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Dynamical Evolution of Sodium Anysotropies in the Exosphere of Mercury

Stefano Orsini (1), Valeria Magano (1), Anna Milillo (1), Alessandro Mura (1), and Francois Leblanc (2)
(1) INAF, Istituto di Fisica dello Spazio Interplanetario, Rome, Italy , (2) CNRS/IPSL, Paris, France

The exosphere of Mercury is a complex system whose composition and dynamics are the result of the diverse interactions that occur between the Hermean surface and magnetic field on one side, and the interplanetary medium (Solar wind, photons and meteoroids) and Interplanetary Magnetic Field (IMF) on the other. Since the discovery of the sodium component in the Hermean exosphere in 1985, many observations have been performed which evidenced a strong variability with time, both in the global emission intensity and in the appearance and disappearance of localized peaks, which may appear at mid latitude in both hemispheres. A correlation with the IMF has been supposed since specific IMF orientation may allow preferential precipitation of solar wind protons under planetary magnetic cusps. Furthermore, the short term variability cannot be easily explained by other external agents.
By using a set of data of Mercury's sodium observations from the THEMIS solar telescope, we analyse the variability in time-scale of 1 hour, investigating the possible mechanisms of sodium release to the exosphere and its dynamics. Our interpretation links the appearance of sodium asymmetries to combined effects of plasma and photons impact onto the Mercury's surface and sodium ballistic trajectories. In fact, the comparison of the data evolution with the results of a comprehensive simulation including photon stimulated desorption, ion sputtering, chemical sputtering and particle dynamics shows the suitability of our hypothesis.