SPACE AND COSMIC RAY PHYSICS SEMINAR

University of Maryland
Computer & Space Sciences Building, Room 2400
4:30 PM Monday, April 11th, 2005
Coffee, Tea & cookies 4:00-4:30 PM

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Mercury's Magnetosphere and its Influence on the Neutral Exosphere

Mercury's magnetosphere, discovered by instruments onboard the Mariner 10 spacecraft in 1975, is stil poorly constrained. It is believed to be about 1 seventh the size of Earth's magnetosphere, with the planet filling the region analogous to the Earth's inner magnetosphere. Thus Mercury has no ring current, and is more open. Because of this the solar wind impinges on the surface of Mercury at times to low latitudes. The exosphere of Mercury is coupled to its magnetosphere through the dependence of an important source process, sputtering, on the magnetospheric configuration. Mercury's magnetospheric configuration can change in response to the solar wind, especially the IMF, on timescales of minutes. The degree of penetration of solar wind electrons and ions onto the surface of Mercury is therefore highly variable. It has been shown that the latitude and extent o the cusp regions of Mercury's magnetosphere depend on both the solar wind dynamic pressure and the magnitude and extent of the interplanetary magnetic field (IMF), but the IMF is the most critical parameter. The IMF, the solar wind pressure, density and velocity have been measured at the orbit of Mercury by both the Helios I and II spacecraft. In order to determine the most likely configuration for Mercury's magnetosphere, and also to determine the possible magnetospheric configurations and how often they are likely to occur, we have done a statistical study of the Helios data at the times when the spacecraft were within the bounds of Mercury's orbit. We show statistics for the IMF at Mercury, its various components, and the relationships between them, the solar wind dynamic pressure and density. We have calculated the most likely magnetospheric configurations, and the possible excursions. Then we compute the most likely exospheric density and distribution and the possible variation from that mean. We intend to show that Mercury's neutral exosphere, which can be observed with Earth-based telescopes, is a proxy for the magnetspheric configuration.

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