OBSERVING TIME PROPOSAL FORM FOR NEW SOLAR TELESCOPE (NST)

Important Notes:

Two Proposal Submission Deadlines:

• 15 April 2015 for Session 1 (May 1 - June 30)

• <u>1 June 2015</u> for Session 2 (July 1 - 31 and September 15 - October 31)

1. Time window available for 2015: May 1 - July 31 and September 15 - October 31;

2. For the information of NST and BBSO, please visit http://www.bbso.njit.edu;

3. For the instrument information, feel free to contact Prof. Wenda Cao at wcao@bbso.njit.edu; 4. Final decision on telescope allocation for session 1 and session 2 will be made no later than April 25 and June 15 2015, respectively by BBSO Telescope Allocation Committee (TAC). High priority may be given to the PIs who produced good scientific results from the previous observations, to the proposals with scientifically challenging and achievable objectives, and the observing proposal with coordinated observations.

Make sure to submit your proposal in PDF format to Wenda Cao (TAC chair) via wcao@bbso.njit.edu before the deadlines

Qualified internal and external applicants:

1. Internal applicants refer to the scientific staff residing at BBSO, scientists and students in NJIT's Center for Solar-Terrestrial Research, and BBSO partners.

2. External applicants refer to the scientists and students from the institutes or universities in USA recognized by NSF or NASA.

3. The PI must have a PhD degree or be a PhD student with the supervisor as the Co-I.

Acknowledgement Requirement:

Please acknowledge BBSO and the instrument PIs in the paper relevant to this observation: BBSO operation is supported by NJIT, US NSF AGS-1250818 and NASA NNX13AG14G

1 General Information

1.1 Applicant Name and Affiliation

PI: V. Yurchyshyn New Jersey Institute of Technology

*Note that Co-Is have the same data access rights as the PI. Please coordinate data access among team members.

1.2 Proposal Information

 \Box Renewal or continuation

 \Box Linked to an US NSF funding

 \blacksquare Linked to an AFOSR funding

 \Box Linked to a PhD thesis in preparation and led by a PhD student

 \Box A coordinated observation with a ground-based telescope

 \Box A coordinated observation with a space-based observatory (e.g. IRIS or Hinode)

1.3 Observing Conditions

- \square Good Seeing
- Ø Sky Clarity

☑ Low Water Vapor

□ Specific Solar Activity

 \Box Quiet Sun Observation

 \Box Solar Limb Tracking

1.4 Preferred Observing Date and Time*

Cho, K.-S., Bong, S.-C., Nakariakov, V. M., et al. 2015, ApJ, 802, 45

Yurchyshyn, V., Abramenko, V., & Kilcik, A. 2015, ApJ, 798, 136

Bong, S.-C., Cho, K.-S., & Yurchyshyn, V. 2014, Journal of Korean Astronomical Society, 47, 311

Vargas Domínguez, S., Kosovichev, A., & Yurchyshyn, V. 2014, ApJ, 794, 140

Yurchyshyn, V., Abramenko, V., Kosovichev, A., & Goode, P. 2014, ApJ, 787, 58

Abramenko, V. I., Zank, G. P., Dosch, A., et al. 2013, ApJ, 773, 167

Lim, E.-K., Yurchyshyn, V., Goode, P., & Cho, K.-S. 2013, ApJ Lett, 769, LL18

Yurchyshyn, V., Abramenko, V., & Goode, P. 2013, ApJ, 767, 17

Abramenko, V. I., Yurchyshyn, V. B., Goode, P. R., Kitiashvili, I. N., & Kosovichev, A. G. 2012, ApJ Lett, 756, LL27

Yurchyshyn, V., Abramenko, V., & Watanabe, H. 2012, Hinode-3: The 3rd Hinode Science Meeting, 454, 311

Goode, P. R., Abramenko, V., & Yurchyshyn, V. 2012, Physica Scripta, 86, 018402

Yurchyshyn, V., Ahn, K., Abramenko, V., Goode, P., & Cao, W. 2012, arXiv:1207.6418

Yurchyshyn, V., Kilcik, A., & Abramenko, V. 2012, arXiv:1207.6417

Lim, E.-K., Yurchyshyn, V., & Goode, P. 2012, ApJ, 753, 89

Kitiashvili, I. N., Abramenko, V. I., Goode, P. R., et al. 2012, arXiv:1206.5300

Abramenko, V., Yurchyshyn, V., & Goode, P. R. 2012, 4th Hinode Science Meeting: Unsolved Problems and Recent Insights, 455, 17

