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Advancing Astronomy and Geophysics

MINUTES OF THE COUNCIL MEETING
11 MARCH 2011
AT 1100 IN THE COUNCIL ROOM

1. PRESENT: Professor R.L. Davies; Professor O. Lahav; Professor J.C. Zarnecki; Professor P.G. Murdin; Dr H.J. Walker; Professor M.A. Barstow; Dr I.A. Crawford; Professor K. Blundell; Professor P.K. Browning; Dr E. Bunce; Dr I.F. Corbett; Professor A.W. Hood; Professor D.W. Hughes; Dr A. Norton; Professor D.J. Southwood
APOLOGIES: Professor M. Kendall; Dr R.J. Barber; Professor J. Drew; Professor R. Ivison; Professor R.E. Spencer; Mr M. Thompson
IN ATTENDANCE: D. Elliott (Executive Secretary); R. Massey (Deputy Executive Secretary)

2. MINUTES
The minutes of the meeting of 11 February 2011 were approved and signed.

3. MATTERS ARISING
3.1 A number of revisions were suggested to the design provided by *Fattorini Ltd* of the *Patrick Moore Medal*

4. PRESIDENT'S BUSINESS
4.1 The President summarised his appearance at the House of Commons Science and Technology Committee's inquiry into *Astronomy and Particle Physics.* Specifically to investigate:

- the impact of reduced capital funding on UK capability
- the impact of withdrawal from international ground-based facilities (for example the Gemini Observatory and Isaac Newton Group of telescopes) on the UK's research base and international reputation
- whether the Science and Technology Facilities Council (STFC) has sufficiently engaged with its research community in these two areas on its strategic direction and impacts of budget reductions
- opportunities for, and threats to, outreach and inspiring the next generation of astronomers and particle physicists.

Oral evidence was taken from 6 school students, who explained how their enthusiasm for astronomy had lead them to opt for science subjects, and from Dr. Maggie Aderin-Pocock and Professor Jim Al-Khalili, who spoke about the role of astronomy and physics more

generally in the Public Engagement in Science before he and Professor Jocelyn Bell Burnell, President of the Institute of Physics, presented the perspective of the professional research community (reproduced as annexe A). The President informed Council that the final session would hear evidence from 6 senior academics (Professor Phil Allport, Head of Particle Physics and Director of the Liverpool Semiconductor Detector Centre, University of Liverpool, Professor Mike Bode, Director of the Astrophysics Research Institute, Liverpool John Moores University, Professor Robert C. Kennicutt, Jr., Plumian Professor of Astronomy and Experimental Philosophy Director, Institute of Astronomy, University of Cambridge, Professor John Peacock, Head of the Institute for Astronomy, University of Edinburgh, Professor Steve Rawlings, sub-Department of Astrophysics, Oxford University, and Professor Andrei Seryi, Director, John Adams Institute for Accelerator Science) and finally from Professor Keith Mason, Chief Executive of the Science and Technology Facilities Council (STFC), and Sir Adrian Smith, Director General, Knowledge and Innovation, Department of Business, Innovation and Skills.

Council agreed with the suggestion of the President that the Society should give some sort of acknowledgement to the school students. It also noted that it was expected that the advertisement for the position of CEO of STFC was likely to appear in the summer.

4.2 Following the replacement of STFC's standard and rolling grants by consolidated grants, the President reported that he was concerned about the amount of peer review which would be required if all major groups submitted applications in the 2011 round. Following a *tour de table* it was agreed he would discuss with STFC the risk that this, and administrative overload in the funding council, would result in applications being carried forward to 2012, which would be most unsatisfactory - given that the driver for the changes was reduced administrative costs.

4.3 Professor Davies took opinions from Council about the likely impact of recently imposed immigration quotas on the appointment of non-EU research staff to UK institutions. It was agreed that it should not be serious given the new rules for visa applicants with STEM qualifications. However, Council members were advised to bring any individual cases where difficulties were experienced with the UK Border Agency to the attention of the Campaign for Science and Engineering (CaSE), of which the Society was a corporate member.

5. ORGANISATION AND STRUCTURE

5.1 Following a proposal made at the last Away Day, Professor Southwood spoke to a paper on the use by the Society of 'A' and 'G' descriptors for its fellows. After reviewing their history he concluded that they continued to serve a useful function, though it was important that fellows did not feel constrained by them, that distinctions did not become divisive and that 'A' and 'G' officers should not aim to represent 'constituencies' (and that individuals should be left to decide, and change at any time, their 'A' or 'G' affiliation).Since the key consideration was to ensure fairness to all fellows it was important to query the utility of these descriptors, perhaps every 10 years or so, since the boundaries of the science covered by the Society were fast changing.

