

# Institute of Physics

# PHYSICS

# SOUTH-WEST

The newsletter of the South Western Branch of the Institute of Physics

Issue 5 January 2007

## Branching thoughts

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

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

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After six or more years as newsletter editor for the branch, with almost all of that time spent also on the branch committee, I thought I might offer a bit of insight into who we are as a committee and what we do – or try to do.

When I joined the committee, I realized at once the enormous experience of the people I was to work with and come to call friends. Frank Smith, Ron McEwen, Roger Moses, Mike Wilson, Peter Ford and Vince Smith knew and know their physics folk well. This is what has brought you such a varied, delightful and intelligent programme over the years.

This is something that must be properly considered when discussing the proposed new constitution.

Like many highly effective committees, ours had, and has, a rapid and complex flow, and a tendency to shorthand. This can be daunting to new members – and over the years I have seen several come and go – but finally it appears that a new generation of able and enthusiastic volunteers has stepped up to the plate. Two are already straight in there with their sleeves rolled up.

Claire Bedrock of IOP Publishing in Bristol, who was co-opted in 2005 and elected in 2006, is now honorary secretary. Neil Dennis-Purves, formerly of the National Physical Laboratory

and now in Devon-based commercial research into textiles, has taken over the vital job of treasurer in this his second year on the committee.

Others new in 2005 and continuing this year are Nick Boyall, an advisor with the Ministry of Defence, and Martin Lavelle of the School of Mathematics and Statistics in Plymouth. New in 2006 were student Anne Pawsey and Prof. James Annett, both of the University of Bristol. This represents an intelligent and effective group of people.

We have also had valuable contributions from Bryan Berry, programme director of the Science Learning Centre South West based at At-Bristol, and Laura Jackson of IOP Publishing.

The money side of what we do is interesting. Our budget depends on what we do rather than the other way about. The Institute of Physics has funds available for good projects (of modest cost), so our income as a branch goes up and down, largely in line with our ideas and enthusiasm. If you have a good idea, don't keep it to yourself.

Most members are aware that we have an excellent programme of events – due entirely to the efforts of others than myself – based on evening lectures and a one-day Festival of Physics in the spring. We also have at least one organized visit each year and an irregular programme of

erecting blue plaques.

We also have (and it is here that you may be able to help us) a determination to hold events in every part of our region. Since (I am told) Tewkesbury is closer to Scotland than it is to Lands End, this is a task that we never properly fulfil. We organize lectures in a range of centres: regularly in Cheltenham and frequently in more southerly parts. We have held committee meetings in Plymouth and Exeter as part of this commitment.

Our problem is that there are some gaps in our network of local organizers of events. So if you live far from those places where we currently hold lectures and you want to help, get in touch with the chair or vice-chair and you will receive copious practical assistance and advice in getting a lecture or other event up and running near you.

If you have welcomed these further insights into who we are and how we work, let me know, and I might be encouraged to do it again some time. Also, please send me any thoughts or articles you might have, such as on a physics-related book you have read, a lecture you have attended, etc. It has even been suggested that we might include practical information useful to students, such as trends in awarding research grants. But we can only print what we receive.

**Roger Brewis** newsletter editor

**Got an idea for a branch event? If so, let us know**  
**E-mail: [rogerbrewis@breathemail.net](mailto:rogerbrewis@breathemail.net)**

# More money helps kids to 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 of physics clearly, support the curriculum and provide help to the teachers. To do this successfully takes careful preparation, which requires far more time than busy people tend to 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 and can be used for this purpose. It has just been announced that a second round of EPSRC PPE funding has been awarded to the scheme, which will enable the team to provide videos and workshops to help physicists to get started.

The site has presentations covering different areas of the curriculum. Each session includes 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



*Children exploring the contents of a black bag during a session on light.*

be anticipated and corrected. Also a well illustrated PowerPoint presentation has been provided for each session. This can be downloaded free of charge. The website is extensive and includes detailed guidance notes collected from those who are already experienced at going into schools.

You can find the site from the homepage of the new Institute website by choosing the "Engaging the public" option. On the page that appears, the Physicists and Primary Schools

Project is listed as a link the top of the column on the left. Do take a look at the site and, if you use the material, the team would like to hear your feedback. 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.

## Benevolent fund aids our members who face a crisis

The principal aim of the Institute's Benevolent Fund is to provide members or their dependents who face a critical need (which cannot be met by other means) with assistance that will help to improve their prospects of continuing to lead a fulfilling life.

The fund can help:

- members or their families in need due to disability, illness, death or unforeseen problems;
- members facing critical career issues;
- members facing problems in employment;
- students of physics facing hardship through illness, disability or other unforeseen problems.

The principal beneficiary will be members of the Institute of Physics and members of the Institute of Physics and Engineering in Medicine. However, in exceptional circumstances, help can be provided to those who are not part of the membership.

If you would like more details or if you feel you might meet these criteria, or know someone who might, contact Sue Dowling (secretary of the Benevolent Fund, Crosswinds, Grovehurst Road, Iwade, Kent ME9 8RE; e-mail: suemdowling@yahoo.co.uk). Any correspondence will be treated as confidential.

## Blue plaque recognizes Lindemann

On the afternoon of Saturday 23 September at the Sidholme Hotel, Sidmouth, Devon, a blue plaque was unveiled to commemorate the scientist Frederick Lindemann, who lived there for much of his childhood.

Lindemann was born in the German town of Baden-Baden in 1886, where his family was on holiday, but shortly afterwards they returned to Sidholme, the family home. He grew up in a privileged environment and among many talents became a tennis player of international standard. His father Adolf was a keen amateur scientist and astronomer and it was probably

this that kindled Frederick's own interest in science.

There are three important aspects to Lindemann's career. First, he was an outstanding scientist in his own right, particularly in the area of low-temperature physics, where he made several key contributions. However, working with his elder brother, Charles, in their private lab in an annexe at Sidholme, he developed the "Lindemann glass". This was a special composition of glass that was more transparent to X-rays than existing glass and would be useful in the medical field. There were plans to manufacture

it commercially at Sidholme but these came to nothing.

His second great contribution was to build up the Physics Department at the University of Oxford – the famous Clarendon Laboratory. Lindemann became head of the lab in 1919 at a time when it had been moribund in research for several decades. He initiated a vigorous research programme and appointed several active and dynamic physicists to work there. In the 1930s, when Germany was in the grip of the Nazi regime, he brought over to Oxford quite a few outstanding scientists seeking to escape from Nazi

Germany. Some remained and established the Clarendon Laboratory as one of the leading centres in the world for research in low-temperature physics, a status that it retains.

