Project Details

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

Topic: Focused science topic for Strategic Goal 1 (Solar storms): Exploring the magnetic connection between the photosphere and low corona

Project Title:
Observations and Modeling of Alfven Waves in the low Atmosphere

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Summary:
Alfven waves have long been invoked as a possible mechanism for the heating of the solar corona and the acceleration of the solar wind. Using the unprecedented spatial (0.2arcsec) and temporal resolution (5s) of Hinode/SOT and 3D MHD simulations, we have recently found the first unambiguous evidence in the lower solar atmosphere of Alfven waves that carry an energy flux large enough to accelerate the solar wind. These waves have longer periods (100-500s) than the high-frequency kHz waves previously assumed in many models and observations of the solar wind. Our results directly support recent models based on low-frequency waves.

We propose to use an integrated approach of Hinode/SOT-EIS, SUMER and TRACE/AIA observations, Monte Carlo simulations and advanced radiative 3D MHD simulations to determine the source, propagation, and impact of these Alfven waves. We will directly constrain input parameters of solar wind models such as the Alfven wave amplitudes, periods, and energy flux (for quiet Sun, coronal hole and active regions) by using imaging and Dopplergram observations from photosphere through corona, as well as advanced radiative 3D MHD models that include a region from the convection zone to the corona.

Our results will lead to a much improved understanding of what drives the quiescent solar wind, an important step in improving predictions of CME propagation and impact on the Earth's space environment. Modellers will be able to use our results to pin down crucial details of wind acceleration and wave damping mechanisms. Our work will also help reveal what dominates the energy and momentum balances of the chromosphere, which are poorly understood. This will drastically improve our understanding of how the chromosphere impacts the magnetic field, which is crucial if we want to use SDO/HMI data to understand the coronal/heliospheric field.

Publication References:

Summary: no summary

Reference: McIntosh, Scott W.; De Pontieu, Bart; Tarbell, Theodore D.; (2008), Reappraising Transition Region Line Widths in Light of Recent Alfvén Wave Discoveries, The Astrophysical Journal Letters, Volume 673, Issue 2, article id. L219, pp, doi: 10.1086/528682

Summary: no summary

Reference: McIntosh, Scott W.; de Pontieu, Bart; Carlsson, Mats; Hansteen, Viggo; Boerner, Paul; Goossens, Marcel; (2011),

Alfvénic waves with sufficient energy to power the quiet solar corona and fast solar wind, Nature, Volume 475, Issue 7357, pp. 477-480, doi: 10.1038/nature10235