5.2 Another follow-up action from the Away Day, on the operation of the Society's Grants Scheme, was introduced by Dr Walker. She informed Council that, following an internal review, it was recommended that:

- The composition of the grants committee should be publicised on the web site

- The existing (2) deadlines for the receipt of applications should be retained but that 10% of the allocation should be held back to deal with 'urgent' applications (and to deter merely late applications posturing as urgent ones such cases a) would be capped at £1000 and b) would be considered only if there was convincing evidence of its genuine urgency)
- The current criteria for awards should be revised since they were complicated, and in some cases anachronistic
- Undergraduate summer bursaries (based on the Nuffield scales) should be restricted to a maximum period of 6 weeks and that there should be a 'one bursary one institution' rule
- The right to make applications (though not grants themselves) should continue to be restricted to fellows. However they should be required to write a supporting statement (and not simply 'rubber stamp' applications)
- To avoid grants being unclaimed, grantees should be required to acknowledge receipt of the award offer immediately and to take it up within 12 months (after which it would revert)
- To encourage scientists on the Society's list to give talks to schools and local societies, they should be entitled to claim reimbursement from the RAS of reasonable travel and other unavoidable costs up to a maximum of £50 (by completing an expenses form and attaching supporting documentation)

5.3 The Executive Secretary reminded Council that it had agreed to create 3 new Fellowships p.a. for 3 years starting in October 2010, on the same terms and conditions as the Sir Norman Lockyer Fellowship, to compensate (in some way, and within the Society's means) for some of the expected loss of career opportunities resulting from the reduction in the number of research council funded post-docs. They were envisaged as lasting for a limited duration to 'rescue' a number of promising careers otherwise likely to be blighted and would be awarded on the basis on achievement and potential subject to the following conditions:

- While applicants could be of any nationality, to achieve the aim of 'rescuing' careers affected by the domestic funding crisis, they needed to be 'ordinarily resident' in the UK
- To target early career scientists, the PhD had to be awarded no more than 5 years before the commencement of the fellowship and
- To spread the benefits, UK institutions would be restricted to hosting one fellowship during the duration of the scheme

To date (i.e. for the 2010 and 2011 cohorts) the commitments for the so-called '2010 Fellowships' amounted to £ £768,000. The Executive Secretary went on to explain that it was timely for Council to consider the future of this scheme following the completion of the 3rd round, due to start later in the year, which Professor Southwood would lead with the assistance of a refreshed awards panel. In discussion it was unanimously agreed that it was one of its most useful and well regarded programmes and should be made permanent, with the proviso that the number of awards offered would be determined annually in the light of the Society's financial situation. Following discussion, it was agreed to retain the existing criteria (above) though, to remove some ambiguity, the third would be amended to read *To spread the benefits, there will be a limit of one Fellow per university at any one time*. It was also suggested that the name of the Fellowships might be changed (*Herschel Fellowships?)*

and that efforts should be made to seek co-sponsorship. The Executive Secretary undertook to upload comprehensive information about the scheme, and the award holders, on the RAS web site.

5.4 It was agreed that the following changes to the bye-laws would be proposed at the May 2011 AGM:

Bye-law 33 REPLACE ... *On receipt by the Society all applications will be exhibited at the Society's premises for a minimum period of four weeks to provide an opportunity for Fellows to draw the attention of Council to any relevant information about the candidate.*

BY ... *On receipt by the Society all applications will be posted to the members part of the Society's web site for a minimum period of two weeks to provide an opportunity for Fellows to draw the attention of Council to any relevant information about the candidate*.

Rationale: To reflect actual practice

Bye-law 78 REPLACE ... *Each of these medals is to be awarded at intervals of not less than two years. In addition, at intervals of not less than one year, the Jackson-Gwilt Medal shall be awarded for the invention, improvement, or development of astronomical instrumentation or techniques; for achievement in observational astronomy; or for achievement in research into the history of astronomy*.

BY *The Society may recognise achievement in fields of interest by the award of the Eddington Medal (for investigations of outstanding merit in theoretical astrophysics); Herschel Medal (for investigations of outstanding merit in observational astrophysics); Price Medal (for investigations of outstanding merit in solid-earth geophysics, oceanography, or planetary sciences); Chapman Medal (for investigations of outstanding merit in solar-terrestrial physics including geomagnetism and aeronomy); Jackson-Gwilt Medal (for the invention, improvement, or development of astronomical instrumentation or techniques; for achievement in observational astronomy; or for achievement in research into the history of astronomy).Each of these medals is to be available for award annually*
Rationale: To enhance the Society's capacity to recognise outstanding achievement.

5.5 2010 The Executive Secretary presented the narrative section of the Annual Report for 2010 which, subject to Council's approval, would be sent the Society's auditors and, following presentation at the AGM, filed with the Charity Commission. He explained that the Financial Statements would be added when the audit was complete. Council was reminded that, because their affairs were managed through other committees, the Society's publications were not on its agenda as often as their importance would otherwise require. He drew attention to the continued success of the research journals on whose income much of the Society's other activity depended viz during 2010 the number of papers submitted for publication in *MNRAS* increased by 6% while downloads totalled 1,543,912, an increase of 24% compared to 2009; similarly *GJI* saw an 11% increase in the number of submissions and 266,839 full text downloads, an increase of 35% over 2009. In both cases subscription renewals remained well above industry standards at 101% in for the *MNRAS* (117% for *MNRAS Letters*) and 93% for *GJI*.

In a discussion about the Society's Burlington House premises concern was expressed about the reliability of its wireless networks and A-V systems. It was also suggested that video conferencing facilities might be installed. It was agreed to ask an *ad hoc* group, consisting of Professors Blundell and Lahav, together with the Executive Secretary, Facilities Officer and Web Master (Dr Stanley), to look into this.

