Magnetosphere, Ionosphere and Solar-Terrestrial

UK Sun-Planetary scientific community

To: John Womersley, Director Science Programmes, STFC Date: 25 July 2008

Dear John,

I am writing on behalf of the MIST community (www.mist.ac.uk) to offer a few comments on the proposals for topical panels that will advise PPAN – in particular the proposal for a near-universe committee, as that is the one that most affects our community. This also follows up on Keith Mason's advice to RAS Council that community comments are welcome.

We understand that the idea of a near-universe committee was discussed within PPARC some years ago – and eventually rejected on the grounds that its remit would be very extensive and it would be near-impossible to do justice to all fields in a single committee. We do not see any reason why this has changed. It would be difficult to build a committee with adequate breath of expertise - such that the community trusted that they were being adequately represented - without it being very large and possibly unworkable.

We recognise STFC's desire to build a coherent science vision across all areas of its remit. In principle a near-universe committee could aid this by stimulating synergy between studies of astrophysical processes in the solar system and those in the wider universe. Building that synergy is a worthy scientific objective; indeed there are bottom-up efforts under way with that goal, e.g. cross-cutting sessions at the recent National Astronomy Meeting. However, those efforts show that there are major differences of approach between solar system physics and other parts of astrophysics (see Annex). Overcoming those differences is very worthwhile scientific challenge (it is one that I am exploring personally). We are happy to discuss how best this can be achieved, whilst re-building the confidence of the community in the STFC. But the present proposal is premature. It puts the whole enterprise at risk from the unfortunate, but natural, human tendency to confuse differences of approach with errors of method.

We recommend that the near-universe be represented by smaller areas where it is clear that the community can work together, e.g. solar system and beyond the solar system, but construct better routes for communication between these areas, and ensure that they are maintained. This will offer you a much better chance of re-building confidence.

Please let me know if you have questions or need any further background on these points.

Best wishes,
Mike Hapgood (m.hapgood@rl.ac.uk)
Chair, MIST Council

Annex

A key difference between solar system physics and astronomy of more distant objects lies in the nature of the data. Solar system physics now has access to a wealth of high-resolution data from a variety of techniques including in-situ sampling, remote sounding by radars and lidars and high resolution remote-sensing by nearby spacecraft - as well as more distant remote sensing by telescopes (whether on Earth or in space). For distant objects only the latter technique is available.

This difference has important consequences for the approach to the science:

- It reveals the complexity of many solar system phenomena. We now realise that many of these phenomena are highly coupled, non-linear interacting systems and thus to advance our understanding we have to deploy modern methods of studying complex natural systems and exploit the wealth of available data to do so. Dealing with the complexity of natural physical phenomena on earth and in space is widely recognised a major intellectual challenge for the twenty-first century. It is a timely issue for much solar system physics but is, at present, not a major issue for other astronomy as this complexity is generally still below telescope resolution.
- It has a profound impact on data management and analysis. Distant astronomical objects are readily indexed by the two-dimensional system of astronomical coordinates (right ascension and declination). This relative simplicity underpins the considerable development of astronomical data systems over the past 20 to 30 years; it facilities both the indexing of the data and the merging of information from multiple sources. Solar system data are more complex – typically they must be indexed in a minimum of four dimensions, namely three of position and one of time. Thus they need more complex systems for both access and for merging – and this forces a very different way of working compared to the astronomy of distant objects.

Another key difference between solar system physics and the astronomy of more distant objects is the role of plasma physics. This is an area where astronomy and solar system science have diverged over the past forty years – much work on astronomy has focused on the astrophysical effects of gravity whilst large parts of solar system science (e.g. solar physics, STP and parts of planetary science) have focused on understanding the behaviour of cosmic plasmas. Both approaches are valid in their domains, but much work is needed to get the two groups to understand each other.

Finally note that modern planetary exploration has much in common with the Earth Sciences. We can explore the planets in detail and apply the same physics techniques as applied to study the Earth, e.g. seismology and magnetic induction. It is widely recognised that planetary exploration can learn from experience gained on Earth but also that our understanding of the Earth will benefit from comparisons between planets. This has great scientific potential. But it is again a very different approach to that used in the study of distant astronomical objects.