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Modeling the neutral exosphere and the energy distribution of pick-up ions of lunar origin

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A large volume of recently available in-situ measurements has significantly improved the understanding of the lunar environment. Usually these measurements sample the environment along trajectories of particular spacecrafts. Determining the state of the entire lunar environment needs theoretical models that use these in-situ measurements as reference points.

Here we present preliminary results obtained with our kinetic lunar exosphere model, which describes the distribution of He, Ar, Na, K and their corresponding ions in the exosphere. The ions are produced by photoionization of neutral atoms. The model takes into account the rotation of the Moon, which allows us to reproduce the observed diurnal variation of the argon's surface abundance. Trajectories of neutral particles are simulated considering the lunar gravity and solar radiation pressure. The Lorentz force that defines the motion of ions is calculated with magnetic and electric fields obtained from results of a global MHD simulation of the solar wind/Earth's magnetosphere interaction.

Modeled number and column densities of the neutral species and energy distribution of the pickup ions are compared with remote and in situ observations.