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Comparative Magnetospheres
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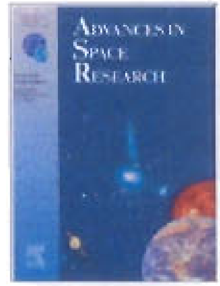

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Preface

This volume consists of the written version of papers originally presented at the Scientific Symposium "Comparative Magnetospheres", held at the 34th COSPAR Scientific Assembly (at the Second World Space Congress) in Houston, Texas, 10–19 October, 2002. A magnetosphere is a region of strong magnetic field surrounding a planetary body with sufficient strength to deflect the solar wind. There are two quite distinct classes of planetary magnetosphere, intrinsic and induced. Intrinsic magnetospheres are produced around planets that have a permanent magnetic field, generally produced by an internal magnetic dynamo but possibly associated with a strong, crustal, remanent magnetic field. The largest intrinsic magnetosphere in the solar system is that surrounding Jupiter. The smallest is that of Mercury unless one considers the regions of solar wind interaction of the localized magnetic anomalies on the moon and Mars to be magnetospheres. Induced magnetospheres are produced by the currents induced in an electrically conducting planetary body by a time-variable field or by the interaction of the solar wind with a body that adds ions to the flow. The largest induced magnetosphere of the first type is that of Venus whose electrically conducting ionosphere usually has a time scale for diffusion, or decay of currents induced in it, that is much larger than the time scale for change of the solar wind magnetic field. Mars has a similar induced magnetosphere. The prototypical mass-loading magnetosphere is that of a comet, although both Venus and Mars also add mass to the solar wind flow.

In an experimental laboratory one can validate one's understanding by changing the test conditions. In the solar system we are not in control of those conditions. In order to understand the Earth's magnetosphere we monitor the magnetosphere from a fleet of spacecraft waiting for the right solar wind conditions. Even so there are things we cannot do. We cannot alter the upper atmosphere and ionosphere. We cannot change the size of the dipole moment. We cannot change the spin period of the Earth. We can however examine different planets. The variation of solar wind properties with distance from the sun, the differences in the planetary magnetic moments, the changes in a planetary atmosphere and rotation rate all lead to differences in the properties of the magnetospheres. In turn we can use these differences to determine how the processes work. The unifying theme of this symposium was to do just that, to compare the solar wind interactions to learn more about the underlying physics of the interactions.

The volume begins and ends with tutorial articles by two of the leading scientists in the area of planetary magnetospheres, A. Nishida and V.M. Vasyliunas. In between are tutorials and reviews by the leading researchers on the solar wind interactions at Mercury, Venus and Mars, comets and asteroids, the outer planets and their moons and of course the Earth. The tutorials are designed to provide a basic review of the physics of the system while the following reviews give the latest research on particular aspects of the interaction. Shorter contributed talks have been included at the appropriate topical locations.

We would like to thank the referees who worked so hard in reviewing these papers. As a result of their efforts the papers in this volume have been strengthened significantly. The referees who agreed to be identified are as follows: Stas Barabash, David A. Brain, Emma Bunce, Andrew Coates, Frank Crary, Thomas E. Cravens, Dana Crider, Peter Gary, Karl-Heinz Glassmeier, Samuel Gulkis, Thomas Hill, Peter Israelevich, Konstantin Kabin, Esa Kallio, Krishan Khurana, Rosemary Killen, Philippe Louarn, Janet Luhmann, Christian Mazelle, Atsuhiro Nishida, Nojan Omidi, Hector Perez-de-Tejada, Tuija Pulkkinen, Joachim Raeder, James A. Slavin, Robert J. Strangeway, Karoly Szego, Michelle Thomsen, Richard Thorne, Rudolf A. Treumann, Jean Gabriel Trotignon, Vytenis M. Vasyliunas, Raymond Walker, Yongli Wang, Philippe Zarka, and Tielong Zhang. We also wish to thank Robert J. Strangeway for assisting with editing where both editors had a conflict of interest. Last but not least we would like to thank Marjorie Sowmendran who oversaw the reviews, copy editing and submittal to the publisher. She made our job very much easier.

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