His third contribution – perhaps the most significant – was his appointment in September 1939 as the personal scientific advisor to Churchill throughout the Second World War. This was the darkest hour both for Britain and the free world, and the scientific and technological developments made in the UK towards the war effort under Lindemann's overall leadership were decisive for the eventual defeat of Nazi Germany.

He later became Lord Cherwell and died at Oxford in 1957.

## Our constitution is set to change

The current branch constitution was agreed at our AGM in May 2001 so it is now high time that it was brought up to date. The Council of the Institute requires a few changes, primarily to the operation of the branch committee. The others changes are mostly intended to streamline the document, and to remove things that don't need to be specified.

The change with the most important consequence is in Para 7: Period of Office. Previously, Officers could change hats at the end of their four-year term. Now they must stand down for at least one year before offering themselves for re-election. The same applies to Ordinary members of the Committee. The objective is to make it easier to bring new blood onto the committee, and to the posts of Officers (Chair, Vice Chair, Hon Secretary, Hon Treasurer). Previously, we were able to avoid this rule by using special resolutions at the AGM, but in the new constitution this can be done for one year only. So we must renew our efforts to find new members of the committee, and if anyone is interested in coming onto the committee, please talk to one of the existing members, and/or stand for election at the AGM.

● A copy of the new constitution is included with this issue.

**Vince Smith**, vice-chair

## From your new regional officer

I'm Dr Alison Rivett, the new regional officer for the South West region. I have been in post since the middle of August and I work two days a week for the Institute. I'm employed by the Institute's membership directorate but work from home in the South West, doing my utmost to cover a large and extremely diverse region – from Swindon to the Scilly Isles and from Chipping Camden to the Channel Islands.

The Institute has recently recruited regional and national officers to work across the whole of the UK, building on the success of the officers who have been active in Ireland for almost 10 years. Our remit is to increase the activity, profile and influence of the Institute in our respective regions. This will involve stimulating public policy and political debate – particularly in relation to physics education and funding; developing physics outreach activities; working in partnership with other science and technology bodies in industry, education and government; and helping to recruit and retain members. It's a very wide brief. What does it mean in practice?

Some of the things that I have been doing in the last few months include liaising with science-focused organizations in the area, such as the Science Learning Centre, the Setpoints and the South West Regional

Development Agency. I've given a presentation about the benefits of Institute membership to the new intake of physics undergraduates at Bristol. I've spent a very fun day getting covered in green "goo" on Lab In A Lorry, and most recently I had two days networking like crazy at the South West Higher Education Regional Development Association's annual conference in Torquay.

Coming up in the diary are discussions with Local Education Authority science advisors from across the region and a meeting with newly qualified graduates working towards their Chartered qualifications. I will be finding out more about physics-based businesses in the area and also the challenges facing physics students and teachers in our schools and universities. In conjunction with the branch I am organizing a careers event for GCSE students in Devon and Cornwall to encourage them to consider physics as an A-Level option. It looks like I'm going to be in for a busy time.

I have to confess at this point that I am actually a chemist by training. I studied chemistry with environmental chemistry at the University of Swansea and as part of my degree undertook an industrial placement at Burmah Oil Chemicals Division in Hamburg, Germany. Having experienced working in the "real world" I decided to study for a

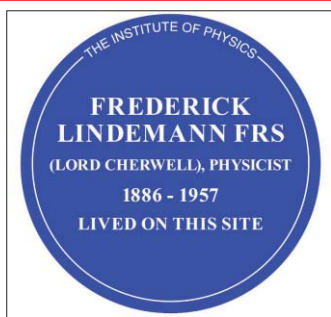
PhD in the School of Chemistry at the University of Bristol, where I researched air pollution and its effects in the urban environment.

While in Bristol I got involved in a number of outreach activities for local schools and students, which I enjoyed immensely. I then spent three years working for Wessex Setpoint at the University of Bath, promoting science and technology to schools and young people. This gave me a range of experience developing and delivering hands-on activities to students and teachers on a whole host of topics – and I'm also now a Lego Robotics expert.

In my new role I'm really excited by the possibilities of physics and the scope for stimulating hands-on activities and demonstrations. I think it is important that people know how rewarding a career in science can be and that businesses recognize the benefits of employing physicists. Above all I enjoy spreading the word about science and how crucial it is in our lives and for the future.

I am very much looking forward to working with the branch and members in the region and to hearing all of your ideas about what we can do to promote physics in the South West region.

**Alison Rivett**, South West regional officer



The blue plaque was unveiled by Prof. Sir Peter Knight who is head of physics at Imperial College, London. He was introduced by Dr Peter Ford of the University of Bath, chair of the branch. Both Knight and Ford were students at the University of Sussex in the mid-

1960s when there was a very strong research group in low-temperature physics and several academic staff had come from the Clarendon, where they had worked with some of those appointed by Lindemann.

During the unveiling ceremony, thanks and appreciation was expressed to Paul Grainger, manager of the Sidholme Hotel, and his staff, as well as to members of the local community. Special thanks should go to Brian Gosling who first alerted the Institute to the connection between Lindemann and Sidholme. He also produced an excellent poster display board dealing with Lindemann's life and work.

Later a few of the guests

attending the unveiling visited the nearby Norman Lockyer Observatory and were shown the magnificent telescopes and planetarium there. Lockyer was a professor of physics in what later became Imperial College and specialized in studying spectroscopy. This provided a direct link to Knight, who holds a comparable position.

Two years ago the Institute unveiled a blue plaque at the Norman Lockyer Observatory to Ambrose Fleming, who retired to the Sidmouth area and died there in 1945. He invented the diode in 1904 and was the world's first professor of electrical engineering (at University College, London).

**Peter Ford**, branch chair

## Join us!

Would you like to see more physics-related activities in your region? Would you like to see some different activities from the ones that your branch traditionally offers? Are you brimming full of innovative new ideas? If this describes you, why don't you join the South West Branch committee? We get together about four times a year and are always on the lookout for new ways of promoting physics and supporting physicists in our region.

For more information, contact the branch secretary, Claire Bedrock (e-mail: [claire.bedrock@iop.org](mailto:claire.bedrock@iop.org); tel: 0117 930 1151).

# The physics of contemporary dance

Back in 2003 the Institute commissioned Rambert Dance Company to choreograph and perform a new dance piece for the European Year of Physics in 2005, based on the *annus mirabilis* of 1905 when Albert Einstein submitted a series of papers to Max Planck, editor of *Annalen der Physik*, that have since passed into legend.

