

EGU2020-13261

<https://doi.org/10.5194/egusphere-egu2020-13261>

EGU General Assembly 2020

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On the Space Weather Effect and CME-Driven Exospheres of the Moon and Ceres

Hua-Shan Shi¹, Zheng-Xian Chen¹, and Wing-Huen Ip^{1,2}

¹Institute of Space Science, National Central University, Taiwan (yagaga82@gmail.com)

²Institute of Astronomy, National Central University, Taiwan

A number of moon-sized objects in the solar system are characterized by the formation of a surface-bound exosphere. These include the Moon, Ceres, Jupiter's icy moons, namely, Europa, Ganymede and Callisto, and several of the Saturnian icy moons including Rhea, Dione, and Tethys. There are several major source mechanisms ranging from micrometeoroid bombardment, photo-stimulated desorption, and energetic ion sputtering - in addition to the surface (or subsurface) thermal sublimation in the case of Ceres and the icy Moon. It is interesting that Ceres and the Moon could experience extreme space weather effects when they encounter large solar flare events or coronal mass ejection events. An important consequence is the production of a transient exosphere due to the sudden increase of ion sputtering rates. We have developed time-dependent Monte Carlo models that can be applied to the Moon and Ceres. Some simulation results will be described in this presentation with a view to construct the CME-driven H₂O and O₂ exosphere of Ceres and the flare-up of the lunar sodium corona and tail emission.