6. FINANCE

6.1 The Treasurer outlined the budget proposed by the Library Committee for 2011 totalling some £28,400. In addition to books and computer purchases, this allowed for journal binding and conservation of valuable items as well as 2 or 3 eight week summer internships to enable undergraduates to gain library experience (and to provide assistance to the Librarian). In approving the budget, Council expressed the hope that the Librarian would find time to clear the backlog of acquisitions. It was also agreed that Council members would be given an opportunity to visit the RAS Annexe (above the Geological Society) which housed the library reserve collection

6.2 The proposed 2012 Annual Subscriptions were formally approved viz

Category 1 Fellows: Fellows who completed full time education more than 5 years before 2012 Jan 1. £98.
Category 2 Recently qualified Fellows: Fellows who completed full-time education less than 5 years before 2012 Jan 1. £65.
Category 3 Student Fellows: Fellows who, on 2012 Jan 1 (or at the time of election in 2012), are full-time students at any level (or part-time postgraduate students enrolled on a research degree), who are studying Astronomy, Geophysics or a related subject. A certificate available from the Society must be completed. £26.
Newly elected fellows: There is no admission fee. The following rates are applicable in the first year of election, **only** for those who agree to pay by Direct Debit or Standing Order from a UK bank account or by Continuous Payment Authority on an acceptable Credit or Debit Card:
Category 1 Fellows. £65.
Category 2 Recently qualified Fellows. £43. This rate is also available in their first year for Fellows transferring from category 3 to category 2.
Category 3 Student Fellows. £1.
Discounts, concessions and fees:
Discount for older fellows:
- For fellows who exercised their rights under Byelaw 38 before 2003 Jan 1 the subscription is £nil.
- For fellows who, without having the above historic rights, validly exercise their rights under Bye-law 38, the subscription is £26.
Discount for those joining with the year part over: Subscription rates for newly elected Fellows joining in Categories 1 or 2 after the end of June are reduced by 50% in the first year.
Discount for IoP members: Rates for Fellows in Categories 1 and 2 are reduced by 25% if they are also members of the Institute of Physics.
Payments by cheque etc. .: a voluntary donation of £5 will be requested to cover the additional costs of processing payments by cheque, bank transfer or any other means than Direct Debit, Standing Order or Continuous Payment Authority

6.3 The up-dated Operations Plan was tabled. Council noted that the projected positive balances provided a good basis for the decision taken on the future of the Fellowship scheme.

Satisfaction was also expressed at the chart, tabled by the Treasurer, which showed a steady increase in the membership from 2000, when it stood at around 2,800 to the present level of 3,600.

7. POLICY & PUBLIC ENGAGEMENT

7.1 The Deputy Executive Secretary drew Council's attention to the submission made by the Society to the governmental review of the *National Planning Policy Framework* and to the inquiry of the House of Commons Science & Technology Committee into *Emergencies*. The first re-stated the Society's requests that, in reviewing planning applications, a careful assessment should be made of the risk of adding to light pollution. The second, much of which was written by Professor Hapgood, dealt with an area of growing importance and concern viz the impact of space weather.

7.2 The Deputy Executive Secretary tabled statistics provided by UCAS showing the numbers of applications for astronomy-related undergraduate programmes between 2002 and 2010. It was noted that they excluded Open University students. Dr Norton undertook to supply these. It was agreed also that the statistics should be expanded to include information for geophysics, and planetary and solar sciences, courses. Following this it was suggested that Dr Massey could produce an article for *A&G* to highlight admission trends.

8. OTHER

8.1 The report of the *GJI* Editorial Board Meeting held in December during the AGU Congress in the USA was noted.

8.2 The following candidates were elected to membership of the Society:

Surname	**First Name**
Angus	Doug
Anslow	Laurence
Bryan	Sarah
Farnhill	Hywel
Ferdman	Robert
Ghodsi	Hoda
Hopwood	Leslie
Iliev	Ilian
Lee	Jae-Min
Li	Baojiu
Lockey	Alex
MacInnes	Scott
Newling	Timothy
Ray	Licia
Weltevrede	Patrick
Wilson	Paul Anthony
Wrathmall	Steven

8.3 The minutes of *A&G* meeting of 11 February 2011 were approved and signed

9. AOB

9.1 The Treasurer spoke to a paper tabled by the chair of the Astronomy Heritage Committee, Professor Edmunds, concerning the RAS Harrison Regulator which Council had previously agreed should be examined by Jonathan Betts of the National Maritime Museum (where the Regulator is on long term loan**).** Council agreed that, together with the British Horological Institute and the Museum, the Society should contribute to the costs of dismantling, examining, documenting and re-assembling the instrument with the intention of producing accurate data, descriptions, drawings and images for the use of future scholars. Council authorised the Treasurer to negotiate an agreement with the other parties with the proviso that the RAS share of the costs should be limited to £10,000 and that a video record should be made of the entire process.

