on site hotel shuttle coach back to Noordwijk.

The next day we took a long coach ride to cross the Netherlands to reach Venlo in Limburg on the border with Belgium, this year's site for the 10 yearly horticultural spectacle "Floriade". This event, besides being a "global spectacle" with a 100 countries participating, is used as an opportunity to develop what was an area of scrub woodland. A good impression of the scale of the 66 hectare site was had from the 1km long ride 35m above the show site in a cable car. The weather, away from the coast, was calm and sunny.



Saturday was the day of the big flower parade in Noordwijk and was the main decisive factor for the trip timing. The parade consists of decorated cars, trucks, buses and floats all elaborately covered in flowers, some with shivering nymphs, jazz bands etc. Several marching bands were dispersed between the floats. The whole parade moved at walking pace taking an hour to pass by our hotel on the way to Haarlem via the Keukenhof gardens. Decorated cars were then left parked along the boulevard till Sunday evening to provide the longest and most decorative traffic jam in Holland. Our

The branch newsfeed and calendar are at <http://london.iop.org>

planned trip to the Valkenburg am Meer narrow gauge railway was delayed by an hour. Some of the REMS can be seen structurally testing Tony's balcony to the top right of the left hand picture below.



After our trip on the steam driven narrow gauge railway we visited Zaanse Schans. The site provides at one location what you would expect to find in the Netherlands: working windmills, both water pumping and providing the power for grinding, in one case paint pigments, a cheese making shop and a clog making machine shop, several Dutch style old cottages surrounded by small canals and of course a sweet / savoury pancake café.

On our penultimate day we went to Amsterdam. Some went off to the Rijksmuseum or the Van Gogh museum, some went to the Opera (*The Turk in Italy* sung in Italian with Dutch subtitles!) some went to.... The final challenge was to find our own way back to Noordwijk by public transport. Unfortunately



the Dutch railway system was recovering from a train crash the previous day and there was an element of chaos at Amsterdam Railway Station. Fortunately trains were running to Leiden and then a service bus brought us back.

The next morning we left by plane, car or train with nobody lost and only minor hiccups. Where to next?

David Pick

**To Join the Retired Members Section (REMS)
Contact John Belling**

E-mail john.a.belling.secrems@gmail.com

A new Chair for the History of Physics Group.

On the 23 February 2012 the History of Physics Group Committee asked members of the Group to suggest nominations for the post of Chair. Nomination closed on the 2 April 2012. The work of the Chair includes chairing two or three History of Physics Meetings each year, and two or three committee meetings. The chair also monitors all the other activities of the Group, which includes finding speakers and themes for meetings, finding new and appropriate committee members, supervising the annual budget, the newsletter, prizes, Blue plaques, etc. The Committee offered one nomination, Professor Edward A Davis of Cambridge University, proposed by Dr Peter Ford, and seconded by Dr John Roche. There were no other candidates for nomination for the chair.

Professor Edward A Davis is therefore duly elected to the Chair. Professor Edward A Davis was an undergraduate in the Physics Department at Birmingham University and a postgraduate at Reading University. In the 1960s he spent seven years in the USA, first as a post-doc at the University of Illinois and then as a scientist at the Xerox Corporation. He returned to the UK to a position in the Cavendish Laboratory where he worked and co-authored a book with Professor Sir Nevill Mott on Electronic Processes in Non-crystalline Materials. He held a Royal Society John Jaffé Fellowship Award before being appointed a lecturer in the Department of Physics and a Fellow of Fitzwilliam College.

In 1980 Professor Davis was offered a Chair of Physics at the University of Leicester where he remained until his official retirement, although he still lectures there to undergraduates in the Department of Physics and Astronomy. He now holds the position of Distinguished Research Fellow in the Department of Materials Science and Metallurgy at the University of Cambridge. He is currently Coordinating Editor and Letters Editor of Philosophical Magazine – a condensed matter physics and materials science journal first published in 1798.

John Roche
On behalf of the History of Physics Group Committee

Accelerated Dreams continued from page 1

They can accelerate particles to energies superior to 10 million MeV. Today, these instruments are used for nuclear physics and for radio-carbon dating (i.e. Turin Shroud and the Skeleton Lake in India). Electrostatic accelerators also have their uses in computers (Intel) where ions are implanted into the silicon. A small scale example of this class of accelerator is the cathode x-ray tube in an ordinary old television set.



