Project Details

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Project Title:
Using EUV Waves to Probe the Solar Corona

PI Name: Cooper Downs
PI Email: cdowns@predsci.com
Affiliation: Predictive Science Incorporated
Project Member(s):
- Liu, Wei ; Co-I; Bay Area Environmental Research Institute
- Torok, Tibor ; Co-I; Predictive Science, Inc.
- Linker, Jon A; Collaborator; Predictive Science, Inc.

Summary:
SDO/AIA observations of large-scale coronal waves (EUV waves) triggered by CMEs provide a tantalizing amount of information about the dynamics of solar eruptions and the ambient plasma state of the solar corona. While much progress has been made during the lifetime of the SDO/AIA mission, many questions remain about the physical nature of EUV waves and the myriad of associated fine-scale structures that are now observed. Similarly, harnessing the potential of using EUV waves to make seismological estimates of magnetic field and/or plasma parameters remains difficult, due in part to the ad-hoc or simplifying assumptions often required for their interpretation.

In this context, we propose to improve upon current methods used for analyzing and understanding EUV waves. We will tackle this problem using a coupled observational analysis and modeling approach. This involves using a state-of-the-art MHD model to systematically couple the physical mechanisms of large-scale transients generated by eruptions directly to observables available from SDO/AIA. Our study will capitalize on the rich, high cadence multi-filter datasets provided by SDO/AIA, as well as recent MHD modeling developments that allow us to simulate solar eruptions for observed configurations in a global coronal model. In practice, this effort will involve two major arcs:

A) A series of eruption experiments which allow us to isolate and study specific aspects of EUV waves. A major component of this effort will be the express development and refinement of methods that can be used for the inverse problem, i.e. converting perturbations of the observables into meaningful insight on the changing magnetic and plasma state of the corona. We expect the output of these experiments to be broadly applicable to a large-number of events observed by SDO/AIA.

B) Case studies of selected solar eruptions observed by SDO/AIA. Here we will explicitly model the thermal-magnetic state of the entire corona before and during the eruption, bridging the gap between what was observed and the underlying physical evolution. These studies will also aid in characterizing the methods developed in the first effort.

The crux of this investigation is the synthesis of model results in terms of AIA observables and their direct comparison to available observational data. We believe that this coupled approach is a unique and complimentary way to harness the scientific potential of the SDO/AIA instrument, and is therefore relevant to the goals of the NASA LWS program.

Publication References:

no references