A welcome opportunity to foster interdisciplinary research

Mike Hapgood, Head of Space Plasmas, Rutherford Appleton Laboratory; Secretary of the RAS.

First of all, I must state that I am making these comments in my personal capacity.

The government’s “Science and innovation” paper provides an excellent opportunity to invigorate interdisciplinary work linking astronomy and geophysics to other disciplines. Members of the RAS are already involved in many examples of such work. I present here four key examples:

My first and prime example is the application of modern ideas in plasma physics. In this field there is a growing synergy between astrophysical, laboratory and theoretical studies of plasma physics. The solar system contains many phenomena that challenge our fundamental understanding of plasma physics processes such as magnetic reconnection, particle acceleration and plasma turbulence. RAS science will benefit greatly if the new research council structure facilitates links between plasma astrophysics and the mainstream plasma physics community.

Another example is the coupling between space and the lower atmosphere. The past decade has seen a growing body of evidence that space phenomena have important effects on the lower atmosphere. The obvious example is the confirmation of the variability of solar output; more controversial, but potentially of great importance, are the possibilities that cosmic rays modulate the global electric circuit or even trigger lightning. We are now even seeing the emergence of viable mechanisms whereby cosmic rays influence the formation of some clouds. This is an important element in the study of global change, where it is now widely recognized that one must distinguish forcing external to the Earth from natural internal variability and man-made effects if one is to accurately predict the full impact of human activities on Earth’s climate system. This is an area where RAS science must interact strongly with the climate modelling community.

A third example is planetary science – a key growth area given the UK’s commitment to the Aurora programme – where much work seeks to identify commonalities and differences between planetary environments and that at the Earth. This comparative planetology has a natural synergy with work in many geo-science areas including solid-Earth geophysics, geo-geophysics, hydrology, oceanography, atmospheric and ionospheric science. The success of this programme will also require good links between planetary science and the engineering community that will build the Aurora missions. UK success in planetary science will require continuing support for interdisciplinary work to build on current achievements.

My final example is the increasing realization that space is a source of hazards (e.g. near-Earth objects and space weather) that threaten the technologies on which we rely and, in some extreme cases, human life itself. Members of the Society are involved in worldwide efforts to advance the physical understanding that underpins our ability to mitigate these threats. But to be effective they have to interact with a wide range of other disciplines including radiation physics, orbital dynamics, space, power and communications engineering and also non-technical areas such as insurance and law.

These examples show that there is a high potential for interdisciplinary science involving astronomy and geophysics. Thus I personally welcome the fact that the government’s proposal encourages interdisciplinary work. I hope that the detailed implementation will deliver on this and address the problems with interdisciplinary work that were identified in the recent report of the International Review of UK Physics and Astronomy.

It is vital that we find the right balance between pure basic research and use-inspired strategic research (which includes much interdisciplinary work). This is increasingly recognized in science policy debates where the pure mode is linked with the aspirations of Niels Bohr and use-inspired mode is personified by Louis Pasteur. We need to encourage both these modes of basic scientific research.


dr Mike Hapgood.jpg

Enlarging the ignorosphere

Alan Ayland, University College London.

Ever since PPARC was set up in 1994 there has been a problem facing science at the interface between lower and upper atmosphere – the “ignorosphere” centred around the mesopause. The split from SERC into PPARC and NERC was done with little consistency. With the new arrangement we will have the same sort of problem deciding where bits fit. Some terrestrial atmospheric work could be amalgamated with NERC (if they stretch the definition of what regions of the atmosphere they cover) but then what happens to planetary atmosphere research?

It is unlikely NERC will want to take on science above the neutral atmosphere, into the plasmasphere and magnetosphere. If the atmospheric field goes into NERC, then it seems likely that multidisciplinary programmes will have to be cut into bits for different councils. Our main – and only – ground-based facility in future will be EISCAT, but it is uncertain if EISCAT will be deemed a major facility. If it is, it can follow the others into the Large Facilities Council. If not, what? Does EPSRC have the structure to deal with a facility like this and the community that goes with it? And does NERC have the structure to deal with the sorts of research programmes our community has? Would we be expected to change the nature and structure of our research to fit with NERC’s or EPSRC’s structure? What about rolling grants? We could see many atmospheric science groups forming more easily into the NERC system, but more wide-ranging work – such as our extratropical planet research – does not look an attractive prospect for NERC.

“UK success in planetary science will require continuing support for interdisciplinary work to build on current achievements”

Stephen Serjeant, Open University.

I have several worries over the proposed changes to the research councils, and the creation of an LFRC. First, the changes would decouple large facilities management from the science roadmaps. This appears to me to be quite mad. What if PPARC (or whatever replaces it) decides on scientific grounds that a facility should close to free up funds for involvement in a new scientific facility?

Secondly, PPARC’s funding and planning strategy is longer-term than the other research councils, with longer road maps and rolling grants. This has been to the enormous benefit of the UK particle physics and astrophysics communities. It concerns me greatly that this is not recognized or even mentioned. Adopting an EPSRC-like funding and planning model for PPARC science presents a real and serious risk to the UK’s world-leading roles in these areas. If the Treasury wishes to see the large facilities managed under a common structure, one way forward could be the creation of a single joint research council like the American NSF, perhaps even incorporating CCLRC.

This would keep the management of large facilities accountable to the science committee(s) that define the scientific road maps. But it appears obvious that any structure that decouples facilities management from the science the facilities are meant to produce will be badly flawed.

Which brings me to my largest and most wide-ranging worry of all: why is the structure being defined without apparently first stating or even asking what such structure is meant to achieve?