Another type of accelerator entered the stage: oscillating field accelerators using radio-frequency electromagnetic fields (thus circumventing the breakdown challenge). Rolf Widerøe invented the Linear accelerator (LINAC). It uses alternating voltages of high magnitudes to propel particles along in a straight line. The particles pass through a line of hollow metal tubes enclosed in an evacuated cylinder. An alternate voltage is timed so that a particle is pushed forward each time it goes through a gap between two of the metal tubes. Today's largest LINAC is at Stanford university and is over 3Km long. Linac's uses are predominantly for radiotherapy, thus displacing the obsolete Cobalt-60 therapy. The electrons can be used directly or can be collided with a target to produce X-rays.

Continued page 7

Accelerated Dreams continued from page 6



(Hence the additional name of 'atom smashers' for particle accelerators).

Ernest O Lawrence (and Stanley, his PhD student) conceived and developed the cyclotron in the 1930's (Lawrence was awarded the Nobel Prize in 1939). This was the first circular accelerator. In these, a magnetic field, produced by a powerful magnet, keeps the particles in circular motion. Instead of tubes, the machine has two hollow vacuum chambers. The advantage of cyclotrons over linear accelerators is that the toroid topology facilitates continuous acceleration, as the particle can transit indefinitely.

But there is more. Synchrotrons, such as the Large Hadron Collider (LHC) in Geneva which is 27Km long, are capable of reaching much higher energies. The particles are accelerated in a ring of constant radius. Instead of a giant magnet, they have a line of hundreds of bending magnets, enclosing -or enclosed by- vacuum connecting pipes. LHC is actually an accelerator complex.

The pioneering EMMA (Electron Model For Many Applications) project is to build a non-scaling accelerator that suggests a range of potential applications including charged particle cancer therapy, accelerator driven reactors and particle physics. Its technology is more compact, cost effective and operationally simpler. It consists of a ring of magnets which use their combined magnetic field simultaneously to steer and focus the electron beam around the machine. The strength of this magnetic field increases steeply as the beam spirals outwards while it is accelerated to 20 million electron volts around the ring.

Due to the strength of the magnetic focussing, the displacement of the beam as it accelerates and spirals around the ring is much smaller than in any equivalent accelerator. As a result, EMMA's ring of magnets is much more compact and is easier to accelerate the beam.

The lecture drew to a close with insightful suggestions on the exciting concept and potential use of Thorium nuclear reactors (instead of Uranium) because of their safety, availability and cost-effectiveness. This was followed by a chain of interesting and thought provoking questions from the audience.

Acceleration in the linear-nonscaling fixed-field gradient accelerator EMMA: S. Machida et al, *Nature Physics* 8, 243-247 (2012).

Dr N M Calvo

**The Medium and the Message:
Broadcasting, podcasting, YouTube
and other ways of communicating
physics
29 June 2012, Institute of Physics,
Organised by the IOP Physics
Communicators Group**

The Physics Communicators Group Summer meeting will investigate the wide array of different media that can be used to communicate physics. Speakers are expected to include Deborah Cohen, Editor of the BBC Radio Science Unit & Simon Singh.

For more information & registration please visit the website

<http://www.iop.org/conferences>

**This online newsletter has been
produced
by
The London & South East Branch
IOP**

**The contents 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

REMS visit BBC BUSH HOUSE Afternoon visit Monday 14 May 2012

This event was organised by Rodica Mager and George Freeman

Bush House was built by a wealthy American business man Irving T. Bush as a trade centre for American and UK manufacturers. The plan was to have under one roof luxury accommodation, exhibition galleries, conference rooms, reference libraries, a club and a restaurant in the lavish style of the 1920s. The 1921 recession changed all this and although the original plans for the Central Block were not altered, the other four wings were adapted for more conventional office use.



On 19th December 1932, from Broadcasting House, the BBC introduced its listeners to the Empire Service (precursor of today's World Service); the aim was to unite the English speaking peoples of the Empire. However, after a landmine damaged Broadcasting House in 1940, the Overseas Service moved into the SE wing of Bush House (the venue was requisitioned by the then Ministry of Works on behalf of the BBC). There were a number of historic broadcasts from Bush House during the war, one of which was when

General De Gaulle addressed the French soldiers at the time of the French surrender in 1940.