9.2 Council approved a grant of £2500 towards the cost of Liverpool John Moore University arranging, in June, a RAS specialist one-day meeting on *The Scaling Relations of Galaxy Clusters.* The President reminded Council that he would welcome similar proposals for 'Out of London' meetings from other universities.

9.3 The President informed Council that he had accepted an invitation to join the *Higher Education Commission,* a think-tank newly established under the aegis of back-bench MPs

9.4 Finally, the President paid tribute to the contribution of Dr Walker who, after 10 years, was attending her last meeting of Council as a Secretary.

Council rose at 1520

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R.L. Davies 13 May 2011

President

Annexe A

Q1 Chair: We now move on to the people who are in charge of some of the issues that we have dealt with today. I am pleased that both of you sat through the evidence sessions because it might inform some of the exchanges. I want to start on a broader issue, if I may. In the written evidence that we have had for the inquiry, there appears to be a lot of ongoing baggage from the troubled times of the STFC. Has the research community put all that behind it?

Professor Bell-Burnell: The relationships between STFC and the academic research communities have been atrocious in the past but are considerably better now. STFC has made considerable efforts to involve and inform people. The situation is an awful lot better now than it was.

Professor Davies: I would concur with that. At its formation in 2007 there were a lot of challenges that that organisation faced and it did not handle them particularly well. In particular, it did not consult with its community very well. Therefore, it did not use the resource available. That has changed. There is a much wider structure now for consultation. It has to be said that that is good. However, it also has to be said that the consultation isn't always listened to.

Q2 Chair: During the 2009 prioritisation programme around the recent allocation process, did the STFC properly engage, in your view, with the learned societies?

Professor Bell-Burnell: The Institute of Physics has had several useful meetings with senior members of STFC, particularly recently. It is a lot better than it used to be, but there has been a real history of suspicion and bad feeling that they have had to overcome.

Professor Davies: Specifically, with respect to the 2009 prioritisation, at least the Royal Astronomical Society did not have a direct role to play in that. However, we do sponsor a group called the Astronomy Forum, which is a mechanism through which heads of astronomy, groups and departments in the country can meet with senior STFC staff, and that works very well. That has become a really useful conduit backwards and forwards between the research councils and the community. That is nothing to do with the 2009 priority exercise but it is, nevertheless, a very good conduit. Those things have improved substantially.

Professor Bell-Burnell: A related issue is the membership of the council of STFC. Initially, there were very, very few scientists on it. There were huge protests from the community. A few more were added. It is fair to say that the community, probably, feels it is still too light on scientists.

Professor Davies: I would agree with that and add one thing. As a result of the Wakeham report, a couple of science members were added to the council, but the most recent members who are being sought, again, are not scientists. There is a minority of scientists on the council which does compare, in a confusing way, with all the other research council memberships.

Q3 Chair: We understand that sometime in the not-too-distant future there will be a new chief executive appointment. What would you have on your wish list of changes in terms of his or her relationship directly with researchers and particularly with learned societies?

Professor Davies: The job of the chief executive of the STFC is a very difficult one. It is an extraordinarily broad portfolio of interests, covering essentially the whole of science. It is a tough call for anybody. There are some aspects of the structure that are always going to be difficult to manage because you have a large standing army of laboratory people who are employees of the STFC, while holding the stewardship of a big area of UK physical science. For me, it would be good to have a chief executive who probably is based in physical science, because that is where the facilities are. Although they are used by a range of scientists, they use the expertise of physical scientists. So it would be a physical scientist who can be effective in advocating the programme of the STFC upwards to the Government, within BIS and so on, and also who is effective at communicating what needs to be communicated down to the community.

Professor Bell-Burnell: I don't think I have anything to add to that.

Q4 Stephen McPartland: Professor Davies, what do you think of Professor Mason's assertion in the evidence that he gave to the Select Committee in January that there has been a deliberate over-investment in astronomy during the last decade?

Professor Davies: As the Royal Astronomical Society said in its written evidence, we don't recognise this as reality at all. It is a complicated question, of course. About a decade ago the UK joined the European Southern Observatory. That does require an up-front payment to get in, as it were. We had access to the facilities of that observatory immediately, so the back investment that the other partners had made requires that you pay an up-front fee. That is spread out over about 10 years. However, unless you interpret that as an over-investment, which I don't think you really can, there is no evidence at all anywhere, in any paperwork that I can find, that there has been a deliberate plan to expand and, therefore, now contract the subject.

Q5 Stephen McPartland: Do either of you believe that, with the publication of the STFC delivery plan and the Budget settlement, there will be any vulnerabilities in astronomy or physics?

Professor Bell-Burnell: Yes, probably rather too many. The biggest ones are our reputation both abroad and with our young people. We are finding a lot of our recently graduating grad students are heading to Australia because Australia is putting a lot of money into science at the moment. In Britain, it is doom and gloom. That is probably partly the way we are describing these cuts, and I don't know that we are doing ourselves a service. There is a problem for the reputation of science with our own young people and there is clearly a major problem with our standing internationally. We are not reliable, we pull out with no notice, we do this and we do that. We really need to take a lot of care there. Those are areas that I see as particularly significant and ones that, perhaps, we overlook if we start delving into the figures of who is getting how much.

