On the role of dust in the lunar ionosphere

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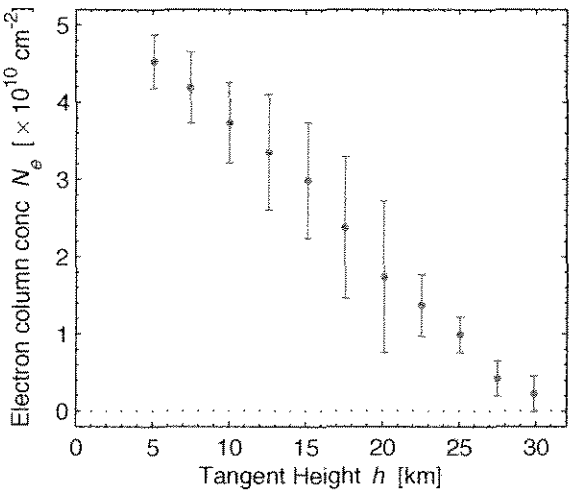
Abstract. Evidence suggests that electron concentrations above the dayside lunar surface can be significantly higher than expected from either the photo-ionization of exospheric neutrals or any other well-known process. The Luna 19 mission performed dual-frequency radio occultation experiments in order to determine electron column concentrations above the lunar limb as a function of tangent height[1] (shown in the figure below). The resulting electron concentration profiles surprisingly indicated a peak of ~500–1000 cm^{-3} and scale heights of ~10–30 km. It has been suggested that electrically charged exospheric dust could contribute to these electron enhancements[2]. Here we describe how to estimate the electrons produced by photo-charged dust, which is then used to predict electron concentrations from exospheric dust distribution models that are based on the "excess brightness" observed in Apollo 15 coronal photographs[3]. The results indicate that radio occultation measurements likely provide a valuable perspective on the role of dust in the lunar environment.



Electron column concentrations measured above the lunar limb by Luna 19[1].

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[2] Imamura, T., et al., The possibility of studying the lunar ionosphere with the SELENE radio science experiment, *Earth Planets Space*, 60, 387–390 (2008).
[3] McCoy, J.E., Photometric studies of light scattering above the lunar terminator from Apollo solar corona photography. *Proc. 7th Lunar Sci. Conf.*, 1087–1112 (1976).