ROYAL ASTRONOMICAL SOCIETY
Burlington House, Piccadilly
London W1J 0BQ, UK
T: 020 7734 4582/ 3307
F: 020 7494 0166
de@ras.org.uk
www.ras.org.uk
Registered Charity 226545

Advancing Astronomy and Geophysics

THE FUTURE OF PLANETARY SCIENCES IN THE UK – A STATEMENT BY THE ROYAL ASTRONOMICAL SOCIETY

EXECUTIVE SUMMARY

1. The planetary science community should ensure that it continues the recent growth in open debate and discussion on present and future scientific paths. Only by doing so can it maintain a focussed direction, making the most efficient use of the limited resources available.

2. The RAS encourages the community to exploit the opportunities that the Society can provide, e.g. through its meetings and publications, to promote excellence in planetary science in line with the Society's objective of promoting all aspects of astronomy and geophysics.

3. A key issue in the development of planetary science in the 21st century is to adopt an integrated approach that allows scientists to combine heterogeneous data sources to derive a coherent understanding of planetary systems. This new approach is recognised in the PPARC Solar System Science Strategy and mirrored in parallel developments across the geo-sciences (e.g. NERC's support for earth system science). Advances in understanding will come from combining the diverse but detailed studies that are made possible by proximity to the subject matter and by comparison with equivalent terrestrial phenomena.

4. Both PPARC and NERC openly recognise the importance of planetary science in their research portfolios. As the primary funding bodies in the UK, it is important that these research councils continue to ensure that all areas within their remit receive an appropriate fraction of available resources in an open and transparent manner.

5. Planetary science is an exciting subject that is attractive to students. The UK possesses scores of planetary scientists of international renown. UK Universities should review their strengths and weaknesses in this area, and consider the establishment of planetary science groups to take advantage of both student interest and future research opportunities.

6. Extra government spending in astronomical research in recent years has been necessary and welcome. If the government wishes to capitalise on the recognised public and educational interest in science generated by planetary missions such as Beagle 2 and Huygens, it needs to ensure that this financial backbone does not remain static but continues to grow as the further exploration of our own and other solar systems proceeds. In general this extra spend should be allocated on the basis of peer-reviewed priorities, which all scientists agree is the best allocation model.

PLANETARY SCIENCE TODAY

Planetary science traditionally involves the study of bodies that orbit our Sun, ranging from planets and moons, through comets and asteroids and down to microscopic dust particles. As we have moved from the 20th into the 21st century, the realm of study has increased to other solar systems around other stars. This expansion has thrown into sharp focus the basic questions that planetary science is trying to answer. How are planetary systems created and how do they subsequently evolve? What is the exact nature of the interrelationships between planets, their atmospheres and their magnetospheres? Moons and rings, comets, asteroids and dust? Is there anything as simple as a "normal" planetary body? Finally, there is the emerging discipline of astrobiology, which seeks to understand what environments exist in our solar system and elsewhere that might harbour life.

This is an important time in the worldwide development of planetary science. Our ability to study the Solar System is advancing rapidly – in particular through a greater ability to fly scientific instruments to other planets. These advances are reflected in the exciting plans of experienced players such as the US, Europe and Japan and also in growing interest from emerging players such as China and India. These plans are driven by a deep scientific and cultural interest in exploring the Solar System – of understanding our world better by comparing it with other worlds. These plans offer important opportunities for the continuing development of UK planetary science in all its diverse areas.

Planetary science has a long history of excellence in the UK, going back beyond William Herschel's 1781 discovery of the planet Uranus. Today, British astronomers continue to observe and record important phenomena in our solar system, from weather systems on Mars, Jupiter and Saturn, to the discovery and tracking of asteroids and comets., Both professional and amateur astronomers in the UK are looking forward to being involved in the major advances in the coming decades.