Professor Davies: I would certainly concur with that. I would add that there are some threats to major future programmes that people have been building towards. The two I would highlight are the Square Kilometre Array and the European Extremely Large Telescope. In many ways the UK community has built a strong base from which to participate in these programmes, and the current situation means that many of the teams working in preparing for those projects and establishing our strong base are funded only for a few months or a year at a time. Of course, this makes us hugely vulnerable. We have a strong position, but we have a strong position because we have excellent staff who are doing very good work that the other partners in these enterprises would like to do themselves. If we cannot retain our excellent staff because of short-term funding, this is going to mean that we will lose that advantage.

Professor Bell-Burnell: Research staff are extremely mobile internationally and they will go where the money is, and they can go very readily. I would also want to highlight that the narrowing of the programme in particle physics that is going to happen, or is planned to happen, as a consequence of the cuts means that we have only a single focus. It is very dangerous to have all your eggs in one basket, and that is effectively what we are going to be doing. It does not, I think, provide a healthy diversity that will allow for future developments.

Q6 Stephen McPartland: Do you think that the STFC is doing all it can to mitigate the impact of this Budget settlement?

Professor Bell-Burnell: There is some craziness that they still haven't worked through. They have had to do a hell of a lot of rethinking in a very short time. I don't think all of it is thought through yet. In fact, although they have tried to and intended to, and gone about it in quite a sensible way, they are suffering cuts in staff at the same time.

Professor Davies: Yes. I would pick that point up. They are trying very hard to get this right. In particular, the staff on the ground are really struggling to cope with what needs to be done in terms of cutting back in administration, for example. I would not wish to suggest that they are not doing other than the very best job. There are some areas I mentioned where scientific advice has been sought and

groups have been empanelled to give advice. Sometimes panels have been advising on process, for example, rather than on scientific direction. Somehow, some of these things tend to get altered after the advice has been given. So a panel is put in to advise on a particular issue, it gives its advice, priorities 1, 2, 3, but then, at the end, it comes out 2, 1, 3 or some other priority list. That, clearly, is not the best way to go about things, in my view. Of course, that further undermines confidence in the community in both the process and the institution.

Q7 Graham Stringer: Atrocious but improving in terms of the relationship. If atrocious is zero and perfect relationships are 10, where is the relationship at now?

Professor Bell-Burnell: Six or seven.

Q8 Graham Stringer: So there is still quite a way to go.

Professor Bell-Burnell: There is a legacy, you see. There is memory.

Q9 Graham Stringer: The STFC have improved their consultation. The university of Manchester, certainly in their written submission, told us that they did not consult about focusing their investment on their own facilities. Is that right?

Professor Bell-Burnell: I don't know the answer to that one.

Professor Davies: I could not speak definitively on that one either. I did point out, however, that it is a natural conflict of interest in the way the organisation is structured.

Q10 Graham Stringer: Yes. That was in your evidence, is it not?

Professor Davies: Yes.

Professor Bell-Burnell: Yes. I suspect, as a decision, it is not good for science. You need the instrument building close to the people who are doing the research. The two interlock so intimately.

Professor Davies: Could I add one thing to that? I probably slightly missed your point. If we are on the subject of technical innovation and instrumentation and that being focused in the labs, that came as a bit of a surprise, I think it is true to say. There was a very negative reaction in the community. That negative reaction is rational in that one of the reasons why we are at the forefront in many of the areas where we are at the forefront is because we have developed skills and expertise that others don't have. That is the nature of doing research. That is what enables you to do research. The way you sustain that is by training students. If you cannot train students in instrumentation because that is all done in the national labs, that activity will ossify. The academic community is very alarmed by the prospect that that now might happen.

Q11 Graham Stringer: That has answered one of my next questions. You think it is going to have a very negative impact on research within university departments.

Looking at the other side of it, what is it going to do for the future of accelerator beam technology within the STFC facilities themselves? Are they going to really benefit from this or will they lose?

Professor Bell-Burnell: It is the university departments that have the people who are really skilled at building the equipment to go with accelerators, on accelerators and attached to accelerators. The really skilled people are there. If that doesn't happen, if those people leave and go to Australia or whatever, Britain is the loser.

Q12 Graham Stringer: Let me see if I really understand what you are saying. You are saying that, by focusing money within the STFC facilities, those facilities themselves are not going to benefit because the supporting or collaborating staff within the universities may disappear and, therefore, nobody benefits from it. Is that a fair interpretation?

Professor Bell-Burnell: No. I think we may be talking at cross-purposes. I am talking about the instrument development to be done in STFC establishments, not in universities, to be done in-house.

Q13 Graham Stringer: Yes, that is right. I am trying to work out what the implication of that is, both for the university research facilities themselves and for the STFC's facilities. What I understood you to be saying was that it would be bad for the universities, but because they may evaporate—disappear—that investment might be wasted in the STFC facility. Is that right or have I misunderstood it?

Professor Bell-Burnell: Yes. I am sorry. We are now on the same wavelength.