It must be pleasing for the directors of the Institute to see that the dance, *Constant Speed*, is still in Rambert's repertoire during its autumn 2006 tour and still delighting audiences.

Having missed its early performance in Bristol, I caught up with the Mark Baldwin piece for the first time on Saturday 4 November at the Forum Theatre in Malvern. It was performed alongside *Divine Influence* by Martin Joyce, *Swamp* by Michael Clark and *Transit*, a fluid, atmospheric piece where the spotlight that is Venus arcs imperceptibly across the stage, followed and caressed by choreographer and solo performer Melanie Teall.

While *Constant Speed* is

clearly a homage to the constancy of the speed of light, and to Einstein's pivotal role in establishing that concept as scientific fact, Baldwin says that his starting point was Brownian motion and that many of the design elements were derived from the photoelectric effect, in which Einstein also had a hand and for which he received his Nobel Prize.

The piece opens with dancers dressed in white, symbolizing white light, later replaced, through the prism of choreographic design with costumes in bold colours. The female dancers also wore atop their heads pom-pom photons matching their dress. The music by Franz Lehar encouraged a good pace to the movement, although the speed, fortunately for lovers of dance, was not constant. The piece, and the show, ended with a firecracker of a jump by an uncredited and previously unfeatured male dancer, who looked to be exploding mid-leap.

For 30 years, since my first visit to a contemporary dance

production in Birmingham, I have been a passionate fan of Rambert. Yet from my position up in the gods I was perhaps too distant to feel properly the brilliance and passion that I associate with the past choreography of Christopher Bruce, whose iconic *Ghost Dances* so inspired me that day.

Is Bruce the only choreographer to bring magic to the heart? Not on the evidence of *Diversions Dance*, whose *Shades of Passion* tour I caught five days later in Brecon. Their dances have beauty, innovation and wit, and they reminded me that modern choreographers of the likes of Juan Carlos Garcia, Jerry Pearson and *Diversions'* own Roy Campbell-Moore have taken the Bruce ball and are running with it.

The Rambert production as a whole was competent but conservative, although there were too many occasions when a dancer was out of step for "Britain's flagship modern dance company". I liked each piece but I left uninspired. The auditorium was nevertheless packed and

the "mature" Shires audience gave each curtain call enthusiastic applause.

*Constant Speed* is, in my view, a good dance piece but not a great one, with a single "spark" (with two metaphorical meanings) to excite the imagination. Nor was the physics content particularly edifying: there was no constancy of speed and no more apparent Brownian randomness than any other carefully structured contemporary creation; when a rainbow of seven pom-poms eventually took over the stage, two of them were identical blue.

Einstein, the programme tells us, once said: "Human beings, vegetables or cosmic dust – we all dance to a mysterious tune intoned in the distance by an invisible player."

I enjoyed the event but found it a slight disappointment and sensed a carelessness in several respects: in execution; to its distinguished choreographic roots; and, most sadly, from the perspective of this journal, to the concepts of physics.

**Roger Brewis** newsletter editor

## CALENDAR OF EVENTS JANUARY TO MAY 2007

Welcome to our calendar of events for January – May 2007. We hope to see you and your guests at some of these meetings.

Full details, along with any last-minute changes, will be published on our website at [http://www.iop.org/Our\\_Activities/Local\\_Branches/South\\_West/index.html](http://www.iop.org/Our_Activities/Local_Branches/South_West/index.html) or can be obtained by contacting the chair or honorary secretary.

You will receive by e-mail updates and reminders of meetings if you have registered your current e-mail address with the Institute. We urge you to register at <http://members.iop.org>. Select the red "Log On" button and log in using your membership number (on a card with your annual renewal notice) and surname. Proceed to "Your record", insert/amend your e-mail details and select "Send changes to membership department".

All meetings are free to members and visitors, and light

refreshments are usually provided beforehand. Most meetings are suitable for sixth-form students. Anyone planning to bring a group of more than about six people is requested to contact the chair or honorary secretary beforehand. (Of course, we are delighted to welcome such groups!)

### JANUARY

#### Thursday 25 January

The history of the universe: from the Big Bang to the present day  
Prof. Matt Griffin (Cardiff University)

7.30 p.m. Room TC014, Elwes Building, University of Gloucestershire, Park Campus, Cheltenham, GL50 2RH  
Joint meeting with IET Gloucestershire.

#### Wednesday 31 January

##### Breaking the Dirac code

Dr Peter Rowlands (University of Liverpool)  
7.30 p.m. Institute of Physics Publishing, Dirac House, Temple

Back, Bristol BS1 6BE

### MARCH

#### Saturday 3 March

##### Branch AGM and Festival of Physics

10.00 a.m. – 4.00 p.m. H H Wills Physics Laboratory, University of Bristol, Bristol BS8 1TL

#### Wednesday 7 March

##### Mind reading, mysteries and maths

Rob Eastaway  
7.00 p.m. University Hall, University of Bath, Bath BA2 7AY. Tickets are free, but please contact Steph Skaife (e-mail: [s.j.skaife@bath.ac.uk](mailto:s.j.skaife@bath.ac.uk); tel: 01225 386 989) to obtain them.

#### Thursday 29 March

##### Rainbows, haloes and glories

Prof. John Inglesfield (University

of Cardiff)

7.30 p.m. Dirac House, Temple Back, Bristol BS1 6BE

### APRIL

#### Friday 27 April

##### From London to Titan: atmospheric electricity throughout the ages

Karen Aplin (Rutherford Appleton Laboratory)  
7.30 p.m. BRLSI, 16–18 Queen Square, Bath BA1 2HN

### MAY

#### Tuesday 15 May

##### Polarization fingerprints in the clear blue sky

Prof. Sir Michael Berry (University of Bristol)  
7.30 p.m. Institute of Physics Publishing, Dirac House, Temple Back, Bristol BS1 6BE

#### Summer visit(s)

Details to follow.

**Got an idea for a branch event? If so, let us know**  
**E-mail: [rogerbrewis@breathemail.net](mailto:rogerbrewis@breathemail.net)**

# Warts 'n' all? The Schools Lecture

A very long time ago I watched with admiration and exhilaration a TV educational animation, called, I think, *Powers of 10*. This was a walk-through of the universe from the largest to the smallest scales, highlighting the enormous amount that we can see and the great voids that exist both in physical space and in our knowledge of it.

Since that time I have considered that the great beauty of physics, and therefore the great attractor for the new generation, is that nobody really knows anything. I therefore attended the 2006 Institute Schools Lecture, "Gravity, gas and stardust", carrying significant theoretical baggage.

