Spending Review 2010

Institute of Physics response to a House of Commons Science and Technology Committee inquiry

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27 April 2011
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Glenn McKee  
Committee Clerk  
Science and Technology Committee  
7 Millbank  
House of Commons  
London SW1P 3JA

Dear Mr McKee,

**Spending Review 2010**

The Institute of Physics is a leading scientific society promoting physics and bringing physicists together for the benefit of all. It has a worldwide membership of around 40,000 comprising physicists from all sectors, as well as those with an interest in physics. It works to advance physics research, application and education; and engages with policy makers and the public to develop awareness and understanding of physics. Its publishing company, IOP Publishing, is a world leader in professional scientific communications.

The Institute welcomes the opportunity to respond to the House of Commons Science and Technology Committee’s inquiry into the Spending Review 2010. Detailed comments are provided in the attached document, which follow on from our response to the Committee’s inquiry into the impact of reduced capital funding on astronomy and particle physics research.

If you need any further information on the points raised, please do not hesitate to contact me.

Yours sincerely,


Professor Peter Main  
Director, Education and Science
Introduction

1. The Institute, along with the rest of the science and engineering community, breathed a sigh of relief when it was announced last October that the Science Budget for the 2011/12-2014/15 period would be maintained at a flat cash level and was to be ring-fenced in the context of the Coalition government’s fiscal austerity measures. Of course, there were, and still are, considerable concerns about the impact of inflation and the efficiency savings coupled with the significant reduction of the BIS capital budget, but that was all, to an extent, tempered at the time as science had escaped the mooted cash cuts expected to range from anything between and, potentially, beyond 10-25%.

2. Now that the research councils have been allocated their budgets, have published both their delivery and implementation plans, and are implementing policy decisions, this inquiry provides an opportunity for the Institute to raise issues of concern that may impact on the ability of UK physicists to undertake leading-edge research and promote the application of research in a commercial context.

Reduced capital funding

3. The Institute’s response to the Committee’s inquiry into particle physics and astronomy (coupled with the oral evidence session and the supplementary memorandum) dealt with the impact of reduced capital funding for those two research areas along with astroparticle physics research; the following paragraphs summarise the key points that were made.

4. The reduction in capital funding, as we understand it, refers not only to expenditure in relation to the construction of large facilities and upgrades to existing facilities, but also includes maintenance costs associated with existing facilities, and the funding available for university-based laboratory equipment. This is effectively a loss of flexibility in the use of capital across all areas of science supported by RCUK. In particular, this will disproportionately affect ongoing STFC funded research in particle physics, astroparticle physics, astronomy and nuclear physics, which involves long timescales and careful planning.

5. For instance, reduced capital funding is likely to have a significant impact upon the UK’s ability to take a leading role in the European Extremely Large Telescope; will have a strongly negative impact on the development of astroparticle physics research (e.g. dark matter, high-energy gamma-ray astronomy, etc.) within the UK at a time when in continental Europe, in particular, capital (and other) investment is at an all time high; will threaten the continuance of the UK’s high performance computing facilities (i.e. STFC’s DiRAC facility for theoretical particle physics and astronomy, and EPSRC’s HeCToR facility); and will limit UK involvement in the upgrades to many particle physics experiments resulting in a very narrow focus, which will stifle new ideas and initiatives.
6. A consequence of the reduction of capital funding for equipment has presumably led STFC to propose in its Delivery Plan for 2011/12-2014/15\(^1\) a significant reduction in support for university technology R&D and, instead, to focus STFC’s in-house researchers on technology, instrumentation and detector development, with the implication that academics should be left to concentrate on scientific research. Such a policy would be based on a misconception of how cutting-edge science and its associated innovative technology are related. We were pleased, therefore, to learn from the STFC chief executive, when he addressed the Committee on 16 March 2011, that no such policy of concentrating instrumentation development within STFC laboratories to the substantial exclusion of university groups is in fact being proposed by STFC.

