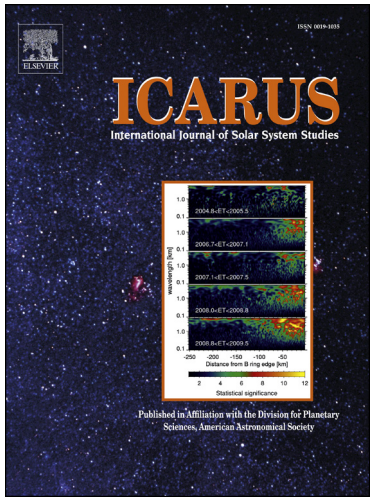
Accepted Manuscript



A test of Hapke's model by means of monte carlo ray-tracing

Mauro Ciarniello, Fabrizio Capaccioni, Gianrico Filacchione

PII: S0019-1035(14)00237-1
DOI: http://dx.doi.org/10.1016/j.icarus.2014.04.045
Reference: YICAR 11075

To appear in: *Icarus*

Received Date: 9 September 2013
Revised Date: 15 April 2014
Accepted Date: 27 April 2014

Please cite this article as: Ciarniello, M., Capaccioni, F., Filacchione, G., A test of Hapke's model by means of monte carlo ray-tracing, *Icarus* (2014), doi: http://dx.doi.org/10.1016/j.icarus.2014.04.045

A test of Hapke's model by means of Monte Carlo ray-tracing

Mauro Ciarniello, Fabrizio Capaccioni, Gianrico Filacchione
IAPS-INAF, via Fosso del Cavaliere, 100, 00133, Rome, Italy
mauro.ciarniello@iaps.inaf.it

Abstract

One of the most applied solution of the radiative transfer equation for a particulate medium is the so called Hapke's model. It is widely used to describe the photometric output of the surfaces of atmosphereless bodies of the Solar System and to interpret remote sensing data. In this paper we use a Monte Carlo routine which simulates ray-tracing in particulate media to test three formulations of the Hapke's model: IMSA (Isotropic Multiple Scattering Approximation), AMSA (Anisotropic Multiple Scattering Approximation) and an updated version of the model described in Hapke (2008) (from now on H2008). While IMSA and AMSA assume a continuos medium, H2008 accounts for the discreteness of a particulate medium (regolith) and introduces a dependence of the photometric output on the filling factor. Using Monte Carlo ray-tracing we have simulated photometric output of media with different porosities and scattering behaviors (isotropic, back-scattering and forward-scattering). The Shadow Hiding Opposition Effect (SHOE) has been investigated as well. What emerges from this analysis is that H2008 is the most appropriate model to describe the photometric output of particulate media with arbitrary porosities, far from the opposition effect regime, and it is also able to characterize anisotropic scattering, unless the medium exhibits a strongly forward-scattering behavior. On the contrary, IMSA and