I feel that it is something of a conceit, peculiar to modern physics, to equate mathematical description with comprehension. Nor do I like the current approach to physics A-level, which seems to move repetitively from experimental observation through analogy to equation and exercise, and then on to the next topic before the questioning can become difficult or interesting.

This is not to criticize the excellent lecturer, Dr Pete Edwards of Durham University, who has understood the scientific *zeitgeist* very well, but to place his colourful efforts in the context of the continuing concern about getting the best and brightest of our youth interested in a career in physics. No one, I observed, seemed to leave his lecture with a fraction of the excitement that I once felt.

It is partly, I am sure, the complexity of the mathematics that has led physics away from physical explanation. But there is also something novel, introduced into acceptance in physics during the 20th century. Newton was passionate about the "true nature" of things, as evidenced by his discovery that light had component colours, and his advocacy of a corpuscular explanation. So

when he said that he "made no hypothesis" regarding his equations relating what we now call force, acceleration and gravity, we must believe that it was with a heavy heart and continued curiosity.

A successful mathematical model is knowledge, but it is no substitute for understanding. Newton made a "particular" inference, where Young and Fresnel saw a wave at work. Maxwell's breakthrough was a displacement current, physically interpreted in the "luminiferous medium". Lorentz had a physical picture of his transformation, and Planck said of his own seminal work in quantum mechanics:

"But even if the radiation formula should prove to be absolutely accurate it would after all be only an interpolation formula found by happy guesswork, and would thus leave one rather unsatisfied. I was, therefore, from the day of its origination, occupied with the task of giving it a real physical meaning."

The "great theories" that followed 1900 appear to contain difficulties that are diverse, numerous and fundamental. While it may be a psychological requirement to have some confidence in the ideas that you are paid to develop, it is a disservice to the next generation to gloss over the problems.

Indeed, the conflict over the nature of light, for example, or the differences within modern physics over the role of time and the role of the observer, are – or should be – the meat and drink of the next generation of physical science.

Take this year's Schools Lecture, for example. Certainly there were great graphics, including 3D fly-throughs of animations of our real galaxy and a simulated universe. I felt the *son et lumière* explanation of the Doppler effect was very effective. More could have been said about the seriously cool

technology of the diffraction grating – after all, each pupil got to take one home.

For me, however, the most exciting thing about the Big Bang hypothesis is not that it matches observation in three or four places, and that this is two more than the next-best model, but that it demonstrates glaring failures in key areas.

Over lunch I found myself, briefly, in a fruitless discussion over whether the time gap between the Big Bang and the formation of the first stars in a stable Milky Way was 100 million years or 300. That reputable scientists can even entertain either possibility indicates the bankruptcy of thought in cosmology. This is, after all, at best one-and-a-half revolutions of the cloud of dust that might one day form our galaxy. Simulations of solar system formation require 50 to 100 revolutions, and the same might be expected of galactic formation.

## Impossibly difficult

This can only start once a cloud has settled out gravitationally following a Big Bang, a process that itself confounds us. In a lecture a few years ago to this branch, Astronomer Royal the then Prof. Sir Martin Rees (now Lord Rees) confessed to having concluded that it is an almost impossibly difficult process. Prof. Andy Albrecht says that, to end up with a universe that looks like ours, "we have to take a number that describes the density of the matter in the universe and get it right to a hundred decimal places".

The other classic failure of Big Bang cosmology is an almost pathological avoidance of "the edge problem". Either our universe, expanding or otherwise, has an edge, or it doesn't. The "finite but unbounded" hypothesis requires a long-range curvature for which there is, let's face it, not a shred of evidence. Yet the

physics of an edge rapidly becomes very peculiar.

Aspects of cosmological "fact", such as the raisin-bread model, nicely illustrated by Edwards, and the popular interpretation of the microwave background as an "echo" of the bang, rapidly become problematic when appended to an overall model.

Add in the lack of causal reasoning in inflation "theory" and the expanding universe is starting to look scientifically threadbare.

Pete Edwards is a nice guy, a capable scientist and a competent communicator. It is not his job to make sense out of this muddle. Well, actually it is, but better men have failed. Nor is he to blame, other than collectively, for the attempt to pass off speculation as fact across physics. At the end of his lecture he paid lip service to a couple of the less fundamental problems in this area.

He should be commended and not criticized for an excellent attempt to communicate these imperfectly formed ideas to a young audience, and to enthuse them with the awe and wonder that many of us feel.

Nor is there anything wrong with a science that does not know the critical answers. This was the essential nature of the Earth sciences before Wegener, and of biology before our understanding of inheritance and cell energetics.

What is immoral, and as a strategy for scientific advancement insane – but hardly the fault of Edwards – is to try to keep our failures from the very generation who might, with a clearer and more honest exposition of the problems, be energized to solve them.

**Roger Brewis** newsletter editor  
● Sections of this article are based on a longer manuscript that is in preparation. The views expressed are those of the author and not those of the Institute or the branch.

**Check out the branch website at <http://sw.iop.org>**

# Our energy options: doing nothing isn't one of them

The branch's series of four lectures on energy was launched on 9 November by Prof. Max Irvine of the University of Manchester, who provided an excellent, thought-provoking and non-technical overview of the UK energy-supply situation and the problems facing us.

Irvine reminded the capacity audience packed into the Powell Lecture Theatre at the University of Bristol that energy is the single most important commodity that underpins our modern way of life, and that consequently a strategy for ensuring a secure and adequate supply must be near the top of the list of national priorities.

He emphasized the global hunger for energy and the quite rapid changes currently affecting both our supplies and the wider geopolitical world order. His whole thrust was that these issues are far too important to be left to under-regulated privatized utilities acting in their shareholders' interests. *Realpolitik* must rule the day.

Irvine noted that, at present, 75% of our existing electricity supplies are generated using fossil fuels. However, by 2010 we will be importing oil and by 2020 80% of our gas. Moreover, the Large Combustion Plants Directive, which will place controls on emissions, will cause 50% of coal-fired power stations to close within the next 10 years. In addition, Magnox power stations are currently being decommissioned.

Meanwhile the case that human activity is driving climate change is sufficiently proven for us to take the precautionary approach. However, while it is clear that climate change is high on the political agenda, it certainly isn't the only energy

problem that needs urgent consideration. 33% of UK electricity-generating capacity will need replacement in the next 10 years, and with it a big investment in the National Grid.

Ideally new capacity would be near the centre of demand – somewhere between Birmingham and London – replacing the Scottish supply currently transmitted south. Surprisingly the grid is at present more efficient at transmitting south than transmitting north, so, if the new southern capacity were needed to supply Scotland, new investment would be needed. More significantly, £5 billion would be needed for the grid if the supplies of wind in the Hebrides – the most plentiful in Europe – are to be exploited.