7. In addition, Appendix D of the STFC Delivery Plan shows an increase of approximately £15m over the period 2011/12-2014/15, which has been interpreted by some as an indication that the particle physics budget has been protected. In fact, the increase in particle physics ‘resource’ is a displacement from shortfalls in the allocation of ‘capital’; in terms of both human capital and R&D, the particle physics resource has declined sharply in the past five years. This apparent increase in the particle physics ‘resource’ goes almost exclusively towards the CERN subscription.

8. Similar concerns exist about the impact of a reduction in capital funding on nuclear physics research, and the major national facilities (particularly ISIS), which are addressed in the following paragraphs.

i) Nuclear physics

9. Since 1993, when the last UK nuclear physics research facility was closed, there has been essentially no funding for nuclear physics facilities. Previously, major capital equipment was provided as a contribution in kind to facilitate access to international laboratories, where all nuclear physics research is now carried out. The new reductions in capital funding following the Spending Review 2010 settlement will have a major detrimental effect on the ability of UK nuclear physics researchers to contribute essential equipment to the laboratories where they work. This is more significant for nuclear physics than for other science areas which are supported by central facilities or international subscriptions.

10. This field has been especially hard hit and has already considerably contracted. The ~£10m per annum devoted to nuclear physics in 1993 has declined even in cash terms to a projected £6m per annum for the coming years, prior to any further cut following the Spending Review 2010 settlement. In terms of projects, prior to the settlement, nuclear physics had been reduced to one project to build a limited range of equipment for the Facility for Antiproton and Ion Research (FAIR) and a small part of the European Advanced Gamma Tracking Array (AGATA). UK nuclear physicists have little or no influence on the future of a research area that relies on large facilities, where planning, building, commissioning and exploitation can take decades.

11. At the same time nuclear physics is advancing rapidly elsewhere; major new facilities are being constructed such as FAIR (GSI, Germany), ISOLDE (CERN), SPIRAL2 (GANIL, France), and the Jefferson Lab (US). These facilities are important to UK nuclear physicists as they are where future advances in the field are most likely to be made; for instance, providing the beams of radioactive ions or high energy electrons needed to understand the structure of the nucleon, the wide variation in the properties of nuclei and the nuclear reactions fuelling stars and stellar

\(^1\) http://www.stfc.ac.uk/resources/pdf/dp2011-15.pdf
explosions as well as the creation of the heavy elements. Unless the UK plays a major part in the development and operation of these facilities our nuclear physicists will be left out and will rapidly lose the leadership roles they currently possess. These facilities still require capital funding to complete some buildings and the equipment they house; if the UK were able to contribute capital funding in the region of £20-25m to these projects spread over a five year period, the UK’s standing and influence would be transformed.

ii) UK central facilities

12. The Spending Review 2010 settlement for STFC introduced the ‘Drayson partition’, with ring-fenced funding for international subscriptions, grants for the STFC-funded scientific communities, and operational funding for the three national facilities: the Diamond Light Source, the ISIS neutron and muon facility, and the Central Laser Facility (CLF).

13. The initial plan had been that a new funding model for the facilities would be in place before the settlement, including the requirements of the research councils, which would have determined the allocation for each facility. As the development of the new funding model had been delayed, the research councils, via the RCUK Large Facilities working group, made the collective decision that the overall funding for all the facilities should remain at the level of 5.6% of total research council expenditure. Within these boundaries, it was agreed that Diamond would operate at full capacity for 250 days per annum (including the operation of all existing beamlines and those which will become operational during the Spending Review 2010 period), ISIS would have its operation reduced to 120 days per annum at both target stations (a significant reduction compared with the historic facility operation of 180 days per annum), and CLF operation would be reduced.

14. The research councils made these decisions apparently unaware to what extent the facilities were supporting their current programmes; the research councils’ requirements for access to the facilities for the Spending Review 2010 period had not been established. It is regrettable that they have not consulted the science community more widely, or adopted a more transparent approach to the allocation of funds. STFC was widely criticised for its failure to engage with the community in deciding programme cuts in 2007/08, and has since greatly improved its approach. We recommend that RCUK should adopt a similar process.

15. While we appreciate the budgetary constraints under which STFC is operating, ISIS should operate for a higher number of days to maximise its scientific output and the return on the UK’s capital investment.

