Project Details

ROSES ID: NRA-NNH04ZSS001N
Selection Year: 2005
Program Element: Focused Science Topic

Topic: To determine the topology and evolution of the open magnetic field of the Sun connecting the photosphere through the corona to the heliosphere.

Project Title:
Supporting Theoretical Studies of the Processes that Control the Topology and Evolution of the Open Magntic Flux of the Sun

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Summary:
Project Summary This investigation will develop theories for the fundamental processes that control the evolution of the open magnetic flux of the Sun. The theories are intended to provide insights and inputs to numerical models that need to be developed for the dynamic behavior of the solar corona, its magnetic field, and the solar wind. This research thus needs to be conducted in close coordination with the investigations developing these models through the Focus Team formed for LWS TR&T Program Objective T3e. The investigation will also conduct analysis of data sets we have access to, which can provide tests of models for the topology and evolution of the open magnetic flux. Such tests are important for both verifying the models and providing feedback to improve the theoretical concepts on which the models are based. This research also needs to be conducted through the Focus Team for Objective T3e. One of the most significant issues for understanding the coupling of the Sun and the heliosphere, and thus the formation of the heliosphere, is to determine the topology and evolution of the open magnetic flux of the Sun. The open flux controls the flow of the solar wind in the solar corona; the escape of energetic particles; the conditions through which Coronal Mass Ejections propagate and accelerate energetic particles; it is an integral component in the magnetic field reversal of the Sun. We have introduced a number of concepts that we consider are important for determining the topology and evolution of the open magnetic flux of the Sun. In particular, we have argued that open magnetic field lines can reconnect with closed magnetic loops, and that this represents a significant transport mechanism for the open flux that affects its distribution on the Sun and its evolution, and results in motions that alter the heliospheric magnetic field. We have and are proposing here to develop theoretical models to describe the transport of open flux by this mechanism, and the consequences. The results of these theoretical investigations should provide (i) insights into the likely distributions of open magnetic flux outside of coronal holes; (ii) the inner boundary conditions for the solar corona, such as the mass flux of the solar wind and the Poynting vector; and (iii) the deposition of energy into the corona to accelerate the solar wind. All these outputs are intended to be useful for developing full numerical models for the topology and evolution of the open magnetic flux of the Sun.

Publication References:

Summary: no summary

Reference: Fisk, L. A.; (2005), The Open Magnetic Flux of the Sun. I. Transport by Reconnections with Coronal Loops, The Astrophysical Journal, Volume 626, Issue 1, pp. 563-573, doi: 10.1086/429957