Project Details

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Project Title:
MHD Streamer Structure: Slow Solar Wind, the Streamer Brightness Boundary, and CMEs

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Summary:
Coronal mass ejections (CMEs) are studied because they are massive expulsions of plasma from the Sun and the main cause of non-recurrent geomagnetic storms. Moreover, most major terrestrial energetic proton events are the result of particle acceleration at shocks driven by CMEs. CMEs are caused by magnetic activity ejecting mass from low in the solar atmosphere that sweeps up material from the corona streamer material. However, ejections are sometimes contained by the overlying corona. In other words, properties of CMEs depend on properties of the overlying corona. A dependence also exists for energetic particles because properties of coronal CME-generated shock waves depend on properties of the ambient medium which can enhance or preclude shock formation.
We propose to study the dependence of CMEs on streamer properties and develop ways to use existing observations to better predict CME properties. This is meant to be distinct from studying the origin of CMEs. We will use models to investigate the likelihood that ejections will carry away overlying streamers. We will examine dependence on streamer size, history, density, and temperature and on the ambient outside streamers. We will develop models of the streamer ambient and show where and when strong shocks are formed in front of CMEs and hence where energetic particles are produced. Streamer size, history, density, and temperature will be used as the defining parameters because some or all of these are measured from SOHO and Yohkoh and will be measured from GOES/SXI, STEREO SDO, and Far Side Sentinal. Our goal is to develop techniques to apply underutilized empirical parameters to better predict consequences of CMEs, as opposed to the initiation of CMEs. We will base our research on a semi-analytic model which we will use for perturbation studies and modeling streamer environment. It will be a more powerful tool for parametric studies than existing numerical models. The model will address specific ideas for the origin of slow solar wind, the physical interpretation of the streamer brightness boundary, and the formation of CMEs as a consequence of magnetic activity near the base of streamers.

Publication References:

Summary: no summary

Reference: Suess, S. T.; Bemporad, A.; Poletto, G.; (2004), A slow streamer blowout at the Sun and Ulysses, Geophysical Research Letters, Volume 31, Issue 5, CiteID L05801, doi: 10.1029/2003GL018895