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Exosphere-surface interaction models of Mercury

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Mercury is a poorly known planet, since the only space-based information comes from three flybys performed in 1974 by the Mariner 10 spacecraft. Ground-based observations also provided some interesting results, but they are particularly difficult to obtain due to the planet's proximity to the Sun. Nevertheless, the fact that the planet's orbit is so close to the Sun makes Mercury a particularly interesting subject for the extreme environmental conditions. Among a number of crucial scientific topics to be faced, Mercury's exosphere and its interaction with the solar wind and its escape from the surface of the planet, can provide important clues on planetary evolution. In fact, the Hermean exosphere is continuously eroded and refilled through these interactions, so that it would be more proper to consider the Hermean environment as a unified surface-exosphere-magnetosphere system; In fact, these three regions are physically strongly linked to each other. In the last years, two missions scheduled to explore the iron planet: the NASA MESSENGER mission (launch in March 2004) and the ESA cornerstone mission BepiColombo (jointly with JAXA, to be launched in 2012), have stimulated new interest for the many unresolved mysteries related to Mercury. At present, by taking profit from new technologies, more detailed ground-based observations are acquired, and new simulation studies have been performed. In this presentation both old and new observations and studies related to the surface-exosphere-magnetosphere system are reviewed, and the investigations achievable by the planned space-based observations are outlined.