Testing the Standard Flare Model with Hinode/EIS, RHESSI, and SDO/AIA Data

Doschek, G. A. (1), george.doschek@nrl.navy.mil; H. P. Warren (1); B. R. Dennis (2); and J. W. Reep (3).
(1) Naval Research Laboratory, Washington, DC, USA
(2) NASA Goddard Space Flight Center, Greenbelt, MD, USA
(3) Rice University, Houston, TX, USA

Hinode/EIS and RHESSI observed an M3.5 flare on 25 September 2011. At the time of the X-ray burst recorded by RHESSI at energies between 3 and ~100 keV, EIS was scanning the footpoint regions of the flare and detected the dynamics of the footpoint regions in spectral lines of O VI, Fe X, Fe XII, Fe XIV, Fe XV, Fe XVI, Fe XXIII and Fe XXIV. Large evaporation outflows in Fe XXIII and Fe XXIV on the order of several hundred km/s were measured, as well as outflows and downflows in the cooler lines. Thermal electron densities are determined from the intensity ratio of two Fe XIV lines. The EIS slit is spatially coincident with strong emission in the RHESSI hard X-ray images. The RHESSI X-ray spectra provide measures of the energy in the hot thermal plasma at ~20 MK and the total energy in the nonthermal electrons generating the hard X-rays. In addition, there was a spectacular surge-like event associated with the flare that is well observed by SDO/AIA. By a fortunate coincidence EIS continued its raster scan spatially over the surge region as it was occurring and therefore temperatures and dynamical properties of the surge plasma have been determined from the EIS spectra. The flare temperatures, densities, and dynamics resulting from an electron beam interacting in the chromosphere thick target are modeled using the 1D HYDRAD code. Results from the flare, surge, and modeling are given in this paper. This work is supported by a NASA Hinode grant.