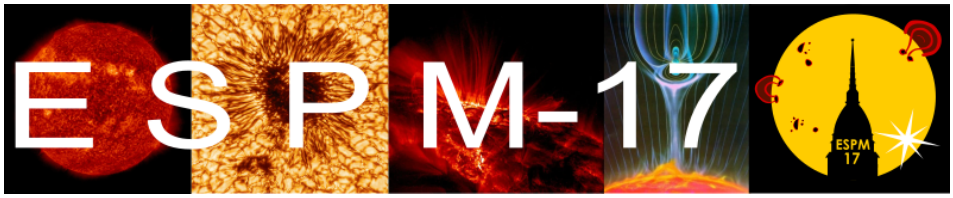

Contribution ID: **22** Type: **Poster**

Spectral Irradiance Variability in Lyman-alpha Emission During Solar Flares

The ultraviolet Lyman-alpha line of neutral hydrogen is the brightest emission line in the quiescent solar spectrum and is a significant radiator of flare energy. The study of spectrally resolved Lyman-alpha flare observations may provide a valuable diagnostic of where flare heating occurs in the solar atmosphere. Despite this potential diagnostic use, most contemporary flare observations in Lyman-alpha are not spectrally resolved. SORCE/SOLSTICE provided flux and wavelength calibrated spectral irradiance measurements of the Lyman-alpha line between 2003 and 2013. A number of these scans coincided with the impulsive phase of major solar flares, several of which were also simultaneously observed by RHESSI. This study focused on two flares of class M5.3 and M8.3, both observed by SOLSTICE and RHESSI. We compared the spectral response of the Lyman-alpha line to the properties of non-thermal electrons driving the line's enhancement. The respective flares had electron beam spectral indices of 3.38 and 7.76, with greater enhancement of the Lyman-alpha line wings relative to the line core for the former flare. Our findings illustrate a positive correlation between electron beam hardness and relative enhancement of the Lyman-alpha line wings compared to its core for flares of similar GOES magnitude. These comparisons of Lyman-alpha spectral emission and electron beam spectral index may help guide and interpret radiative hydrodynamic flare simulations such as RADYN. This research may serve as a baseline study for the advent of spectral Lyman-alpha flare observations anticipated from new instruments coming online during Solar Cycle 25, including Solar-C/EUVST and SNIFS.

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Session Classification: Coffee break and poster session 2

Track Classification: Multi-scale energy release, flares and coronal mass ejections