Project Details

ROSES ID: NNH07ZDA001N
Selection Year: 2008
Program Element: Independent Investigation

Project Title:
Eclipse observations of heavy ions, neutrals and dust grains in the solar corona

PI Name: Shadia Habbal
PI Email: shadia@ifa.hawaii.edu
Affiliation: University of Hawaii at Manoa
Project Member(s):
- Kuhn, Jeff R; Co-I; Institute for Astronomy
- Mickey, Donald L; Co-I; null
- Morgan, Huw ; Co-I; Institute for Astronomy
- Daw, Adrian ; Co-I/Institutional PI; NASA/Goddard Space Flight Center
- Arndt, Martina B.; Co-I/Institutional PI; Bridgewater State College
- Scholl, Isabelle F.; Collaborator; University of Hawaii
- Johnson, Judd ; Consultant; Electricon Corp.
- Nayfeh, Munir H; Co-I/Institutional PI; University of Illinois at Urbana-Champaign

Summary:
Coronal observations, spanning a field of view of approximately 4 degrees, are proposed for the total solar eclipses of 1 August 2008, 22 July 2009, and 11 July 2010. These eclipses coincide with three almost equally spaced periods of time in the rising phase of the new solar activity cycle. The goals are: (1) to map the ion abundance, electron temperature, and direction of the coronal magnetic field, (2) to explore the presence and distribution of neutral hydrogen and helium in the corona, and (3) to investigate the properties of dust grains in the near Sun environment, with complementary laboratory experiments. Polarimetric imaging in Fe X 637.4, Fe XI 789.2, Fe XIII 1074.7 and Fe XIV 530.3 nm, in S IX 1252.4 and Si X 1430.5 nm, in H alpha 656.3 nm, in He I 587.6 and He I 1083 nm, will be combined with spectroscopy in the visible and near infrared with polarization to target the properties of different ionization states of Fe, one from Si and S, and neutral hydrogen and helium. They will yield for the first time the locations in the corona where the transition from a collisional to a collisionless plasma occurs, and where the coupling between the different species decreases rapidly. This physics-based Independent Investigation for NASA's LWS TR&T program will explore the interconnected properties of coronal magnetic fields, heavy ions, neutrals, and dust grains in the corona. It will thus fill some of the deficiencies in the current understanding of the drivers of the solar wind. The complement of proposed instruments and observations will also serve as a test for an instrument suite for future space-based observations to explore this critical region of the solar wind flow that continuously shapes and controls Earth's magnetic environment.

Publication References:

Summary: no summary

Reference:
Habbal, S. Rifai; Druckmüller, M.; Morgan, H.; Daw, A.; Johnson, J.; Ding, A.; Arndt, M.; Esser, R.; Rušin, V.; Scholl, I.; (2010), Mapping the Distribution of Electron Temperature and Fe Charge States in the Corona with Total Solar Eclipse Observations, The Astrophysical Journal, Volume 708, Issue 2, pp. 1650-1662, doi: 10.1088/0004-637X/708/2/1650

Summary: no summary

Reference: Habbal, Shadia Rifai; Morgan, Huw; Druckmüller, Miloslav; Ding, Adalbert; (2010), On the Constancy of the Electron Temperature in the Expanding Corona Throughout Solar Cycle 23, The Astrophysical Journal Letters, Volume 711, Issue 2, pp. L75-L78, doi: 2010ApJ...711L..75H

Summary: no summary

Reference: Habbal, S. Rifai; Druckmüller, M.; Morgan, H.; Scholl, I.; Rušin, V.; Daw, A.; Johnson, J.; Arndt, M.; (2010), Total Solar Eclipse Observations of Hot Prominence Shrouds, The Astrophysical Journal, Volume 719, Issue 2, pp. 1362-1369, doi: 10.1088/0004-637X/719/2/1362

Summary: no summary

Reference:
Habbal, Shadia Rifai; Druckmüller, Miloslav; Morgan, Huw; Ding, Adalbert; Johnson, Judd; Druckmüllerová, Hana; Daw, Adrian; Arndt, Martina B.; Dietzel, Martin; Saken, Jon; (2011), Thermodynamics of the Solar Corona and Evolution of the Solar Magnetic Field as Inferred from the Total Solar Eclipse Observations of 2010 July 11, The Astrophysical Journal, Volume 734, Issue 2, article id. 120, 18 pp, doi: 10.1088/0004-637X/734/2/120

Summary: no summary

Reference: Habbal, S. Rifai; Morgan, H.; Druckmüller, M.; Ding, A.; Cooper, J. F.; Daw, A.; Sittler, E. C.; (2013), Probing the Fundamental Physics of the Solar Corona with Lunar Solar Occultation Observations, Solar Physics, Volume 285, Issue 1-2, pp. 9-24, doi: 10.1007/s11207-012-0115-5

Summary: no summary

Reference: Judge, P. G.; Habbal, S.; Landi, E.; (2013), From Forbidden Coronal Lines to Meaningful Coronal Magnetic Fields, Solar Physics, Volume 288, Issue 2, pp.467-480, doi: 10.1007/s11207-013-0309-5