Professor Davies: I would add to that that almost everything we do in these spheres is international. If you are going to innovate and lead, you need to gain the confidence and partnerships of your international collaborators. Generally speaking, this is done through university groups but not exclusively. The laboratory staff have a very important part to play in the development of this area, but, without the role played, essentially, by scientific entrepreneurs in the universities, then their future will also be in jeopardy because the new projects, the new opportunities, which are all international, will not come along.

Q14 Graham Stringer: You keep answering my questions just before I have asked them, which is very clever. My next question was going to be, after LHC, what impact are these proposals likely to have on our future involvement in that area of particle accelerators? You have sort of answered that question by saying it is bleak.

Professor Davies: I think so. We have covered that, haven't we?

Q15 David Morris: Professor Davies, the UK currently has a leading role in priority astronomical projects such as the European Extremely Large Telescope and the Square Kilometre Array. Would you say that this is under threat?

Professor Davies: It is under threat in the way I described, in the sense that we have not committed to either of these projects yet. We have not been asked to quite, but the international arrangements are getting very close to that stage. If we are not able to commit at the time that we are asked, then that will be a major setback. We have leading teams. We have the opportunity to take the lead in some areas. Obviously, if we are tardy in committing, that lead will evaporate. It won't evaporate instantly but it will go. Our staff will move. Other countries will say, "We could do that bit." We will suddenly find that, instead of having a leadership role and doing the interesting things that, maybe, lead on to the next thing, we are back doing something less interesting and not in the lead. So the ability to commit to these projects in a timely manner is fundamental to the health of the subject.

Q16 David Morris: What would you say the benefit of these projects has been to the UK so far?

Professor Davies: These particular projects?

David Morris: Yes.

Professor Davies: The SKA is a very interesting one. Being radio astronomy technology, there are many connections with communications, telecoms and so on. There are possible developments in Cornwall to do with the Goonhilly site and so on that are directly related to advances in that area. In the area of optical infrared astronomy for the E-ELT, the UK has major activities in sensor design and production. Also, many of the types of technologies that are produced in that area have been used in medical applications, for example, breast cancer screening. There are topics going back to the radio area in security such as terahertz imaging where you can see a plastic gun as you go through a scanner. There are large areas of pretty advanced technology, usually, where spin-offs from the kind of work that is done for these technological areas have real world applications.

Q17 Roger Williams: It has been said that astronomers are trying to have their cake and eat it. I expect they are like most other people in that. Would you accept that, when it was decided 10 years ago that the UK joined the European Southern Observatory, that meant that other projects would have to go? Should we not accept that ESO membership has to be paid for by withdrawing from other projects?

Professor Bell-Burnell: Other projects did go. They have gone. The snag is that we are now getting more rounds of cuts. In a sense, we have paid for ESO through closing things.

Professor Davies: There was a plan, in fact, made at the time. It required us to withdraw from the Anglo-Australian Observatory, which we have now done, also to reduce our share of the William Herschel Telescope, which we have now done, and also to cut down on the operations cost of the UK Infrared Telescope in Hawaii, which we have now done. It is not true to say that that plan included, for example, the closing of all northern hemisphere observatories, which is what we are threatened with.

Q18 Roger Williams: Professor Mason argued that if we are going to stay in front of the pack we have to concentrate our resources. Do you agree that we should, for instance, look at the Gemini project and the Isaac Newton Telescopes as facilities that might have to stand aside while we concentrate on the ESO?

Professor Bell-Burnell: I think you can be too concentrated. Since we have joined Gemini, the effort put into running both the UKIRT and the Isaac Newton Telescopes have drastically reduced. What has been really inspiring to me is how ingeniously those telescopes have been used by UK astronomers at minimal cost. The way that they have saved a lot of money up till now is by having a suite of instruments that you don't change basically. You have a standard piece of kit on the telescope and, therefore, you reduce the staffing, changes and everything. Fantastic science has come out of that. While it is important that you have a goal, a destination, somewhere to aim for, it is bad policy to focus only on that. You need to keep a bit of diversity, a bit of hairiness on your string that leads you out of the maze.

Professor Davies: Your question was, should we look at these things? The answer is that we look at them all the time. Immediately before joining the European Southern Observatory, we closed the Royal Greenwich Observatory. We look at our programme all the time and think, "This is the amount of resource we have. Where is the best way to get the best astrophysics done?" That involves tough decisions, but it is done in a way that the community has built for itself. Some people are disappointed but we don't shoot each other.

There are other aspects here. The withdrawal from Gemini was one of the things that seriously damaged our international reputation in the way it was done. However, it's done. We are pulling out from 2012. If we further close the other northern hemisphere observatories, there are a number of serious consequences for our competitiveness internationally. This is a very international subject, and UK people are going abroad and people from abroad are coming to the UK to work all the time. That is a very healthy thing. It means that the people teaching in UK universities have a very broad experience, for example. If we only have the ability to look at half the sky, we will be much less attractive at drawing people in internationally because they will see that they cannot make their careers successfully here.

Furthermore, there are real astrophysical issues to be looked at. There are unique objects in the northern hemisphere. The nearest galaxy to our own, the Andromeda Nebula, which the young people behind probably have seen with their naked eye in the sky—it is the most distant object you can see with the naked eye—is 2 million light years away. That object is only available in the northern hemisphere.