16. For the last few years, since the formation of STFC, ISIS has only operated typically five 30 day cycles delivering 150 days to the science programme², with a marginal cost of £1.7m corresponding to around 5% of the overall operational budget. In a 30 day cycle and with 28 operational instruments, ISIS delivers typically 200 experiments, resulting on average in over 100 scientific papers; 60% of the science programme at ISIS maps onto the grand challenges: energy, environment, health, security; the remaining 40% covers a broad range of world class science with significant impact.

² Historically, ISIS has operated for 180 days per annum and is geared up for this level of operation. Recommendations by the National Audit Office are for 220 days in order to optimise the return from the Science Budget investment. In comparison, the ILL research reactor operates for 200 days per annum; the US spallation neutron source – SNS – operates for 220 days per annum.
17. Through agreements with international partners, ISIS attracts each year cash contributions to the operating costs at a level of £2.2m. This income depends on the UK’s ability to deliver beamtime to their communities and is at risk, which has the potential further to aggravate the financial situation.

18. The CLF science programme advances fundamental science aligned to national grand challenges. The high powered laser and plasma physics programmes are world leading. STFC budgetary constraints threaten the high impact, internationally recognised projects. These projects include the Vulcan 10 petawatt project, the advanced laser technologies needed for the European Extreme Laser Infrastructure project, and the fusion energy concept, HiPER.

19. Moreover, the new funding model puts at risk the CLF’s pioneering facilities at the life science/physical science interface, housed in the new Research Complex at Harwell adjacent to Diamond. This potentially stalls the economic benefit that arises from their research output.

20. STFC has taken the decision to reduce the UK’s contribution to the European Synchrotron Radiation Facility (ESRF) and reduce the UK’s involvement in Free Electron Laser (FEL) research to zero. This reduction is mainly in response to STFC providing full support to Diamond (i.e. operation and upgrades). At the ESRF, exploitation will be reduced from 14% to 10%, probably leading to a hard cap to UK access.

**EPSRC project studentships policy**

21. EPSRC has implemented a policy to discontinue the provision of project studentships on its research grants and fellowships from 31 January 2013. As well as the impact this policy will have on UK PhD students, there is considerable concern that the recruitment of high-quality European students will be severely disadvantaged, as project studentships were, and are still to a great extent, the principal means of funding such students. The average fraction of departmental PhD students from project studentships is around 20% and, of those, around 60% are hired from Europe and/or other overseas nations.

22. There seems no sign that the loss will be made up elsewhere in the EPSRC system, so this is a serious cut in the support for research by EPSRC, particularly as the non-UK students recruited have been of a very high standard, and they have made a very positive contribution to the research environment to the benefit of the whole cohort of EPSRC-funded students. Discontinuation of project studentships, at a time of reduced Doctoral Training Account (DTA) awards, is a major threat, particularly, as we understand that DTA studentships are not costed on an fEC basis, which creates uncertainty relating to supporting students if they are using equipment and facilities that have significant costs; project studentships allowed for the true costs of doing PhD level research to be recognised and properly supported. The EPSRC policy will impact on research within the UK, its global reach (via those PhD students going abroad to do postdoctoral research), and on employers.

23. We understand that EPSRC will permit 10% of the DTA funded studentships to be used for EU and/or other overseas students, but this is a rather small number. Furthermore, it is not yet clear if the 10% figure is 10% of students or 10% of the DTA cash; 10% of the DTA cash would be more flexible.

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24. It would also be beneficial to allow some EU and/or other overseas students to support work in STFC research areas through its doctoral training grants.

Research concentration

25. It was of concern to note the BIS Allocation of Science and Research Funding for 2011/12 to 2014/15 document\(^4\) state that: “The science and research funding allocations will support the very best research, by further concentrating resources on research centres of proven excellence and with the critical mass and multidisciplinary capacity.” This statement was echoed in the research council delivery plans.

26. As far as physics is concerned, research in the UK is already highly concentrated and dominated by a few, fairly large physics departments. However, the RAE2008 physics sub-panel revealed that ‘excellence’ is spread across the physics base, and is not just the domain of the big departments.

