Project Details

ROSES ID: NNH10ZDA001N
Selection Year: 2011
Program Element: Focused Science Topic

Topic: Jets in the Solar Atmosphere and their Effects in the Heliosphere

Project Title:
Linking Photospheric Dynamic Magnetic Fields to Chromospheric Jetting Activity

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Summary:
With increasingly finer resolution, the solar chromosphere shows an even richer ceaselessly changing character with small-scale energetic events occurring constantly all over the solar surface. These events are expected to hold the key to unlocking the mystery of chromospheric and coronal heating. Such chromospheric activity is thought to be the result of the relentlessly changing photospheric magnetic field driven by turbulent solar flows.

Big Bear Solar Observatory (BBSO) group proposes to utilize our 1.6 m clear aperture New Solar Telescope (NST) and data from various NASA missions to explore the connection between chromospheric activity and photospheric dynamics.

The main goal is to advance our understanding of how a variety of chromospheric events originate. These events include spicules, rapid blue shifted events (or spicules II), anemone jets as well as tiny intergranular jets recently discovered using BBSO's NST. In particular we will constrain the driving mechanisms of chromospheric upflows.

We will achieve this goal by analyzing high resolution NST, Hinode, and SDO data for CHs and quiet Sun areas.

Task 1. Studies of chromospheric jet properties (such as velocities, association with the magnetic field, time evolution)

Task 2. Studies of chromospheric response to photospheric dynamics (e.g., bright point sudden horizontal acceleration, appearance/disappearance, collision, etc).

Task 3. One of the major goals of this research plan is to organize several joint campaigns between NST, Hinode and SDO. We believe that these joint observations and data analysis should be one of the major strengths of the NASA LWS focus science team (FST).

The NASA LWS solicitation intends to form science teams focused on a specific topic. The potential contribution of the BBSO group to the LWS focused science team will include:

1) Data sets. The focused team jets will most certainly benefit from these unique data sets provided by the largest 1.6m open aperture solar telescope at BBSO.

2) Organizing joint campaigns between BBSO, Hinode and other observatories.

3) Data analysis. BBSO group will perform data analysis and the results will potentially contribute to the success of the team. For example, results of statistical studies of observed magnetic fields can be compared to those derived from simulated magnetograms. Such comparative studies could lead to a significant improvement of existing MHD models.

The PI and Co-I of this proposal have the valuable experience of having previously worked in two successful LWS teams. We expect that NST data will enable us to see details on the solar surface with unprecedented clarity. Thus, we can expect knowledge that has escaped us, because of lower resolution of the existing data, to be revealed on the dynamics of small-scale magnetic fields in the photosphere and the chromosphere.

Other broad impact includes: i) NST data will be made available for solar community and support from NASA will enable us to perform observations per requests from outside researchers; ii)education and outreach. Recent high quality NST data has already generated significant interest among general public.

Publication References:

Summary: no summary

Reference: Yurchyshyn, V. B.; Goode, P. R.; Abramenko, V. I.; Steiner, O.; (2011), On the Origin of Intergranular Jets, The Astrophysical Journal Letters, Volume 736, Issue 2, article id. L35, 6 pp, doi: 10.1088/2041-8205/736/2/L35

Summary: no summary

Reference: Vargas Dominguez, S.; Kosovichev, A. G.; Yurchyshyn, V.; (2014), Emergence of a small-scale magnetic flux tube and the response of the solar atmosphere, Central European Astrophysical Bulletin, Vol. 38, p. 25-30

Summary: no summary

Reference: Yurchyshyn, V.; Abramenko, V.; Kosovichev, A.; Goode, P.; (2014), High Resolution Observations of Chromospheric Jets in Sunspot Umbra, The Astrophysical Journal, Volume 787, Issue 1, article id. 58, 7 pp, doi: 10.1088/0004-637X/787/1/58

Summary: no summary

Reference: Kumar, Pankaj; Yurchyshyn, Vasyl; Wang, Haimin; Cho, Kyung-Suk; (2015), Formation and Eruption of a Small Flux Rope in the Chromosphere Observed by NST, IRIS, and SDO, The Astrophysical Journal, Volume 809, Issue 1, article id. 83, 14 pp, doi: 10.1088/0004-637X/809/1/83

Summary: no summary

Reference: Lim, Eun-Kyung; Yurchyshyn, Vasyl; Park, Sung-Hong; Kim, Sujin; Cho, Kyung-Suk; Kumar, Pankaj; Chae, Jongchul; Yang, Heesu; Cho, Kyuhyoun; Song, Donguk; Kim, Yeon-Han; (2016), Observations of a Series of Flares and Associated Jet-like Eruptions Driven by the Emergence of Twisted Magnetic Fields, The Astrophysical Journal, Volume 817, Issue 1, article id. 39, 11 pp, doi: 10.3847/0004-637X/817/1/39