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A statistical study of sodium intensity and dynamics in the exosphere of Mercury

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Abstract

The exosphere of Mercury is a complex system whose composition and dynamics are the effect of coupling between surface and the external environment, under the influence of the planet's magnetic field (see for a review [1]). Hence, solar wind particles and photons, meteoritic impacts and interplanetary magnetic field have an influence on the morphology, content and time evolution of this tiny gaseous envelope.

Thanks to a new dataset of observations lasting 3 years at the THEMIS solar telescope in Canary Islands, a new statistical analysis is performed with the intent to try to solve the riddle of the morphological anysotropies of the exosphere.

1. Introduction

Since the discovery of the sodium component in the Hermean exosphere in 1985 [2], many observations have been performed that have evidenced a strong variability with time, in the emission intensity as well as in appearance/disappearance of the localized sodium emission peaks. They may appear at mid-latitude in both hemispheres, or localized only in one hemisphere. A correlation with the interplanetary magnetic field orientation has been supposed, as it seems to be confirmed by observed relationships between the IMF Bx component and the peak position. This result may imply that preferential precipitation of solar wind protons in one of the two planetary magnetic cusps drives this asymmetric behavior.

Recently, [3] found a correlation between the sodium emission intensity and the position of Mercury with respect to the interplanetary disk of dust that is supposed to exist on the ecliptic plane.

2. This work

Since 2007, a wide set of Mercury observations have been performed by using the solar telescope THEMIS at Tenerife, Canary Islands. The THEMIS solar telescope is a F/16 Ritchey-Chretien telescope in altitude-azimuth mounting with a 0.9 m primary mirror and a 15.04 m focal length. It works in the spectral range between 400 and 1000 nm and may observe at the same time the two D lines at 5890-5896 Angstroms.

After three years of campaign (2007-2009) the THEMIS dataset consists of 80 days of observations and almost 300 scans of the disk of Mercury at different IMF and solar conditions, phase angles, TAAs and other orbital parameters. With these data we intend to corroborate the Kameda et al. [3] results and want to perform a statistical analysis and speculate about the origin of the appearance/disappearance of sodium emission asymmetries.

Results will be presented and discussed.

References

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