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:
Exploring the Magnetic Connection and Associated Dynamics from the Photosphere through Chromosphere to the Corona

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Summary:
We have made great efforts and accumulated experience in exploring the magnetic structure and dynamics in the chromosphere in the past several years. By comparing the Stokes profiles between chromospheric and photospheric spectral lines and with Stokes asymmetry analysis, we have found significant differences between the two layers for various regions. These differences hint at dramatic changes of the field inclination, strength, and plasma flows from the photosphere to the chromosphere. We are collaborating with researchers in Max Planck Institute for Solar System Research (MPS, Germany), Big Bear Solar Observatory (BBSO), and University of California Riverside for chromospheric Stokes inversions, more chromospheric observations, and non-force free field extrapolations, respectively. These prepare us for exploiting the unprecedented imaging chromospheric Stokes data that can be provided by the newly launched Hinode (Solar-B) mission. We propose to make further efforts to study the accurate magnetic field and plasma flows in the chromosphere, as well as their connection with the photosphere and their role in the coronal models, with Hinode Spectro-Polarimeter (SP) and Narrowband Filter Imager (NFI) observations and our well established experience and techniques. We arrange our proposed project in the following three connected tactic steps:

(1) We will perform a detailed Stokes asymmetry analysis on the existing chromospheric spectropolarimetric data (Mg I b 517.27 nm line, the chromospheric line also used in NFI of Hinode) that we observed with ASP. We will use these Stokes profiles to test the inversion code for the chromosphere that has been developed at MPS and will be used on a routinely basis starting from 2008.

(2) We will make further chromospheric observations using Na D line with BBSO's Visible-light Imaging Magnetograph (VIM), a tunable narrowband filter-based magnetograph, which in principle is similar to NFI of Hinode. Na D line is also used in Hinode NFI for detecting very weak fields in the chromosphere. We will apply the chromospheric Stokes inversion technique described in step (1) to BBSO's Na D data to test its feasibility to filter-based Stokes data.

(3) Finally, we will apply the matured spectral analysis tools and chromospheric Stokes inversion technique to Hinode SP and NFI data. We will use the accurately inverted magnetic and flow field both in the photosphere and chromosphere as boundary conditions to simulate the coronal field configuration with the non-force free field extrapolations, thereby to test the coronal models.

The proposed research clearly match the NASA's LWS TRT focused science topic for Strategic Goal 1 (Solar storms): Exploring the magnetic connection between the photosphere and low corona. Our observational results and developed techniques will significantly complement and optimize Hinode data. The expected products will promote real progress in the predictive qualities of the coronal and heliospheric models.

Publication References:

no references