PLANETARY SCIENCE IN THE UK

The field of planetary science encompasses a wide range of research topics, ranging from comparative studies of planetary geology and atmospheres through to the formation planets and the origin and evolution of minor bodies. Hence funding of professional research in the UK is primarily controlled by the Natural Environment Research Council (NERC) and the Particle Physics and Astronomy Research Council (PPARC). Since the 1980's, the UK planetary science community has gone from strength to strength, capitalising on renewed interest in the field and developing expertise in a number of areas. The UK community has reached a point where it has the potential to make a leading contribution to the international development of

planetary science, and has much to gain from such an involvement. This has been recognised by strong UK participation in the preparatory phases of ESA's Aurora programme now underway, and by the encouragement given to the UK community by PPARC and NERC, e.g. through support of the Comparative Planetology Meeting held in 2004.

The UK has many strengths, which will enable it to contribute to the international development of planetary science at the highest levels. The most obvious is the expertise developed in planetary landers, based on experience gained from Beagle 2 and, more recently, the highly successful Huygens mission. Supporting this area is the UK's internationally recognised expertise in laboratory science, which provides critical support for interpretation of space-based measurements and of samples returned from space. Until now, this has been something of a behind-the-scenes activity, in the public view at least, but should now have a much higher public profile in line with its scientific importance. The analysis of samples in the laboratory is an excellent example of where investment in a particular area is now having a positive impact in the UK's ability to lead the future direction of planetary-related programmes. It is therefore important that such investment be made in other areas of UK strengths to ensure that the UK remains able to influence the development of planetary science in its broadest sense.

The breadth of UK expertise is particularly important where comparative studies are made, especially when transferring knowledge and techniques from terrestrial science and applying them to their planetary equivalents, e.g. space plasma science knowledge is now being applied to studies of plasma environments around Mercury, Venus, Mars and Saturn and atmospheric science expertise to the atmospheres of Venus, Mars, Saturn and Titan. The world-leading status of UK planetary scientists in these areas of science, has led to numerous opportunities on current planetary missions such as Cassini-Huygens and Rosetta. This work in particular has highlighted the increasing inter-disciplinarity of planetary science, and the need for broad expertise to be supported in order for the UK to continue to be at the forefront of planetary science in general.

Moving away from space-based studies, the UK provides strong support for ground-based optical and radio telescopes. In the planetary field, these are used for observations of objects such as asteroids, comets and planetary magnetospheres as well as other astronomical phenomena. In addition, radio telescopes can be used as ground stations during critical phases of planetary space missions. A recent example is the use of a worldwide network of radio telescopes to monitor the trajectory of Huygens during its descent into Titan's atmosphere. However, ground-based work is perhaps an area where the UK planetary science community has not exploited opportunities to the full, and would benefit from a higher profile within the community, which would then translate into a higher profile within a UK planetary science programme as a whole.

Underpinning much of this work are established and exciting programmes in theoretical understanding. For example, modelling of the formation of solar systems has gained new importance now that we have more than our own to study, and in turn has generated new problems to solve. Similarly, the stunning images being returned by Cassini show beautiful and mysterious structures in Saturn's rings; not only is this pushing theoretical studies of planetary rings, but in turn it gives an insight into processes that occurred in our own protoplanetary disc 4.6 billion years ago.

UK PLANETARY SCIENCE IN THE FUTURE

The advance of planetary science in the UK will be greatly aided by establishing a clear set of scientific aims and focusing resources on the pursuit of those aims through the support of scientific studies, both observational and theoretical, promotion of appropriate mission opportunities, the development of enabling technologies and most important building up the skills base needed to build, operate and exploit those missions. These aims might be similar or complementary to the Solar System Science Strategy document adopted by PPARC in 2002 and currently under revision; however it is important to maintain an independent view of the future of UK planetary science outside the main funding agencies.

To achieve this it is important that the UK planetary science community should establish and maintain effective mechanisms to facilitate communications and collaboration within the community. The UK Planetary Forum is an effective way of communicating information electronically, but the community should be more active in organising events such as meetings and conferences that encourage more interaction between groups and individuals both within and between areas of expertise.

A perceived problem in some quarters is that although the work of UK participants in large international collaborations is highly productive scientifically, often the crucial UK involvement may be overlooked as results are published under the aegis of a large team and publicised more effectively by the larger organisations. The community and PPARC need to be more pro-active in promoting planetary science as a national activity.

