

Project Details

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Project Title:

Empirical Constraints on the Initiation, Propagation, and Structure of CMEs

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Summary:

OBJECTIVES: We will use observations to constrain the initiation processes, near-Sun velocities, and 3-dimensional structure of CMEs. Questions to be addressed include: (1) To what extent can filament eruptions be associated with prior changes in the photospheric field distribution (e.g., with emerging flux)? What is the empirical relation between CME eruptions and multipolar magnetic topologies? (2) Do the various components of a CME have systematically different velocity profiles near the Sun, and is there evidence for a background component which does not reach escape velocity? (3) Can the observed structure of white-light CMEs be represented by flux ropes? What is the basic topology of the ejected filament (when present)?

PROCEDURE: We will identify filament eruptions using SOHO/EIT and ground-based H alpha observations, and search for prior flux emergence in MDI and NSO magnetograms. We will use source surface extrapolations to determine the large-scale coronal field topology above the filament before and after the flux emerges. (2) A previously developed algorithm allows us to record automatically the height-time trajectories of coronal material in the SOHO/LASCO C2 and C3 fields of view. We will extend the algorithm to process C1 and EIT images, thereby obtaining accurate constraints on the dynamics of CMEs very close to the Sun. (3) We will identify flux ropes and other large-scale structures in white-light CME images and deduce their 3-dimensional geometry using simple trial density distributions. We will identify the white-light counterparts of filaments and compare their morphology with existing models for prominences.

RELEVANCE: By elucidating the structure, origin, and dynamical properties of CMEs through data analysis and semi-empirical modeling, the proposed work will contribute to the development of space weather prediction capabilities. The results will also be relevant to the future NASA STEREO mission.

Publication References:

no references