

Possible effects of Mercury surface temperatures on the exosphere

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Abstract

The Messenger mission observed the characteristics of the sodium exosphere of Mercury. We are coupling an exosphere circulation model with a thermophysical model in order to evaluate the dependence of the exosphere characteristics on the local thermophysical properties of the surface.

1. Introduction

The MESSENGER mission observed an equatorial exospheric sodium emission [1] characterized by an enhancement above the cold-pole longitudes (so called because of their lower than average temperature); moreover the observed sodium enhancement follows the cold pole dayside local time from dawn to dusk, while models predict a general enhancement only in the morning side. The origin of the sodium enhancement is yet not clear. We are willing to analyse the possibility that the sodium enhancement could be linked to the extreme temperature variations on the surface of the planet.

2. The method

We study the possible origin of the sodium enhancement and its link with surface temperature and conditions with the help of two models linked together, a thermophysical model and an exosphere circulation model. The sodium abundance and motion in the exosphere is calculated with an exosphere model [2] that takes into account, as boundary condition, the surface temperature; this latter is calculated with a thermophysical model whose output is a function of the thermal conductivity of the first centimeters of soil. The thermophysical code can simulate different kinds of material, from fine dust to bedrock, in ascending order of thermal conductivity. By coupling these models we want to study the exosphere properties by comparison between measured and calculated quantities.

3. Summary and conclusions

BepiColombo mission [3] will arrive at Mercury on December 2025 and will perform a detailed analysis of the planet. It will then be possible to compare the results of the simulations with new observations. In the meanwhile we are trying to interpret the existing information given by the Messenger mission.

References

- [1] Cassidy, T. A., et al., A cold-pole enhancement in Mercury's sodium exosphere, *Geophysical Research Letters*, 43, 11, 2016.
- [2] Mura, A., et al., The sodium exosphere of Mercury: Comparison between observations during Mercury's transit and model results, *Icarus*, Elsevier, 200, 2009.
- [3] Benkhoff, J., American Geophysical Union, Fall Meeting, abstract #P23F-3501, 2018.