In considering adequate new generating capacity, two key factors are vital: the second law of thermodynamics and diversity. Irvine remarked that it is amazing that cooling towers are an accepted part of UK power stations, allowing about two-thirds of the primary energy available in the fuel to be wasted to the atmosphere. Such towers were much less the norm in continental Europe where combined heat and power schemes were more common. Such schemes must be used more widely in the UK.

Diversity of supply is essential for both political and technical reasons. Memories of Winston Churchill, who supported diversity and a switch to some diesel power in the fleet; Ted Heath, who fell to the miners when Britain was overdependent on coal for generation; and Margaret Thatcher, who survived a later conflict when Britain was less dependent on coal – all



*Prof. Max Irvine contemplates our future energy options.*

were invoked to illustrate the political and strategic importance of a diversity of supply. Technically, supply has to follow demand and this can be done with a combination of fuels. In terms of rapid response to demand changes, hydro is best, followed by gas, oil and coal, with nuclear last. Indeed, nuclear is ideally run more or less flat out to satisfy base load, with Chernobyl cited as a failed experiment in running below full capacity.

For fossil fuels the higher energy release in a hydrogen-oxygen reaction, compared with a carbon-oxygen reaction, means that energy/CO<sub>2</sub> is higher the higher the hydrogen:carbon ratio in the fuel. Thus natural gas is more environmentally friendly than oil, which is more friendly than coal. On this basis, hydrogen is the most friendly but, of course, this is not a fuel but a vector (i.e. a means of storing and moving energy, but not a primary source).

Irvine briefly discussed the

various approaches to renewable energy but none was seen as a major player in the medium term. Claims of 50% and more renewable by 2050 were treated with scepticism, with wind dismissed as not a major player, although a possible source of power for generating hydrogen. However, it is essential to use existing sources more efficiently, and to reduce the almost 100% dependence of transport on oil.

In addition to promoting combined heat and power, as noted above, valuable savings could be made by bringing house insulation standards up to Scandinavian levels and insisting that all domestic appliances were A rated, with lower levels banned. Emissions from fossil-fuel power plants could be reduced via carbon capture and sequestration. Increased use of hybrid engines, electrification and perhaps wind-generated hydrogen are all possibilities for reducing the role of oil in transport.

It was made very clear that energy and climate change are global political issues with the UK producing only 2% of the world's CO<sub>2</sub> emissions, China opening one coal-fired power station per week, and 80% of the world's oil and gas under state control, despite the image in the West of Shell, Exxon, Total and BP being dominant players. The audience was left in no doubt that the UK faces significant problems in the medium term and doing nothing is not an option. What was much less clear was what is the best route forward. Perhaps that'll be easier to judge at the end of what should prove to be a very popular and timely lecture series.

**Mike Wilson**

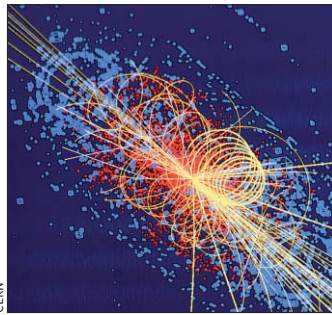
**Please check your e-mail address in your Institute details on the Web to ensure that you receive the e-mails that we send you. See [www.iop.org](http://www.iop.org).**

# Vince Smith talks about the Higgs hypothesis

Around 80 people, including groups from Cheltenham School and Millfield School, listened intently for well over an hour as Dr Vince Smith of the University of Bristol took us “Hunting for the Higgs boson” at the Park Campus in Cheltenham, a joint lecture with the Institution of Engineering and Technology.

Dr Smith, a lecturer at the University of Bristol and a researcher at CERN, displayed an encyclopaedic knowledge of the subject. He took us first through the “rules of the game” as predetermined by relativity theory and quantum physics. Then he moved on to the important question being addressed in this £1 billion a year venture: what are the fundamental particles of force and matter within the standard model of particle physics and what are their properties?

Four-time chair of the branch, current vice-chair and long-time enthusiastic lecturer to extramural audiences in support of the advancement of physics, Dr Smith earned his 2004 MBE for services to physics all over again as he informed and entertained his audience in the University’s Elwes Building.



CERN

A hypothetical LHC impact, which is also featured on Dr Smith’s tie.

For those paying attention, which seemed to be everyone, there was what appeared to be a detailed classification of what currently amount to fundamental particles:

- the six types, or flavours, of quark: up; down; strange; charm; bottom and top, the last found only in the 1990s;
- the six leptons, including the electron and muon, that do not feel the strongest of the four fundamental forces;
- the photons, gluons, bosons and possibly gravitons – force particles that hold everything together, due to their exchange.

Dr Peter Ford, branch chair, who looked as though he had played this game before, joined Dr Smith for this two-hander



scene from Blow Up with invisible balls and boomerangs – the standard model but, as he put it, still “full of holes”, and hence the need for the Large Hadron Collider (LHC).

Hadrons, we learned, were protons, for example, but also entire nuclei, so the LHC will smash lead nucleus into lead nucleus as well as proton into proton, using parallel tubes (and hence a single set of magnets) to achieve contrarotation.

Inevitably, and provided that nothing goes horribly wrong with the technology or the science, there will be bits everywhere – in more senses than one, because among the record-setting details of this epic project (accelerations to

99.999999% of the speed of light; 700 000 l of superfluid liquid helium at 1.9 K; 1296 14 m dipole magnets operating at 8.36 Tesla) are the 100 terabytes/s to be generated, of which, after automated selection, 0.1% will be stored.

Bristol, as one of four contributing UK institutions (Imperial, Brunel, and Rutherford Appleton are the others), has as its focus the Compact Muon Solenoid (CMS) detector, which generates its own superlatives: more iron than the Eiffel Tower; a magnetic field equivalent to the kinetic energy of a 747 in flight.

Regarding what we may find, as Dr Smith put it, with an acknowledgement to Donald Rumsfeld, it is the “unknown unknowns” that prove to be the most exciting.

Among all the detail was the Higgs hypothesis: that mass is an effect of interaction with a “soup of particles that everything is travelling through”. A shiver ran down my spine. Would a negative result mean a replay of the Michelson–Morley debate? Anything but that!

**Roger Brewis**

# The man who managed to prove Einstein right

Sir Arthur Eddington is now celebrated with a new permanent display panel at the North Somerset Museum in Burlington Street, Weston-super-Mare, paid for by the Institute. Eddington led the British expedition to observe the 1919 solar eclipse, which showed that Einstein’s theory of General Relativity was correct.

