Project Details

ROSES ID: NNH09ZDA001N
Selection Year: 2010
Program Element: Focused Science Topic

Topic: Origin and Nature of the Slow Solar Wind, Associated Interplanetary Structures, and SEP Transport

Project Title:
The Wind from the Open-Closed Field Interaction Region

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- Antiochos, Spiro K.; Co-I/Institutional PI; NASA, Goddard SFC
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Summary:
This proposal is focused on two fundamental challenges that have plagued our understanding of the origin of the slow solar wind: 1) The slow solar wind has a composition more similar to plasma of the closed corona, and different than the composition of coronal hole plasma. 2) The extent of the slow solar wind is between 20-30 deg from the current sheet.

Models describing the slow solar wind approximately fall into three categories. Slow solar wind could originate in a quasi-stationary fashion at the boundaries of open field rooted in coronal holes; slow solar wind could be the product of a dynamic instability of steamers; or, slow solar wind could be generated through interchange reconnection. In fact Fisk et al in several previous studies have provided a statistical description for interchange processes all around the solar corona.

Such models of the heliospheric magnetic field have been investigated in a previous LWS working group which has been tremendously successful. Out of this study resulted important conclusions about the slow solar wind and its physical properties: Antiochos et al. demonstrated the existence of open field corridors - small-scale extensions of open field into the topologically closed area of the corona. Recent simulations of the solar corona at unprecedented spatial resolution by the PSI group reveal that corridors and separators are ubiquitous in the streamer belt region. These structural features are natural sites for the interchange reconnection proposed by Fisk et al. Their pervasive presence suggests that a dynamic description of the coronal streamer belt is necessary to understand the slow solar wind.

This proposal will focus on three specific questions related to the open field corridors and their relation to the generation of slow wind. 1) Is the angular extent and temporal behavior of the predicted slow-wind region consistent with data? 2) Does the predicted slow wind have the observed structure and dynamical properties of the slow wind? 3) Can this model be used to make observational predictions for Solar Probe and Solar Orbiter? This work will use a combination of theoretical, modeling and data analysis tools typical for a LWS topic area. Based on the tremendous success of the LWS team in "Heliospheric Magnetic Field", we will propose that the PI of this proposal be the lead of the entire study team to encourage integration of the selected studies.

Publication References:

Summary: no summary

Reference:
Zurbuchen, Thomas H.; von Steiger, Rudolf; Gruesbeck, Jacob; Landi, Enrico; Lepri, Susan T.; Zhao, Liang; Hansteen, Viggo; (2012), Sources of Solar Wind at Solar Minimum: Constraints from Composition Data, Space Science Reviews, Volume 172, Issue 1-4, pp. 41-55, doi: 10.1007/s11214-012-9881-5

Summary: no summary

Reference: Antiochos, Spiro K.; Linker, Jon A.; Lionello, Roberto; Miki?, Zoran; Titov, Viacheslav; Zurbuchen, Thomas H.; (2012), The Structure and Dynamics of the Corona—Heliosphere Connection, Space Science Reviews, Volume 172, Issue 1-4, pp. 169-185, doi: 10.1007/s11214-011-9795-7

Summary: no summary

Reference: Stakhiv, Mark; Landi, Enrico; Lepri, Susan T.; Oran, Rona; Zurbuchen, Thomas H.; (2015), On the Origin of Mid-latitude Fast Wind: Challenging the Two-state Solar Wind Paradigm, The Astrophysical Journal, Volume 801, Issue 2, article id. 100, 8 pp, doi: 10.1088/0004-637X/801/2/100