A MANIFESTO FOR PHYSICS

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The value of specialist teaching is recognised in most school subject areas. But, as a quarter of 11-16 schools in England have no specialist physics teacher, pupils are expected somehow to receive a thorough grounding in the most fundamental of the sciences without instruction by someone with real expertise in the subject.

The drastic shortfall in the number of specialist physics teachers is well documented. Since one of the factors in subject choice is quality and enthusiasm of teaching, without excellent, specialist teachers it becomes less likely that schoolchildren will go on to study physics at A level and beyond. Entries for A-level physics, which have fallen by 40% since 1980, are now increasing slowly, but we need to do more. There are still shortfalls in the numbers of UK physicists and other scientists and engineers, which will hinder the development of the economy unless remedied.

Having fewer physicists limits the UK's ability to develop innovative technology such as lasers or liquid crystal displays, and life-saving medical equipment such as MRI scanners or methods for the detection and treatment of cancer. Physics provides a fundamental understanding of the world we live in and is at the heart of our society, and physics-based innovation will be crucial in meeting challenges such as global security and climate change.

Creating a skilled workforce begins in school – any other mechanisms to improve UK physics are bound to fail if there are not enough physicists to recruit. Access to high-quality physics teaching for every child is one of three key goals set out in the Institute of Physics's *Manifesto for Physics*, a recently published document that makes the case for investment in science and technology in general and physics in particular.

To remedy the deficit of physics teachers, and to improve physics education generally, IOP's manifesto calls for the creation of incentives for physics graduates to enter teaching; GCSE-level teaching that distinguishes physics as a separate subject; and training and information for careers advisers to ensure that they are knowledgeable about the career opportunities opened up by studying physics. The full range of measures set out in the manifesto is available on the IOP website at www.iop.org/manifesto.

WORLD-CLASS RESEARCH

The second goal set out in the IOP manifesto is funding for science that will keep the UK at the forefront of research. UK science has benefited from growth in public funding for research over the past 10 years, and the UK is among the top four countries in the world for research output in many sciences, including physics. Physics underpins many other sciences, and breakthroughs in physics often lead to advances in other fields from healthcare to information technology, which has been revolutionised by physics.

But this cannot be taken for granted, and funding must continue to grow higher to guarantee a knowledge-led

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economy and to attract inward investment. IOP recognises that the coming years will see real pressure on government expenditure, but an additional investment of £1bn over the period of the next spending review would allow the UK's scientists to remain internationally competitive at a time when other countries, notably the US and Japan, have increased funding as part of stimulus packages.

Other measures to protect science funding include assurances that the UK will continue to play a full part in international research facilities such as CERN and the European Southern Observatory, with responsibility for currency management transferred to the Treasury; and support for postgraduates and early-career researchers to maintain the national skills base. The manifesto also notes that hosting a major international facility in the UK would bring a range of benefits both economically and scientifically.

HIGH-TECH BUSINESS

The third goal is the creation of a fiscal and regulatory environment that fosters science-based innovation. Physics provides the basis for high-tech industry and jobs, and these sectors – including areas such as the electronics and photonics industries – contribute as much to the UK economy as do finance or construction, and employ more than a million people. Some 48% of all manufacturing jobs depend on physics, and these high-tech areas have weathered the recent recession better than the rest of the sector.

Physics-based innovation is also a fertile area for new business start-ups. Yet many growing companies have relocated outside of the UK to take advantage of preferential tax and grant regimes. A particularly notable example is the case of Plastic Logic, the University of Cambridge spin-out that moved its manufacturing capacity to Germany in 2007. IOP believes that the UK should provide all the support it can to retain the benefits of innovation and to create new billion-pound, high-tech businesses.

The manifesto recommends, among other measures, provision of long-term investment in start-ups through a large-scale, science-focused venture-capital fund; an expanded R&D tax credit scheme to keep the UK ahead of European competitors; and a more creative approach to public-sector procurement, such as directing a fixed proportion of public expenditure to foster science businesses and support innovation.

IOP'S ROLE

In return for support from an incoming government for these goals, IOP has pledged to do all that it can to promote their successful achievement, by supporting education, science and innovation through its activities, publications, and promotional work as well as its advice to policymakers. To contribute towards these aims, IOP will expand its activities with teachers and pupils through workshops, continuous professional development and online support; assist the research community through publications, subject-group activities and conferences; and create new networks to bring together businesspeople and academics.

Investing in physics is vital to create a future economy that is robust, diversified and knowledge-led. IOP's challenge to members of the next Parliament is that if they do nothing else for UK science, they should support the three basic aims set out in the manifesto. Government support for these aims would represent a sound investment to create the skilled workforce, knowledge base and enterprise culture that will ensure a prosperous future for the UK.

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