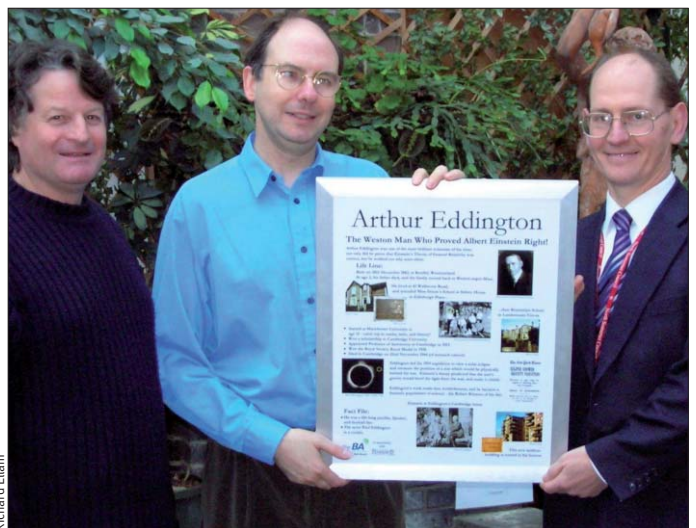
Nick Goff, the museum’s manager, said: “This is another fascinating aspect of Weston’s history that had been a bit neglected. It’s been great fun finding out about the science and it shows how brilliant people can come from anywhere.” Chris Richards, the museum’s researcher, leads walks round Weston, which now include an “Eddington Trail”.

The Eddington family lived at 42 Walliscote Road, where a bronze plaque was unveiled in

1982 on the centenary of his birth. The young Arthur went to Miss Dixon’s School in Edinburgh Place and then to Brynmelyn School in Landermann Circus, where he was inspired to become an astronomer. At 15 he won a scholarship to the University of Manchester, where he came top in maths, Latin and history. After a scholarship to the University of Cambridge, he went on to work at the Royal Greenwich Observatory with the Astronomer Royal. He returned to Cambridge as professor of astronomy in 1913, and stayed there until his death in 1944.

Eddington’s connection with Weston is also celebrated by the naming of the new major complex of flats on the seafront – Eddington Court.

The panel at the museum includes photographs of



Richard Eltam

Chris Richards, Colin Axon and Nick Goff with Eddington’s plaque.

Eddington in his schooldays and contemporary images to identify the sites shown. It was created by the Bristol and Bath Branch

of the British Association for the Advancement of Science and further supported by PPARC.

**Colin Axon**

# Lucie Green plays the superstar

In October, Dr Lucie Green of the Mullard Space Science Laboratory (MSSL), a country mansion based, semi-independent offshoot of the UCL (University College, London) brand, drove from Dorking down to Bristol, through one of the most horrendous traffic jams of modern times, to tell members of the Institute, the Institution of Engineering and Technology and the Bristol Astronomical Society about “The Sun: our superstar”, or, as her opening slide put it, rather less grandly: “Half a century of solar physics”.

The multiple-crash-induced half-hour delay passed without complaint, as acquaintances were made and renewed among the seasoned audience, the wait sporadically enlivened by announcements and witticisms from the redoubtable “Smith and Jones” of the South-West Branch (alias Drs Vince Smith and Peter Ford).

As Lucie emerged, blinking, from several hours of motorway madness into the Frank Lecture Theatre, she was welcomed with heartfelt sympathy, our usual gentle humour and the offer of a nice cup of tea. Alas, the tea was not to be, as a snagged cable resulted in a failed attempt by Dr Smith to pour 20 litres of boiling water over himself. As the urn and its precious liquid rolled and spread over the floor, Dr Smith turned to the lecturer – thoroughly unfazed – and, it has to be said, a most relieved audience, and said with his famous smile: “Would you like milk and sugar with that?”

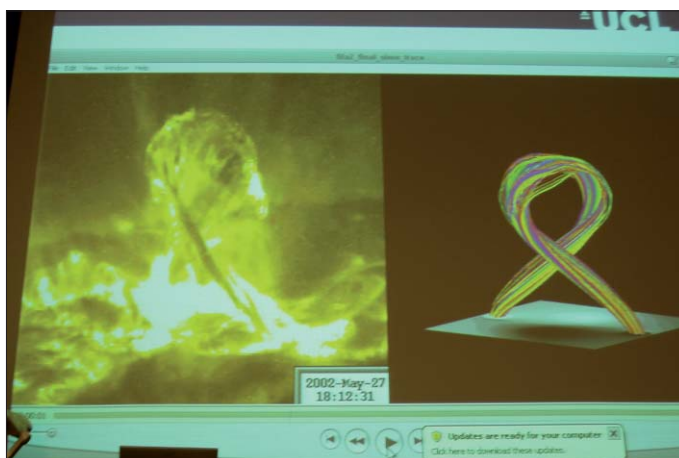
Tension diffused, and a never-ending succession of tail-lights suddenly forgotten, Green turned to her task of getting her presentation up and ready, while our branch chair



*Lucie Green explains a point.*



*Branch chair turns Mrs Mop.*



*A twisting solar prominence and the model version.*

proceeded with a concentrated and convincing demonstration that he had never mopped a floor in his life – and 10 minutes later still hadn’t!

With the warm-up acts finally either completed or abandoned, Green then proceeded to the highlight of the evening’s entertainment – namely her excellent talk. Feeling somewhat flustered, she later admitted, while looking and sounding anything but, she talked of sunspots – paired and rotating –

and solar cycles and X-ray emissions, of the photosphere, chromosphere and corona, of Richard Carrington’s 1859 observation of a solar flare and the subsequent geomagnetic storm, of Skylab and the Solar Maximum Mission, and Yohkoh and SOHO, the Solar and Heliosphere Observatory, and TRACE (the Transition Region And Coronal Explorer).

As anyone with the slightest interest knows, the beauty of the aurora is nowadays matched

by the images of huge, looping, twisting prominences and the carpet of seething magnetic field on the Sun. How does all of this work? What are the causes of the solar cycle, the prominences and their breakdown in coronal mass ejection (CME)? Green, her 150 colleagues at MSSL and the world scientific community are determined to find out, using Hinode (launched September 2006), and Stereo, which will for the first time let us see coronal mass ejections in four dimensions, and whose countdown proceeds as I write. These should allow International Heliophysical Year (2007) to live up to its name.