There are other unique objects in the northern hemisphere. If you want to follow up radio observations that you might do at Jodrell Bank or satellite observations that we get through our membership of the European Space Agency, these all require access to the whole celestial sphere. So only having access to one hemisphere is a serious disadvantage. Retaining access to the northern hemisphere, through the La Palma telescopes, is a very high priority and was identified as such by the advisory bodies that I mentioned earlier.

My final remark on this point is that, in relation to the other members of the European Southern Observatory who are comparable to us, the UK is, by some margin, still the most productive European astronomical community, but the other big countries, such as Germany, France, Italy and Spain, all retain access to northern hemisphere facilities for the very reasons that I have given you. Therefore, again, if we don't have that, we will lose our competitive position.

Q19 Roger Williams: You are arguing very strongly to negotiate some access to the northern observatories.

Professor Bell-Burnell: Yes.

Q20 Roger Williams: Even though we are still participating in the ESO.

Professor Davies: Yes.

Q21 Roger Williams: What is the case for the STFC to continue funding other smaller ground-based facilities such as the Liverpool Telescope?

Professor Bell-Burnell: That one is used a lot by schools as well as its own programme. It is also used for some very exciting work on gamma ray bursts, for example. There are things that you don't need an enormous telescope for and it is actually a waste of time on an enormous telescope. You also have an issue of how you feed the big telescope. Quite often, when countries do a big telescope, they have a suite of little ones saying, "Oh, that's a curious thing. We should get the big telescope to look at it."

Professor Davies: It is a mistake to see the Liverpool Telescope in isolation from the other research facilities on La Palma. They all work synergistically together. There is a property of optics which means that bigger telescopes only look at a tiny patch of sky, whereas a smaller telescope can look at a much larger patch of sky. If you want to do a survey, you are often better off not using the very biggest telescope.

Q22 Gavin Barwell: You have covered some of what I was going to ask about already, which is in relation to access to optical infrared facilities in the northern hemisphere. I want to probe a little bit more on that. Can you clarify exactly what the position is? Several times you have used the phrase "if we lose that access". Is the decision taken on that? What is your understanding of the factual position about whether UK-based researchers will still have access to observations, outputs and data from these facilities?

Professor Davies: My understanding of the default plan, if nothing changes, is that the UK's access to these facilities will be withdrawn in a period between 2012 and 2014, depending on which one you are talking about.

Q23 Gavin Barwell: What impact will that have on astronomical instrumentation R and D beyond the observational data that you have already talked about?

Professor Davies: That is an interesting question. If you take, for example, the William Herschel Telescope on La Palma, one of the aspirations for using that telescope in the future is to follow up a satellite in which the UK has played a major role called Gaia. It is a European Space Agency satellite. That satellite is designed to map out the structure of our Milky Way in order to understand how it formed.

In order to get to the scientific answers that we are trying to achieve using that satellite, we need to do a spectroscopic survey of many of the objects that it will look at. An instrument that could do that would be ideally suited for the future use of the William Herschel Telescope. This is something, again, where the UK has a history of being in the lead. If this were allowed to go forward and be funded, this would retain that leadership.

Q24 Gavin Barwell: Since you have covered most of what I was going to ask before, I want to pick up on Roger's question, if I can, in terms of what the taxpayer is getting for its money. Looking at the figures that we have been provided with, the STFC resource and capital spending on astronomy and particle physics, the resource spending is going up on particle physics from about £117 million in the current year to just under £150 million at the end of the spending review period. That is quite a significant increase there. On astronomy, it is going down from just over £75 million to about £69 million. So there is a cut there.

Professor Bell-Burnell: Are you including capital or just resource spending?

Q25 Gavin Barwell: No. That is resource spending. The capital cuts are quite significant. Can you just explain this to my constituents? The picture I have from you today is that, even on particle physics, despite those resource increases, you have used the phrase, "We are putting all our eggs in one basket and that is not necessarily a sensible thing to do." On the astronomy side, not only are we losing the northern hemisphere optical and infrared capacity, but you were also saying that there are doubts about UK participation in some of the key ESO projects, the E-ELT and the SKA. It is still quite a significant sum of public money that has been put into this project. What are we getting for that money? How is it that there is such a contraction given that the spending reductions, while they exist, are not huge?

Professor Davies: Maybe I should start. Let me take the E-ELT and the last bit of your question. We need to recognise that the spending review that we have just gone through did produce an outcome for our areas which is as healthy, perhaps, as we could have hoped for. However, the capital contraction, even though it is as healthy as we could hope for, is a flat cash settlement. This has an effect in the range of 10% to 20% reductions over four years. This is compounded by the fall-out from 2009. Going into this spending review, these subjects have been cut by about 35%. On an average of 10% to 20%, you are talking about a factor of 2 cut between 2007 and 2012. We specifically mentioned that factor of 2 is in the number of researchers who would be funded on grants. So there will be a very significant cut. You asked, what are we getting? What we are getting is a research endeavour in this area that is world leading, second only to the United States, in citations and so on. We are very well regarded and established and we are getting the range of things that come along with that. Notably, we have talked a lot this morning about outreach, about inspiring school students and so on. Furthermore, there are a lot of technical developments. I would say that the economic value in the technical developments is potentially very high and it is the kind of high value work that the UK, probably, will aspire to in the future for its economic future.