After lunch in the Club Bar we were guided by Carrie Dunton and Angela Carte through the Central Block and South East wing and told about the specific features and the history of Bush House. On the second part of the tour an IT technician (Mark Goodridge) showed us the main Control Room, the News Room, old and more recent control desks on display or in studios, told us how programmes are put together and we wrapped up seeing a Hausa team at work during their 30 minutes live transmission.



Two other members of staff, Ruxandra Obreja, (Head of Digital Radio Development, World Service Chairman, DRM Consortium) and Rob Hugh-Jones, (Managing Editor BBC-US co-productions) told us about the new digital broadcast standards and how the future of broadcast journalism might evolve. Their presentations were relevant because BBC's Bush House lease terminates this year and the World Service is moving to the New Broadcasting House, in Portland Place, next to the

Continued page 9

The branch newsfeed and calendar are at <http://london.iop.org>

Continued from page 8

original building. This coincides with the transfer from analogue to digital recording and broadcasting.



The final but most impressive part of our visit was when three of our members (Tony Gee, John Stevenson and Graham Thompson) sat round the table for a discussion with producer Kazimierz Janowski who has an interest in science. The rest of us, acting as audience, followed the discussion with interest and at times added an opinion or two. This exercise took place in studio S6, (in the basement, the only audience area in Bush House) used for dramas, which had (as explained by the David Milton, senior studio manager and Jeremy Lowe, operations manager) quiet areas and an area used for sound effects with the hardware still in place.

Rodica Mager and George Freeman

Photos by George Freeman, Ed Palmer and Rodica Mager.



New Chief Executive for the Institute of Physics

The Institute of Physics (IOP) has announced the appointment of a new Chief Executive. Professor Paul Hardaker will take up his new post as Chief Executive of IOP on 3 September 2012.

Professor Hardaker has been Chief Executive of the Royal Meteorological Society since October 2006. Prior to this, he worked at the Met Office for 14 years as both Programme Director for the Met Office's Development Programmes, and as the Met Office's Chief Advisor to Government.

Alongside these posts, Professor Hardaker has been a member of the Physics Advisor Panel at the University of Wales and founding editor of the international journal Atmospheric Science Letters.

Paul currently holds a visiting Professorship in the School of Mathematical and Physical Sciences at the University of Reading, he is a Trustee on the Board of Science Council and Chairman of Sense About Science, as well as a regular contributor to TV, radio and his own blog.

Outside of his work in meteorology, Paul has held a number of non-executive positions including a Non-Executive Directorship of a City company working in risk management and in the NHS as Deputy Chair of the Board of NHS Berkshire West, where he was actively involved with local and regional healthcare initiatives.

Paul is excited to be taking forward IOP's mission – to promote physics for the benefit of all. On his appointment to the new post, he said, "I am delighted to be joining the Institute of Physics. I feel very privileged to be working for an organisation that is so highly regarded and respected for its leadership not just in physics but also more widely in the UK and international science community."

Professor Sir Peter Knight, President of IOP, welcomed the appointment of Professor Hardaker as the next Chief Executive of IOP from a very strong field of candidates. He said, "Paul brings a wealth of experience in learned societies and a background in the physical sciences which will really benefit IOP."

Professor Hardaker will take over as CEO of IOP from Dr Robert Kirby-Harris, who retires on 12 June.

Joe Winters
IOP Senior Press Officer

REMS Walks: 26 May 2012 Hampstead Heath.



Above: At Kenwood.

As the Cross Rail and Olympics have stopped us completing the Capital Ring walks until next year, David and Gill Pick very kindly lead a walk on Hampstead Heath. The heath is a large and varied open space with swimming pools and ponds, hills and valleys, open fields and shady woods. We completed a circuit visiting Hill Garden, the pergola garden, Kenwood grounds, and Parliament Hill field. Lunch was at the Spaniard's Inn.

REMS walks give us fresh air, exercise (not too strenuous) pleasant company and conversation but only six people took part in what was a most enjoyable day.

Photos by George Freeman



View from Parliament Hill.

Moore's sculptures

Mayor Visits WOOFYT at St John's Church, Boxmoor, Hemel Hempstead.