Kilcik, A., Yurchyshyn, V. B., Rempel, M., et al. 2012, ApJ, 745, 163

Abramenko, V. I., Yurchyshyn, V. B., & Goode, P. R. 2011, arXiv:1112.2750

Abramenko, V. I., Carbone, V., Yurchyshyn, V., et al. 2011, ApJ, 743, 133

Lim, E.-K., Yurchyshyn, V., Abramenko, V., et al. 2011, ApJ, 740, 82

Yurchyshyn, V. B., Goode, P. R., Abramenko, V. I., & Steiner, O. 2011, ApJ Lett, 736, LL35

Abramenko, V., Yurchyshyn, V., Goode, P., & Kilcik, A. 2010, ApJ Lett, 725, L101

1.5 List of Relevant Publications

□ Fixed Date: 13 - 19 June 2015

 \Box Flexible Date: 5 - 7 days

□ Fixed Observing Time: 18:20:45 UT - 19:00:05 UT

 \blacksquare Suggested Observing Time: Runs once at the beginning of observations and once in the afternoon.

 \blacksquare Program runs every day

^{*}Note that Fridays may be occupied for telescope engineering time.

2 Scientific Rationale

2.1 Title

Toward the NST sunspot catalog: Connection between bright umbral loops and umbral non-uniformities such as light bridges and clusters of umbral dots

2.2 Abstract

Perform daily sunspot disk survey. Take approx 10 bursts of TiO images for each major sunspot in all active regions on the disk. Only main and well developed sunspots. No pores. The observations may be repeated during the day, whenever there is an interruption of the current observing run as well as willingness of the PI and the observer.

2.3 Short Summary of the Request

This statistical study will be based on IRIS, NST, and AIA data and is aimed at the following science question. Are the bright foot-points of umbral loops preferably rooted in or near LBs and/or clusters of UDs? The goal of this study is to look for statistical relationship using spacebased IRIS and AIA 171A images and photospheric data from the NST. We are collecting these data already. Whenever possible we will perform a disk survey with the NST acquiring hi-res images of sunspots. After that the NST is pointed at the target of the day. The outcome of the study will be an NST sunspot catalog. The NST photospheric data are critical for this study. Comparison of HMI and NST images of umbrae showed that the NST umbra is more structured and much richer with intensity variations and dynamics, the traits that appear to be critical for our study.

2.4 Scientific Rationale

2.5 Results from Previous NST Observations

Cho, K.-S., Bong, S.-C., Nakariakov, V. M., et al. 2015, ApJ, 802, 45

Yurchyshyn, V., Abramenko, V., & Kilcik, A. 2015, ApJ, 798, 136

Bong, S.-C., Cho, K.-S., & Yurchyshyn, V. 2014, Journal of Korean Astronomical Society, 47, 311

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Lim, E.-K., Yurchyshyn, V., Abramenko, V., et al. 2011, ApJ, 740, 82

Yurchyshyn, V. B., Goode, P. R., Abramenko, V. I., & Steiner, O. 2011, ApJ Lett, 736, LL35

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2.6 List of Relevant Publications

2.7 Expected Results

We expect to obtain 1-2 high quality TiO images of sunspots per observing days. These images will be used in conjunction with SDO and IRIS (whenever possible) to study the connection between the structure of sunspot umbra and hot umbral loops.

3 Observing Programme

1) TiO: 15 sec cadence, up to 10 bursts. If the seeing is stable and good, then the number of bursts can be reduced to about 4-5, i.e., 1 min of observations.

3.1 Instrumentation Requirements*

 \square Adaptive Optics (AO-308)

 \square Broad-band Filter Imager (BFI)

□ Fast Imaging Solar Spectrograph (FISS)

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- \Box Visible Imaging Spectrometer (VIS)
- □ Infrared Imaging Spectro-polarimeter (NIRIS)
- □ Cryogenic Infrared Spectrograph (CYRA)
- \Box Other

*Note that FISS and VIS can't be used simultaneously. CYRA can't operate with all other instruments simultaneously.

3.2 Observational Strategy

Perform a daily sunspot disk survey. Take approx 10 bursts (up to 5 when the seeing is good and stable) of TiO images for each sunspot in an active region. Only main and well developed sunspots. No pores. Include sunspots located as far to the limb as the AO system will allow. The observations may be repeated during the day, whenever there is an interruption of the current observing run as well as willingness of the PI and the observer.

TiO speckle reconstruction is required.

3.3 Target and Conditions

see above.