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Shock Induced Drift-bounce Interaction with Magnetospheric ULF Waves

R. Rankin (1), A. Degeling (1), and Q. -G. Zong (2)

(1) University of Alberta, University of Alberta, Physics, Edmonton, Canada (rrankin@ualberta.ca, 17804920714), (2) Institute of Space Physics and Applied Technology, Peking University, Beijing 100871 (qgzong@pku.edu.cn, 861062761896)

The up-coming NASA RBSP mission presents an opportunity to evaluate how ULF waves and energetic electrons are excited by shock impact between the solar wind and magnetosphere. It has been demonstrated that interactions of this nature are followed by "ringing" of the magnetosphere in the form of poloidal and toroidal mode waves with frequencies of a few mHz. The wave frequencies are in a range where the drift-bounce resonance condition can be satisfied in the outer radiation belt, which may explain the appearance of energetic (MeV) electrons that are observed in association with the passage of the shock. We make use of a model for ULF waves and a particle pushing algorithm to assess the efficiency of energetic electron production in response to an intense interplanetary shock observed on November 7th, 2004 by a number of spacecraft, including Cluster. The model for ULF waves is based on a solution to the ideal MHD equations in curvilinear geometry, including an approximation of the dayside magnetopause by a parabolic profile that is adjusted to fit observations of the shock passage. By adjusting the bandwidth and amplitude of the source of ULF wave activity at the nose of the magnetopause, we determine the spectrum of discrete modes excited in the magnetosphere. Using the spectrum of ULF waves and amplitudes from the model, we inject test particle electrons and examine their interaction with the wave fields through drift-bounce resonance. We conclude by summarizing our findings as they relate to the shock event of November 7th, 2004, and indicate how RBSP may be used to further elucidate shock generation mechanisms for ULF waves.