Geophysical Research Abstracts
Vol. 14, EGU2012-5802, 2012
EGU General Assembly 2012

Does the presence of cosmic dust influence the displacement of the Earth's Magnetopause?

I. Mann (1,2) and M. Hamrin (2)

(1) EISCAT Scientific Association, Kiruna, Sweden (ingrid.mann@eiscat.se, +46 980 79158), (2) Umeå University, Umeå, Sweden

In a recent paper Treumann and Baumjohann propose that dust particles in interplanetary space occasionally cause large compressions of the magnetopause that, in the absence of coronal mass ejections, are difficult to explain by other mechanisms (R.A. Treumann and W. Baumjohann, Ann. Geophys. 30, 119-130, 2012). They suggest that enhanced dust number density raises the contribution of the dust component to the solar wind dynamical pressure and hence to the pressure balance that determines the extension of the magnetopause. They quantify the influence of the dust component in terms of a variation of the magnetopause stagnation point distance. As a possible event to trigger the compressions they propose the encounters with meteoroid dust streams along Earth's orbit. We investigate the conditions under which these compressions may occur.

The estimate by Treumann and Baumjohann of the magnetopause variation presupposes that the dust particles have reached solar wind speed. Acceleration by electromagnetic forces is efficient in the solar wind for dust particles that have a sufficiently large ratio of surface charge to mass (Mann et al. Plasma Phys. Contr. Fusion, Vol. 52, 124012, 2010). This applies to small dust particles that contribute little to the total dust mass in meteoroid streams. The major fraction of dust particles that reach high speed in the solar wind are nanometer-sized dust particles that form and are accelerated in the inner solar system (Czechowski and Mann, ApJ, Vol. 714, 89, 2010). Observations suggest that the flux of these nanodust particles near 1 AU is highly time-variable (Meyer-Vernet, et al. Solar Physics, Vol. 256, 463, 2009). We estimate a possible variation of the magnetopause stagnation point distance caused by these nanodust fluxes and by the dust associated to meteoroid streams.

We conclude that the Earth's encounters with meteoroid dust streams are not likely to strongly influence the magnetopause according to the proposed effect. We further use the expression for the magnetopause stagnation point distance used by Treumann and Baumjohann to investigate the possible influence of time-variable nanoddust fluxes on the magnetopause.