Project Details

ROSES ID: NNH14ZDA001N
Selection Year: 2014
Program Element: Physics of the Inner Heliosphere

Topic: Physics-based methods to predict connectivity of SEP sources to points in the inner heliosphere, tested by location, timing, and longitudinal separation of SEPs

Project Title:
Implications of the S-Web for Observing and Understanding the Inner Heliosphere

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Project Member(s):
- Karpen, Judy ; Co-I; NASA/Goddard Spaceflight Center
- Young, Aleida ; Graduate/Undergraduate Student; University of Michigan
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Summary:
Objectives: NASA space-based coronagraphs have revealed that the connection of the corona to the inner heliosphere is highly complex and fully dynamic. This connection is clearly due to the Sun's magnetic field. We propose a research program designed to attack this fundamental question in Heliophysics: What are the magnetic topologies and dynamics that produce the observed structure of the inner heliosphere? Answering this question is critical for achieving NASA's goals of understanding the Sun and solar system and for interpreting the wealth of new data that will be obtained by Solar Orbiter and Solar Probe Plus.

Methodology: The proposed work builds on our recently developed S-Web Model for the sources of the slow solar wind and our embedded bipole model for coronal jets. The work consists of a balance of theoretical and numerical studies using state-of-art simulation codes, in particular, our 3D adaptively-refined MHD solver (ARMS). We will employ the methodology that we have used to attack successfully many fundamental Heliophysics problems: first develop insight by investigating idealized models that isolate the key physics of the problem, then apply the understanding gained to calculate signatures that can be compared with observations from the NASA missions.

The Principal Investigator directing this project is Dr. Spiro K. Antiochos of NASA/GSFC. He will be assisted by Drs. Judith T. Karpen and Dr. C. Richard DeVore from GSFC, as well as Dr. Sophie Masson from Catholic U and Ms. Aleida Young, a graduate student from the University of Michigan who will perform part of her thesis research on this project. Dr. Antiochos is an adjunct professor at U. Michigan and is supervising Ms. Young at GSFC.

Relevance to Solar Orbiter/Solar Probe Plus: The physics of the inner heliosphere are almost exclusively determined by the magnetic coupling of the corona to heliosphere. The SO&SPP missions have been designed specifically to measure this coupling for the first time close to the Sun. The proposed research program is essential for understanding the fundamental physical properties of the Sun-heliosphere magnetic field. We will apply our advances in theoretical understanding to the development of detailed models of the inner heliosphere that can be used both to interpret the SO&SPP measurements and to test/refine the theories.

Publication References:

Summary: no summary

Reference: Pariat, E.; Dalmasse, K.; DeVore, C. R.; Antiochos, S. K.; Karpen, J. T.; (2016), A model for straight and helical solar jets. II. Parametric study of the plasma beta, Astronomy & Astrophysics, Volume 596, id.A36, 20 pp, doi:

10.1051/0004-6361/201629109

Summary: no summary

Reference: Higginson, A. K.; Antiochos, S. K.; DeVore, C. R.; Wyper, P. F.; Zurbuchen, T. H.; (2016), Formation of Heliospheric Arcs of Slow Solar Wind, The Astrophysical Journal Letters, Volume 840, Issue 1, article id. L10, 6 pp, doi: 10.3847/2041-8213/aa6d72