HYDROMAGNETIC THEORY FOR THE SCATTERING OF ALFVEN WAVES BY THE MOON IN THE GEOMAGNETIC TAIL LOBES, B.R. Lichtenstein and G. Schubert, Dept. of Geophysics and Space Physics, University of California, Los Angeles, CA 90024.

The moon spends approximately five days each month in the lobes of the geomagnetic tail. Recently, surface and orbital magnetometer data during these times have been used to obtain information on the internal electrical conductivity of the moon (1-3). The lunar response to time varying magnetic fields was modeled by that of an electrically conducting sphere in a vacuum. However, it has been shown that the response of the moon cannot be interpreted on the basis of electromagnetic scattering from a conducting sphere in a vacuum (4). It was suggested that the magnetotail plasma environment may strongly influence lunar electromagnetic induction.

We have developed a linear MHD theory for the scattering of Alfven waves of arbitrary wavelength by the moon in a cold, stationary plasma with a large uniform background magnetic field. In general, the scattered field consists of two modes: a fast mode which propagates isotropically with the Alfven speed and an Alfven mode without density fluctuations which is confined to the magnetic flux tube defined by the moon and the ambient field. This latter mode propagates one-dimensionally along the field lines with the Alfven speed in both directions from the moon. The amplitude of the isotropic fast mode is attenuated with radial distance from the moon, whereas that of the Alfven mode is unattenuated. We compare the fields of Alfven wave scattering from the moon in an MHD plasma with those of electromagnetic scattering from the moon in vacuum and with the observations of magnetic fields scattered from the moon in the geomagnetic tail lobes.

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