

Project Details

ROSES ID: NRA-NNH04ZSS001N

Selection Year: 2005

Program Element: Focused Science Topic

Topic: To determine the solar origins of the plasma and magnetic flux observed in an Interplanetary Coronal Mass Ejection.

Project Title:

The CME-ICME Connection: Understanding ICMEs from a Magnetic Analysis of their Solar Progenitors

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Summary:

In situ measurements of ICMEs at 1 AU and multi-wavelength observations of the solar corona have recently enabled a direct comparison between the properties of ICMEs and their origins, namely the initial CMEs and the source solar active regions. However, the first results of this comparison yield more questions than answers and the quantitative correspondence between CMEs and ICMEs remains unclear and problematic. Moreover, the actual mechanism, or combinations of mechanisms, that trigger CMEs continue to be unknown. As a CME initiation is almost certainly of magnetic origin, we propose to study photospheric and chromospheric, where available, vector magnetic field observations of CME-prolific active regions aiming to understand and quantitatively describe CMEs. Moreover, we propose to investigate for precursors of CMEs in the active region photosphere / chromosphere. In this effort we will employ two newly devised vector magnetogram analysis techniques: First, a technique to infer the flows of the magnetized plasma at the altitude of the magnetic field measurements. This allows an accurate calculation of the helicity variations that triggers CMEs in the solar atmosphere, due to helicity injection from the solar interior and helicity generation by photospheric shuffling. Second, a technique to estimate the total magnetic helicity budget of solar active regions by modeling their coronal magnetic fields. If a CME is launched the magnetic field lines open and the magnetic helicity content decreases in the calculation volume thus leading to an estimation of the magnetic energy, helicity, and the sense of twist of the departed CME to be directly compared with ICME observations. The required vector magnetograms will be provided by the archives of the Imaging Vector Magnetograph (IVM) of the University of Hawaii, while vector magnetograms from the Synoptic Optical Long-Term Investigation of the Sun (SOLIS) will be employed as soon as they become available. The proposed effort addresses the Focused Science Topics (e) and (f) of the LWS TR&T solicitation, namely "to determine the topology and evolution of the open magnetic field on the Sun connecting the photosphere through the corona to the heliosphere" and "to determine the solar origins of the plasma and magnetic flux observed in an ICME".

Publication References:

no references