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Comparison between Earth-based Na observations of Mercury's exosphere by THEMIS and in-situ magnetic field measurements by MESSENGER

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The Na exosphere of Mercury is being studied since its discovery in mid '80s from Earth-based telescopes, and it has revealed a high dynamicity and variability. Though the processes and inter-relations at the basis of the Hermean exosphere dynamics are not still clearly understood, there is no doubt that a connection exists among the surface, the exosphere, the intrinsic magnetic field of the body and the Interplanetary Magnetic Field (IMF), which drives the Solar Wind ions into the Mercury's magnetosphere and surface, via the magnetic reconnection.
In this work we analyze our dataset of images of the exospheric Na emission, collected from 2009 to 2013 by the THEMIS ground-based telescope, to perform a comprehensive statistical study of the recurrent patterns, and their relationship with the variability of the IMF. For this purpose, we take advantage of a subset (years 2011-2013) of contemporary in situ measurements of the IMF obtained by the MAG instrument onboard the MESSENGER spacecraft.
We found that the mid-high latitude double peaks is the most common Na emission pattern, supporting the view that the solar wind ion precipitation through the polar cusps has an important role in the generation of the observed Na exospheric emission. Moreover, the lack of a statistically significant North-South asymmetry seems to disfavour the idea of an asymmetric and/or shifted magnetic dipole. By analysing a subset of quasi-full disk images, we found that most of the Na emission patterns seems to occur in the pre-noon sector (53%), about 1/3 is roughly aligned along the noon meridian (36%), while only 11% takes place in the post-noon sector. Finally, the comparison with the IMF data indicates that the contribution of the IMF Bx component to the magnetic reconnection is generally weak, even if we found a noticeable correlation between positive IMB Bx and symmetric double peaks pattern. Negative IMF Bz values are usually connected with double peaks emission (likely by widening the polar cusps), while positive IMF Bz valules are more frequently associated to single peaked equatorial Na emission.