As the Institute, in the form of its local representatives, treated a deserving lecturer to a Thai curry, we could relax and muse on events. How much simpler it is, for example, when excess liquid nitrogen is poured away (onto the floor) at the end of a demonstration. Does Dr Smith’s MBE now stand for “Mind-boiling effluent”? How could magnetic loops snap, emitting CMEs, and then, in theory at least, reconnect? How can the corona possibly be the two million Kelvin that X-ray emissions indicate?

This was a most interesting and enjoyable talk. If the measure of success is that it gets you talking later, then it once again succeeded admirably. As I ferried Vince Smith home, I mused aloud on the problem. Could the coronal “temperature” be an artefact? Perhaps the motion/acceleration that we are seeing in the X-ray region is a rapid rotation of charged particles in these powerful magnetic loops?

He regarded me stoically and said: “My road is on the left.”

**Roger Brewis**

**The deadline for your contributions to the next issue is:**

**28 February 2007**

**Please e-mail your materials to [rogerbrewis@breathemail.net](mailto:rogerbrewis@breathemail.net)**

## South Western Branch

### Festival of Physics, including branch AGM

10.00 a.m. – 4.00 p.m. Saturday 3 March 2007  
at H H Wills Physics Laboratory, University of Bristol BS8 1TL.

The day is free to members and non-members (including lunch and refreshments), but please help us to organize the catering by booking in advance (contact Dr Claire Bedrock, tel: 0117 930 1151, e-mail: [claire.bedrock@iop.org](mailto:claire.bedrock@iop.org)). No advance booking = no free lunch! Information about how to reach us can be obtained at <http://www.phy.bris.ac.uk/travelandmaps.html> or from the committee. The morning events are also suitable for school physics students from year 11 onwards.

#### **Provisional programme** (see <http://sw.iop.org> for any updates)

10.00–10.30 a.m. **Arrival and welcome. Coffee & biscuits.**

10.30–11.20 a.m. **The science of Coast**

Talk by Dr Alice Roberts, Department of Anatomy, University of Bristol.

Alice Roberts is an expert on bones and human disease of bones, both present-day and in the archaeological record. She is one of the stars of the BBC TV series *Coast*. She will describe some of the science behind the making of the series, illustrated with clips from the programmes.

11.30–12.20 p.m. **The forces of nature**

Talk by Prof. Peter Kalmus, Queen Mary, University of London.

In elementary science we use many names for various forces. However, basically there appear to be no more than four fundamental forces. Gravity and electromagnetism are well known forces, and are sufficient for all chemical and biological phenomena. Physics, astrophysics and cosmology are greedier. Two additional forces were discovered in the first half of the 20th century: the strong force that binds the atomic nucleus and the weak force that allows the Sun to shine. About 20 years ago an experiment that collided matter with antimatter showed that the weak force and electromagnetism were actually aspects of the same force.

12.30–1.15 p.m. **Buffet lunch.** (During lunch there will be demonstrations.)

1.15–2.30 p.m. **AGM**, to include Dr Robert Kirby-Harris, chief executive of the Institute.  
For notice of meeting and agenda, see overleaf.

2.30–3.20 p.m. **A thin hard rain from outer space: the story of cosmic rays**

Talk by Dr Roger Moses, University of Bristol.

Cosmic radiation is still in some ways as mysterious as when it was discovered, nearly a century ago. Some individual particles have enough energy to boil a kettle and take about a month to cross the universe. The radiation dose that they give is a major hazard to space travellers and a minor risk to both crew and electronics in high-flying aircraft. Notwithstanding the above, it is probable that it is essential to the development of life, being the one of the causes of spontaneous mutations in living cells. This talk, supported by a demonstration, will cover the history of our knowledge of this fascinating topic and bring it up to date with the latest space and ground observations.

3.30–4.00 p.m. **Tea.**

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# Institute of Physics South Western Branch AGM 2007

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Notice is hereby given that this meeting will be held on Saturday 3 March 2007 in the H H Wills Physics Laboratory, University of Bristol, at 1.15 p.m.

This is an opportunity for all members of the branch to have their say and make suggestions for future activities and topics for lectures. On behalf of the committee, I do urge members to attend and to contribute to the discussion.

Nominations for new committee members are requested. If you are interested or would like further information, contact the honorary secretary.

Copies of the minutes of our 2006 AGM are available on request to the honorary secretary and will also be available at the meeting. Any branch member wishing to bring forward appropriate business needs to give notice in writing to the honorary secretary at least seven days before the meeting.

Under the branch constitution, the quorum for a general meeting of the branch is 12 members. We certainly expect to see many more than this number present, but if the meeting should be inquorate it will be reconvened at the same place and time, one week later. If this unlikely event happens, it will be announced on our website. The quorum at any reconvened meeting will be the number of corporate members present at the time.

## AGENDA

1. Welcome
2. Apologies for absence
3. Approval of 2006 AGM minutes
4. Matters arising from 2006 minutes
5. Chairman's report
6. Treasurer's report
7. Election of officers and committee
8. Approval of new branch constitution
9. Address by a director of the Institute
10. Any other business

Dr Claire Bedrock, Hon. Secretary. Tel: 0117 930 1151. E-mail: [claire.bedrock@iop.org](mailto:claire.bedrock@iop.org)



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Please return this slip to Dr Claire Bedrock, IOP Publishing, Dirac House, Temple Back, Bristol BS1 6BE.  
Tel: 0117 930 1151. E-mail: [claire.bedrock@iop.org](mailto:claire.bedrock@iop.org)

I will attend the Festival of Physics on 3 March 2007 and will bring \_\_\_\_\_ others with me.

Name \_\_\_\_\_

Tel:/e-mail: \_\_\_\_\_

I am interested in serving on the branch committee/\*I nominate \_\_\_\_\_  
to serve on the committee (please give address and telephone number or e-mail address of nominee).

# Institute *of* Physics

## Constitution and Rules of the South Western Branch

### 1 Name

The Branch shall be known as the South Western Branch of The Institute of Physics.

### 2. Definitions

In these Rules terms used shall be defined according to the definitions given in the Charter and Bylaws of The Institute of Physics. In addition

‘Branch’ means the South Western Branch of The Institute of Physics.

‘Branch Members’ means those members who belong to the Branch as defined under Rule 4.

‘Voting Members’ means those who are eligible to vote at Committee Meetings and includes Officers, Ordinary Members and co-opted members of the Committee.

‘Institute Director’ means the Director of the Institute of Physics responsible for Branches or equivalent person deputising in his/her absence.

### 3. Objectives

The aims of the Branch shall be to further the object of the Institute.