27. The RAE2008 physics sub-panel was emphatic on this point, stating in its report\(^5\) that: “Many of the world-leading research outputs observed in submissions originated from small responsive mode grants. The sub-panel believes that continuing availability of such grants is absolutely vital to encouraging and sustaining groundbreaking research activity. Both national and European funding agencies are concentrating heavily on large collaborative programmes which, though worthwhile in themselves, if pursued to the exclusion of smaller scale grants, may place the nation in a weak position in the future... The physics and science community cannot know where future developments will come from, and attempts to focus funding too narrowly into priority research areas (or priority departments) will limit rather than enhance the prospects of breakthroughs at the highest level.”

28. In light of this, we do appreciate that the research councils do not have enough resource to fund all this excellence, and are under pressure to prioritise the research they sponsor, but the UK is in danger of putting all of its eggs in fewer baskets, unless it supports a more diverse range of research, both basic and applied, and all groups that have demonstrated excellence, irrespective of size. To reinforce this message, there are the cases of landmark discoveries, such as $C_{60}$, which were the result of the efforts of small, less fashionable research groups. Such invaluable contributions as these in the future could be threatened by a policy to focus funds on proposed centres of critical mass.

29. We urge the research councils to liaise closely with the funding councils to formulate a strategy to ensure that these funding reductions, which at face value are being implemented in an arbitrary and unplanned manner, do not lead to the closure of any physics departments. The UK’s physics departments produce well over 2500 physics graduates each year, who are highly valued for their mathematical and technical skills by both the public and private sector. The number of UK university physics departments has already been reduced from around 70 to 46 over the past dozen or so years. Any attempt to concentrate research in priority areas or departments, leading to potentially further closures, will have severe consequences for the teaching of physics at the undergraduate level. Project work in the final years is nowadays routinely carried out in physics department research laboratories – only

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\(^4\) http://www.bis.gov.uk
\(^5\) http://www.rae.ac.uk/pubs/2009/ov
here can training and instruction using state of the art equipment be provided to future physics graduates, who will help rebuild the UK’s economy using their invaluable skills.

Potential brain drain

30. Many of the UK’s competitor nations, even those that face comparable economic challenges, continue to invest heavily in their science and innovation bases. If investment in UK science and innovation continues to stagnate, or even decrease in future settlements, the best UK-based scientists will consider moving overseas to undertake research in well-funded and equipped laboratories. The UK has recently reversed the brain drain and it will be most unfortunate to lose this talent. In addition, there is the distinct possibility that overseas students and researchers will no longer view the UK as a leading nation in terms of scientific endeavour and discovery. As a result, UK universities may lose out on the fees income from overseas undergraduates and postgraduates, and on the pool of world-class researchers and technicians who may decide to seek employment in the UK’s leading competitor nations.

Mathematical physics funding

31. Theoretical physics is an area of research in which the UK excels and is world-leading. However, it is now under severe threat. Funding cuts are to be expected in the present climate, but there is a disproportionately large cut falling on theoretical physics, particularly when some aspects of the research area are becoming more reliant on costly high-performance computing facilities.

32. Research has been funded by both STFC and by the EPSRC mathematics programme, with STFC typically funding the areas with direct application to particle physics, nuclear physics and cosmology and EPSRC funding the more mathematical areas. The cuts to STFC as a whole have led to a 33% cut in funding for theoretical physics from 2005 to 2010. The funding for 2011/12-2014/15 is to be announced shortly, but could lead to further reductions. Now it appears that EPSRC is drastically cutting its funding for mathematical physics.

33. Until now, mathematical physics has accounted for around 10% of the research budget of the EPSRC mathematics programme. From the projects currently funded by EPSRC around £7m is spent directly on theoretical physics research6.

34. Mathematical physics used to be an independent sub-theme supported by EPSRC, but has now disappeared from the new remit recently published on the EPSRC website7. This change will exclude most of the areas of mathematical physics that EPSRC has supported in the past. This includes, but is not restricted to, the ending of support for areas that might also fall under the remit of STFC. This change in remit is in stark contrast to EPSRC’s landscape document where mathematical physics8 is the only listed sub-theme to get the top rating for international profile/standing.

