Project Details

ROSES ID: NNH07ZDA001N
Selection Year: 2008
Program Element: Focused Science Topic

Topic: Prediction of the Interplanetary Magnetic Field Vector Bz at L1

Project Title:
Predictions the magnitude and orientation of magnetic fields in magnetic clouds from solar surface data

PI Name: Vasyl Yurchyshyn
PI Email: atn@g.ucla.edu
Affiliation: New Jersey Institute of Technology
Project Member(s):
- Wang, Haimin ; Collaborator; New Jersey Institute of Technology
- Lanzerotti, Louis J.; Collaborator; New Jersey Institute of Technology
- Hu, Qiang ; Collaborator; The University of Alabama in Huntsville
- Odstrcil, Dusan ; Collaborator; George Mason University

Summary:
Solar coronal mass ejections (CMEs) are a principal link that connects the chain of events in the solar atmosphere and the Earth's magnetic environment. The occurrence of earth-directed CMEs is well associated with geomagnetic disturbances since they can impose large negative Bz interplanetary magnetic fields across the dayside magnetosphere at 1 AU. The goal of this LWS Focused Science Topic is "to quantify accurately the polarity and magnitude of the IMF Bz for the next 12 24 hours. The prime measure of success for this work would be a good agreement in the time series of predicted and observed Bz values at L1". This proposal is chiefly focused on the predictions of the Bz component associated with solar eruptions, specifically, with magnetic clouds. We propose to pursue the following scientific objectives.

1) Recent research from our group has demonstrated that the intensity of the Bz component (therefore the size of a geomagnetic storm, as measured by the geomagnetic index Dst) appears to be well associated with the expansion speed of the halo CME that triggered the storm. We will expand the study to a statistically significant number of data points. Also, we will explore the Vcme-Bz relationship by utilizing MC analysis data. We intend to correlate halo CME speeds (LASCO, STEREO) with various parameters of MC inferred from real data (ACE, WIND, STEREO) and MC fitting procedures (e.g., magnetic flux and peak values of the Bz).

2) During past several years we studied the relationship between magnetic fields of solar sources of CMEs and the associated magnetic clouds. We thus found that the orientation of majority of ejecta does not change significantly during their propagation from the Sun to the near earth environment and there is a possibility to predict MC orientation (polarity) from solar data and coronal field modeling. We will further investigate, via data analysis and with reference to relevant models, the correspondence between i) orientation and twist of the post-eruption arcades (EIT, STEREO, AIA, Halpha), ii) directions of the MC s axial and azimuthal fields (ACE, STEREO), iii) orientation of the halo CME elongation (LASCO, STEREO) and the tilt of the coronal neutral line (synoptic maps, CCMC models). This analysis, employed together with contemporary MHD models that are becoming incorporated into the CCMC, will permit a very rigorous investigation of the relationship between CME source region magnetic structures and the corresponding magnetic structures existent in the interplanetary CMEs at 1AU.

One NJIT graduate student will be involved in the project.

Publication References:

Summary: no summary

Reference: Yurchyshyn, Vasyl; (2008), Relationship between EIT Posteruption Arcades, Coronal Mass Ejections, the Coronal Neutral Line, and Magnetic Clouds, The Astrophysical Journal Letters, Volume 675, Issue 1, article id. L49, pp, doi: 10.1086/533413