Jeremy Sampson's WOOFYT came to St John's Church on 28 May as part of the celebrations of the construction of the new church organ.



Above: Hemel Hempstead Mayor, Councillor Bert Chapman plays the WOOFYT with pupils from South Hill primary School.

Four schools took part in this event: -

Boxmoor Primary
Pixies Hill Primary School
George Street Primary School
and South Hill Primary School

Sessions begin with musical warm ups, (see below).



This was followed by the KS2 requirements for sound. Also included in this part of the session are ideas of molecules and echoes, non-return valves and energy, as well as observing skills. The manometer was also introduced.

One of the main features of the day is playing the WOOFYT but pupils soon learn that the organ does not work properly unless they all co-operate. Air needs to be pumped into the air reservoir and the correct pressure applied to the bag so the manometer is at the correct level. (The original U-Tube) and those at the pipes need to play their note

in the correct order. When all this is done a recognisable tune emerges. The science session had also explored the idea of long tube low pitch, short tube high pitch.



Above: Jeremy Sampson demonstrates the new organ at St John's Church.

At the end of each session Jeremy Sampson demonstrated the new Organ and related the WOOFYT to the real organ, WOOFYT only having one octave and the real organ many.



Pupils were asked to guess the number of pipes in the church organ, a small hint being there are 60 notes on one of the consuls and 13 stops so there must be at least, (13x60) pipes; yes a few pupils could get that right but there are the stops on the other side as well and the feet and another consul. At the end of their session pupils went behind the organ to see the larger pipes. Pupils who could answer questions well were rewarded with an Institute Red Bug. The Branch supported this event.



Left: Wendy Topping, Head of Dacorum Music School, (Hertfordshire Music Service), was also present at the event.

BPhO team to compete in the International Physics Olympiad in Estonia in July.

2012 BRITISH PHYSICS OLYMPIAD.



BPhO TEAM TO COMPETE IN THE IPhO IN ESTONIA IN JULY.

Left to right:		
Adam Brown	Alester Grammar School	Warwickshire
Richard Thornburn	Lingfield Notre Dame School	Surrey
Frank Bloomfield	Colchester R. G. S.	Essex
Peter Budden	King Edward VI School	Southampton
Eric Wieser	Hills Road Sixth Form College	Cambridge

Front Row: (left to Right) Robin Hughes and Dr Cyril Isenberg

RESERVE

Rebecca Harwin	Kendrick School	Oxon.
----------------	-----------------	-------

NPL BPhO THEORETICAL PRIZE.

James Matthew George Heriot's School, Edinburgh

NPL BPhO EXPERIMENTAL PRIZE.

Frank Bloomfield, Colchester Royal Grammar School, Essex

BPhO FINALISTS

Matthew Anketell	The Judd School	Kent.
James Aaronson	St. Paul's School	London.
Duncan Bell	St. Olave's Grammar School	Kent.
Tim Burd	The Cherwell School	Oxon.
Mark Hammond	Royal Grammar School	Guildford, Surrey.
Rebecca Harwin	Kendrick School	Oxon.
Daniel Martin	Thornleigh Salesian College	Bolton.
James Matthews	George Heriot's School	Edinburgh.
Boyuan Xiao	The Cherwell School	Oxon.
Shenbo Wang	Canford School	Dorset.
Bonan Zhu	Leicester Grammar School.	

AS CHALLENGE GOLD PRIZE WINNERS.

Iliya Buyanovsky	King's College School	London.
Celia Shen	City of London Freeman's	School London.
Philip Boyle-Smith	The Grammar School at Leeds.	
Daniel Spencer	St. Peter's School	York.
Edward Kirkby	Amery Hill School	Hampshire.

PHYSICS CHALLENGE GOLD PRIZE WINNERS.

AU Hubert	Winchester College	Hampshire
Tina Xia	St. Paul's Girls' School	London.
Helen Fishwick	St Paul's Girls' School	London.
Frank Han	International College	Dorset.
Madhi Elango	Queen Elizabeth's School	Herts.
Mark Richards	Adams Grammar School	Shropshire.

The presentations at The Royal Society on 26th April were followed by the lecture 'Inside the Human Body: Seeing with Ultrasound' by Professor Peter Wells CBE FRS of Cardiff University.