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6 http://gow.epsrc.ac.uk/ChooseTTS.aspx?Mode=TOPIC&ItemDesc=Mathematical+Physics
7 http://www.epsrc.ac.uk/about/progs/maths/Pages/remit.aspx
8 http://www.epsrc.ac.uk/SiteCollectionDocuments/other/LandscapeMaths.pdf
35. The new remit and the exclusion of STFC-related areas could, if applied consistently, mean that almost all of the currently funded research would not be funded under the new rules. There is no extra funding from STFC to compensate for this, so the result seems likely to be a very substantial further cut in the funding of theoretical physics. There was no general announcement, explanation or community consultation regarding this change of policy.

36. This picture is borne out by the experience of a number of applicants for EPSRC fellowships, with a considerable number being rejected on the grounds of being deemed to be outside its remit, which is contrary to what was explicitly mentioned on the EPSRC website at the time of application. Many were in areas in which fellowships had been awarded in recent years. It is understood that these rejections are made by non-scientists without the benefit of peer-review.

37. It is unacceptable for an important research area to have its funding removed simply because it falls between the remit of two research councils. We recommend that EPSRC should urgently reconsider its policy towards mathematical physics.

NERC funding for Masters courses

38. NERC currently funds 285 studentships on 62 courses through its Masters Training Grants (MTG), which are due to end in September 2011. However, NERC Council has recently decided not to extend support beyond this. Support for current Masters courses will therefore cease at the end of the 2010-11 academic year. Many physics graduates choose to move into the quantitative environmental sciences after their first degree. NERC's decision to withdraw from supporting taught masters courses will inevitably restrict the training opportunities for such young scientists, at a time when fields such as climate modelling need to attract the best physics graduates.

Innovation support for businesses

39. The removal of the innovation support and strategy functions of the Regional Development Agencies (RDAs) has left a sizable gap in such programmes in England.

40. A recent investigation by the Manchester Institute for Innovation Research\(^9\) has suggested that there is demand from businesses for a renewed, locally-delivered programme of sector specific innovation support. It is not clear that the Spending Review 2010 settlement will allow this to happen. In addition, the role of the Local Enterprise Partnerships in this area remains unclear, and the Regional Growth Fund, while a welcome development in the context of cuts, has a fraction of the budget previously associated with such activity.

The Technology Strategy Board

41. The Technology Strategy Board (TSB) has yet publicly to reveal details of its funding settlement from the Spending Review 2010; it is expected that its tasking framework letter and strategy will be released over the next few weeks.

42. It is clear that with the removal of the RDAs from the English innovation scene, the TSB will have an expanded role to play in what is expected to be roughly the same overall budget as previous years. In addition, the TSB will be the majority funder, at least in the first instance, of the new Technology and Innovation Centres (TICs)\(^\text{10}\). The £200m over four years allocated to the TICs is welcome, but it will need to be carefully managed to ensure that the new centres achieve their potential as drivers of new, high-technology industries. There is a danger that the relatively small pot of money may be spread too thinly amongst several centres, putting pressure on their viability.

43. It has been a feature of the TSB’s short history that it has been allocated new programmes and initiatives in a seemingly *ad hoc* manner by the government. In the 2011/12-2014/15 settlement it is clear that the TSB is again being asked to do more with less.

44. Through prudent planning in the period leading up to the Spending Review 2010, for example, by reducing the number of its longer knowledge transfer partnerships, the TSB increased its ‘headroom’ in the new settlement. While this was a wise course of action it does reveal the strain that the TSB’s core budget will come under from the addition of new initiatives and programmes.

The Institute of Physics is a leading scientific society promoting physics and bringing physicists together for the benefit of all. It has a worldwide membership of around 40,000 comprising physicists from all sectors, as well as those with an interest in physics. It works to advance physics research, application and education; and engages with policy makers and the public to develop awareness and understanding of physics. Its publishing company, IOP Publishing, is a world leader in professional scientific communications.

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