Professor Bell-Burnell: One of the interesting statistics we have is that, of undergraduate physics students in Britain, 90% say they have come in because they are interested in particle physics or astrophysics. It is a tremendous pull for the general public as well. You can run astronomy evening classes even without advertising them. I know because we have done it. There is a tremendous interest in the subject. It is perceived as, and I think actually is, a good way into science for those who are scared of science. To pick up on some conversations that took place in the previous section, I have an interest in poetry with a space or astronomy basis. Doing talks on this, I get audiences that are 60% female and 40% male. Doing a straight astronomy talk, I am lucky if I've got four females in the audience. It is reaching a different public. That is one of the great strengths of astronomy. Both astronomy and particle physics, these big ideas, are incredibly attractive to people. When they come into science, if they are students, they don't necessarily stay in astronomy and particle physics. They go into other areas well. It has an enormous draw. There are also many spin-outs from particle physics. Clearly, the radiation treatments for tumours and things, particularly, for instance, the proton and heavy ion stuff that you can get on the continent that we haven't got here yet, is really a much better treatment for tumours than the electrons.

Q26 Gavin Barwell: On Professor Davies' point, I want to get to the bottom on the numbers. Is the thing that is driving this contraction in the range of areas that the UK will be able to participate in the resource reductions or the capital side? What is it that is driving, for example, the removal from the northern hemisphere?

Professor Davies: That is the resource, I think.

Q27 Gavin Barwell: In terms of sums of money that is causing this situation, they are not very large sums of money.

Professor Davies: It is not.

Professor Bell-Burnell: No.

Q28 Gavin Barwell: If you look at this budget on resource on astronomy, the figures I have in front of me show we are at £75 million and we are going down to £69 million. What sort of level would it have to be at to not lose this capacity?

Professor Davies: It is £2 million to £3 million more.

Professor Bell-Burnell: It is a banker's bonus.

Q29 Graham Stringer: In relation to that £2 million or £3 million that has gone, are you saying that that is a hangover from the original underfunding by, from memory, about £80 million?

Professor Davies: Yes.

Q30 Graham Stringer: That £2 million or £3 million hangover is not really the structural part of the latest settlement, is it?

Professor Davies: That is a fair point. A lot of this is left over from 2007 and 2009.

Q31 Stephen Mosley: We started off this morning talking to the sixth formers who explained to us what drew them into physics and science. A couple of times the National Schools Observatory was mentioned. You have mentioned the Liverpool Telescope as well in your submission since then. How important do you think those telescopes are in developing the links between the research community and the education community?

Professor Bell-Burnell: Value for money. They are not wildly expensive to run and they are a fantastic link.

Professor Davies: Yes.

Q32 Stephen Mosley: Within your written evidence you also talk about the STFC reducing funding to produce other material, for instance, posters and leaflets, etcetera.

Professor Bell-Burnell: Yes.

Q33 Stephen Mosley: How much of an impact do you think that will have on schools and on encouraging people into science?

Professor Bell-Burnell: The IOP will do what it can but it doesn't have the same resources. STFC used to have a very good science in society programme. It is still there but at a considerably reduced level.

Professor Davies: If you look at what other research councils have done in order to accommodate to finances, STFC have tried hard to retain as much of this as they can because they know it is an important area for them. I would not be quite so negative. Obviously it would be good to have more and do more, but they have tried to prioritise this area.

Q34 Stephen Mosley: In your written evidence, Professor Bell-Burnell, you do mention about establishing a Virtual Institute.

Professor Bell-Burnell: Yes.

Q35 Stephen Mosley: Could you explain a bit more about that and whether you have had any discussions with the STFC or how is that proceeding?

Professor Bell-Burnell: It is not up to the Institute of Physics to do that. It is up to the individual researchers. I believe a submission has gone in but I haven't heard the outcome.

Q36 Stephen Mosley: As a bit of background information, how will this Virtual Institute operate and work?

Professor Bell-Burnell: It is in the area of overlap of astronomy and particle physics, so it is concerned with things like the very early universe, the nature of dark matter, neutrino astrophysics and areas like that. That is a very strong area in Britain. We are particularly good at that. As I understand it, the Virtual Institute would try and gel and cohere the work in that area. That is about as much as I know about it. **Chair:** Thank you very much, Dame Jocelyn and Professor Davies, for wrapping up what has been a fascinating morning. Several people were critical of people with interests in broader issues than just science. I notice that you, Dame Jocelyn, referred to your interest in poetry. My late father taught me a wonderful little ditty, which I am not going to recite today, but it starts, "Scintillate, Scintillate, Globule Vivific." You can imagine what the rest of it is. It is hugely important that we get the right messages across from this inquiry and we are extremely grateful for your evidence. Thank you very much.

Professor Bell-Burnell: May I say on behalf of both our professional bodies how very grateful we are for this Committee? We feared, come the election, that this Committee might cease to exist. It is so encouraging that all of you have stepped up to the plate and, clearly, are working very, very hard on these important issues. Our thanks to this Committee for your work.

Chair: Thank you.