### 4. Membership

The Branch Members shall be those members whose correspondence address maintained with the Institute is within the area assigned to the Branch by the Council, as well as those members elsewhere who have recorded with the Institute their wish to maintain links with the Branch.

A person who ceases to be a member shall ipso facto cease to be a Branch Member.

### 5. Officers

The Officers of the Branch shall be a Chair, together with an Honorary Secretary and an Honorary Treasurer and may also include a Vice Chair. Only Branch Members shall be eligible to be Officers of the Branch and in accordance with the Bylaws of the Institute they must be Corporate Members of the Institute except where otherwise agreed by Council.

### 6. Committee

The affairs of the Branch shall be managed by a Committee comprising the Officers of the Branch together with (normally) not more than twelve Ordinary Members of the Committee, and such additional members as may be co-opted from time to time under Rule 10. The functions of the Committee and any specific roles and responsibilities of members shall be decided by the Committee.

Only Branch Members shall be eligible for membership of the Committee. In accordance with the Bylaws of the Institute the majority of the Ordinary Members of the Committee must be Corporate Members except where otherwise agreed by Council.

Decisions of the Committee shall be by a simple majority of those present. In the case of an equality of votes the chair of the meeting shall have an additional, casting, vote.

### 7. Period of Office for Officers of the Branch and Ordinary Members of the Committee

The Officers of the Branch and the Ordinary Members of the Committee shall be elected annually at the Annual General Meeting, and shall be eligible for immediate re-election up to a maximum period of four years. After four years in post no Officer of the Branch or Ordinary Member of the Committee may be re-elected until one year has elapsed. Exceptionally any terms of office exceeding those listed shall be authorised by a separate resolution at a General Meeting. Any such resolution may only be applied once for any individual.

### 8. Election of, and Nominations for, Officers of the Branch and Ordinary Members of the Committee

Vacancies for Officers of the Branch and Ordinary Members of the Committee shall be filled by election at the Annual General Meeting (AGM) of the Branch.

At least 6 weeks before the date of the AGM the Committee shall ensure that the members of the Branch are informed of the membership of the committee, including details of those standing down or no longer eligible to serve. The Committee shall also advise the Branch membership of its own nominations for the next committee and invite other nominations from eligible members. Nominations require the support of not less than two Branch members and the consent of the nominee.

The notice of the AGM will be issued to all members at least 21 days before the date of the AGM. The notice shall include the agenda for the meeting and details of all nominations for Officers and Committee members.

### 9. Casual Vacancies

The Committee shall select from the existing Officers of the Branch or Ordinary Members of the Committee (who shall be a Corporate Member) to fill any casual vacancy arising among the Officers between Annual General Meetings. That selection shall be by simple majority of the total membership of the Committee, whether present or not. Officers taking office through this process shall stand down at the next Annual General Meeting. They shall be eligible for election to the post vacated; the period served as a co-opted member of the Committee shall not be taken into account (see Rule 7).

The Committee may co-opt from Branch Members to fill casual vacancies amongst Ordinary Members of the Committee arising between Annual General Meetings. Members so co-opted shall retire in accordance with clause 10.

#### **10. Co-option to the Committee**

The Committee shall have power to co-opt up to three members. This might include members of other Institute committees or other professional bodies for the purpose of programme co-ordination.

Co-opted members shall be eligible to vote at Committee meetings.

Co-opted members shall stand down at the next Annual General Meeting. They shall be eligible for reappointment by the Committee as co-opted members for no more than three successive reappointments.

#### **11. Quorum for Committee Meetings**

At Committee Meetings, one third of the voting membership or five members (whichever is the greater), at least two of whom shall be Officers of the Branch, shall constitute a quorum. Decisions made at a meeting that is not quorate can be ratified by agreement by the necessary number of members by correspondence (including e-mail) after the meeting.

#### **12. Annual General Meeting**

A General Meeting of the Branch shall be held annually, except in exceptional circumstances, to elect Officers of the Branch and Ordinary Members of the Committee and to transact other business. Notification of the date and the Agenda for any Annual General Meeting shall be sent to all Branch Members at least twenty-one days before the meeting. Any Branch Member wishing to bring forward business of a character suitable for consideration at the meeting shall give notice of his/her intention in writing to the Honorary Secretary at least seven days before the meeting.

#### **13. Extraordinary General Meeting**

An Extraordinary General Meeting of the Branch shall be called by the Honorary Secretary following a decision of the Committee, or on receipt of a written request signed by not less than ten Members of the Branch, and shall take place within eight weeks of the receipt by him/her of such instructions or request if these so specify. Notification of the date and the Agenda for any Extraordinary General Meeting shall be sent to all members of the Branch at least twenty-one days before the meeting and shall not contain any other business other than that instructed by the Committee or requested by the members.

#### **14. Quorum for General Meetings**

Twelve members of the Branch, or 1.5% of the Branch membership, whichever is the smaller, present in person shall constitute a quorum at an Annual or Extraordinary General Meeting.

Votes may be given at General Meetings in person only, and either by show of hands or by ballot, as determined by those present by a show of hands. Each Branch Member in attendance shall have one vote. In the case of an equality of votes, whether on a show of hands or on a ballot, the chair of the meeting shall have an additional, casting vote.

#### **15. Finances**

The Branch shall be responsible for the management of its finances within the financial regulations of the Institute, using a bank account opened by the Institute under the name of the Branch.

In August each year the Honorary Treasurer shall submit to the Institute Director an agreed Budget for the ensuing year. The Institute Director will arrange the transfer of approved funds to the Branch's bank account. In January of each year the Honorary Treasurer shall submit to the Institute Director a statement of Income and Expenditure for the preceding year.

#### **16. Communications on behalf of the Institute**

In accordance with the Bylaws, the Branch shall not express opinions on behalf of or in the name of the Institute, except (a) where it is imparting factual information or existing Institute views or statements, or (b) with the prior agreement of Council or a Director acting on behalf of Council.

#### **17. Authority of the Constitution and Rules**

(a) Alterations or additions to the Constitution and Rules shall be proposed by:

Either the Nations and Regions Board

or by the Branch Committee

or by the members of the Branch

and considered at an Annual General Meeting of the Branch. The proposed alterations or additions shall be set out in full in the notice calling the meeting, and may not be amended at the meeting. Such alterations or additions shall be approved for submission to the Council only if supported by a majority vote of those members present and voting at the meeting. The amendments shall not operate unless and until they have received the approval of the Council.

(b) The Branch and its members shall be subject in all things to the Institute's Charter and Bylaws.

(c) Where the Institute's Charter and Bylaws and these rules are silent the decision of the Committee shall stand.