



HAO Colloquium Series

(Refreshments served)

Speaker: Delores. J. Knipp, HAO

Time: 1:30–2:30 pm

Date: Wednesday, October 3, 2012

Location: CG1-1210 South Auditorium

Title: Thermospheric Upheavals Driven by Solar Wind Shears and Pressure Pulses Ahead of Interplanetary Disturbances

Abstract:

Geomagnetic storms deposit energy that raises the exospheric temperature and perturbs the thermospheric neutral density and orbits of spacecraft in the thermosphere. While investigating discrepancies in neutral density forecasts that used the Dst index as a basis, differing responses to apparently similar levels of the index became apparent. In particular, the neutral density upheaval is very fast in the problem storms. Based on a superposed epoch analysis of geomagnetic storms (of similar Dst-strength) during 2004–2005, the differences appear to be associated with the existence/absence of an initial geomagnetic storm phase with large solar wind pressure pulse(s). These poorly forecast storms have a higher energy deposition rate during storm onset, especially with respect to low-energy ions and electrons. In the solar wind, during the pre-phase of many of the problem storms, the leading interplanetary magnetic field has a large east-west component; and the total field strength is high. Additionally, the events arrive with, or are followed by, high-speed flow. During onset of the fast-rise neutral-density events, the median solar wind dynamic pressure is approximately twice that for the control storms. At the ground, the Dst index spikes toward positive at the beginning of these events. I show that geomagnetic perturbations and energy deposition measured during dayside transits of Low Earth Orbiting spacecraft are enhanced during the poorly forecast events, suggesting a propensity for the early energy deposition to be on the dayside. In some cases there is a rapid spread of energy deposition to the nightside. I discuss the mechanisms that are likely to be responsible for the rapid neutral density upheavals in the upper atmosphere.



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