Importantly, planetary science provides an excellent context to explain scientific concepts to students at both school and university levels. With the difficulty in encouraging young people into science and engineering disciplines, it is becoming increasingly important to use exciting programmes to showcase UK science. It is clear from the interest in recent missions such as SMART-1, Mars Express, Beagle 2 and Huygens that planetary science is an excellent vehicle to get across the required message. In particular, there are few planetary science groups in UK universities. We encourage Vice-Chancellors and Provosts to recognise both the attractiveness of this area to students and the ability of UK researchers to attract funding.

It is important to recognise that support is needed in a number of key areas. In particular, resources are required:

- To support UK scientists in promoting mission concepts in broader international contexts, especially within ESA and NASA. This involves providing strong support for scientific studies, involvement on key international committees and support for promoting science aims in terms of mission opportunities.
- To ensure that UK teams can make major contributions to the provision of instruments on planetary science missions though a mix of leadership and supporting roles. While there continue to be realised opportunities in forthcoming missions such as Venus Express and Mars Reconnaissance Orbiter, other such avenues must remain open in the future. This is perhaps the most critical area since participation in instrument hardware is often the key mechanism by which scientists gain access to new missions and immediate access to new data.

- To support instrument technology development both as a UK national activity and though participation in international programmes, e.g. at European level and through bilateral agreements with other national agencies. The latter may be particularly important with the emerging players in planetary science (e.g. China, India).
- To consider planetary science requirements in the development and exploitation of new ground-based telescopes, e.g. the international plans for an Extremely Large Telescope include the aim of detecting exo-planets in sufficient numbers to allow statistical studies of their properties.
- To support UK access to mission results through national support for planetary archiving activities and inter-operability with the standards developed by NASA (and also used by ESA). This should include addition of planetary science requirements to PPARC's e-science programme, e.g. inter-operability with NASA/ESA data standards for planetary science and support for data manipulation related to planetary co-ordinate systems.
- To support the scientific exploitation of data obtained from UK funded involvement in ground- and space-based activities.

ADVANCING UK PLANETARY SCIENCE

Taking into account the description above, we can summarise the requirements necessary to ensure that UK planetary science continues to be internationally competitive in the 21st century.

1. The planetary science community should ensure that it continues the recent growth in open debate and discussion on present and future scientific paths. Only by doing so can it maintain a focussed direction, making the most efficient use of the limited resources available.
2. The RAS encourages the community to exploit the opportunities that the Society can provide, e.g. through its meetings and publications, to promote excellence in planetary science in line with the Society's objective of promoting all aspects of astronomy and geophysics.
3. A key issue in the development of planetary science in the 21st century is to adopt an approach that encompasses different areas, as recognised in the PPARC Solar System Strategy and mirrored in parallel developments across the geo-sciences (e.g. NERC's support for earth system science). Advances in understanding will come from combining the diverse but detailed studies that are made possible by proximity to the subject matter and by comparison with equivalent terrestrial phenomena.
4. Both PPARC and NERC openly recognise the importance of planetary science in their research portfolios. As the primary funding bodies in the UK, it is important that these research councils continue to ensure that all areas within their remit receive an appropriate fraction of available resources in an open and transparent manner.
5. Planetary science is an exciting subject that is attractive to students. The UK possesses scores of planetary scientists of international renown. UK Universities should review their strengths and weaknesses in this area, and consider the establishment of planetary science groups to take advantage of both student interest and future research opportunities.
6. Extra government spending in astronomical research in recent years has been necessary and welcome. This extra spend is generally allocated on the basis of peer-reviewed priorities, which all scientists agree is the proper allocation

model. If the government wishes to capitalise on the recognised public and educational interest in science generated by planetary missions such as Beagle 2 and Huygens, it needs to ensure that this financial backbone does not remain static but continues to grow as the further exploration of our own and other solar systems proceeds.

Adopted by the Council of the RAS on 29 July 2005