

Project Details

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Project Title:

Physics of Coronal Wave Fronts: Coronal Pulse Waves as a Predictive Tool for CME Properties

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Summary:

We propose to study coronal pulse wave fronts as a diagnostic tool to characterize solar coronal mass ejection (CME) events. Such waves ("EIT waves", "Moreton waves", and "SXT waves") are frequently observed in conjunction with CME onset, but so far are poorly understood. By systematically comparing existing CME catalogs with archival data from several instruments, we will identify the currently debated relationship between wave fronts and the CMEs that give rise to them. Further, we will develop tools to semi-automatically identify, extract, and summarize physical wave parameters from existing high cadence TRACE observations that include pulse wave fronts; these data are a good proxy for the prototype operational data from SDO. By quantitatively relating these wave parameters to conditions and effectiveness of past CMEs (including confounding variables), we will develop an empirical predictive tool for rapidly estimating kinetic energy and geoeffectiveness of future CMEs, potentially greatly improving operational space weather forecasts from near-Earth telescopes. This work, while directed toward development of a space-weather predictive tool, has other important consequences for solar physics. Wave observations provide a unique window into the kinetic energy release profile of CME liftoff events, helping to constrain models of CME onset; measurements of wave propagation yield a powerful probe of the plasma through which they propagate; and wave energy dissipation and scattering, which are directly observable in these large-scale mixed-mode waves, are important to the physics of coronal heating.

Publication References:

Summary: "

Reference: DeForest, Craig SwRI - Physics of Coronal Wave Fronts: Coronal Pulse Waves as a Predictive Tool for CME Properties