Nature of Prominences and their role in Space Weather
Proceedings IAU Symposium No. 300, 2013
B. Schmieder, J.-M. Malherbe, & S. T. Wu, eds.

doi:10.1017/S1743921313011459

Prominences in SDO/EVE spectra: contributions from large solar structures

Nicolas Labrosse[1], Hugh Hudson[1,2] and Maria Kazachenko[2]

[1]SUPA, School of Physics and Astronomy, University of Glasgow, Glasgow G12 8QQ, UK
email: Nicolas.Labrosse@glasgow.ac.uk

[2]Space Sciences Laboratory, University of California, USA

Abstract. The EVE instrument on SDO is making accurate measurements of the solar spectral irradiance in the EUV between 30 and 1069 Å, with 1 Å spectral resolution and 10 s sampling rate. These data define solar variability in the "Sun-as-a-star" mode and reveal many interesting kinds of variation. Its high sensitivity also makes it suitable for spectroscopic diagnostics of solar features such as flares. Here we present EVE's potential contribution to the diagnostics of large-scale, slowly evolving features such as prominences and active regions, and what we can learn from this.

Keywords. Sun: activity, Sun: prominences

1. Prominences in EVE spectra

We use AIA and EVE to study the Sun-as-a-star variability in the time range from 2010-06-19 20:00UT until 2010-06-20 06:00UT. Two active regions (NOAA 11082 and 11083) were visible on the disk, though they did not produce any flare in this time period. Two prominence eruptions occurred on the East limb during these observations.

On Fig. 1, a quiescent prominence can be seen at location (-921″, 371″). It erupts between 23:48UT and 3:40UT. This eruption is associated with a GOES A6.4 disturbance. The left panel of Fig. 2 shows that a clear signature in AIA 304 of the NE prominence eruption can be seen, well correlated with an increase in irradiance at 304 Å observed by EVE. Another prominence eruption takes place between 19:47UT and 23:10UT on 19th June on the South East limb (-939″,-407″) but its signature in EVE or AIA signals is less clear. The increasing activity near 06:00UT is due to a filament activation in an active region. Note the overall correlation between AIA intensity across its entire FOV and EVE irradiance. The right panel of Fig. 2 shows that the NE prominence event is not only detected by EVE at 304 Å but also in four Fe lines from Fe XIII to Fe XVI, revealing plasma heating during the eruption.

2. Active regions in EVE spectra

A single large active region can temporarily dominate the EVE spectra (Fig. 3). In July 2012, NOAA AR11520 became the dominant sunspot group, and we believe that the time-series data can be corrected to permit the use of many EVE lines to characterize the coronal luminosity of this region. During more confused times, with many regions, we can resort to correlation analysis based upon magnetic proxy indices.

The left panel of Fig. 3 shows irradiance evolution in one of the many EVE emission lines, Fe XV 284 Å. The right panel shows the total unsigned magnetic flux of the whole solar disk derived from the HMI/SDO. Dashed vertical lines show moments when the

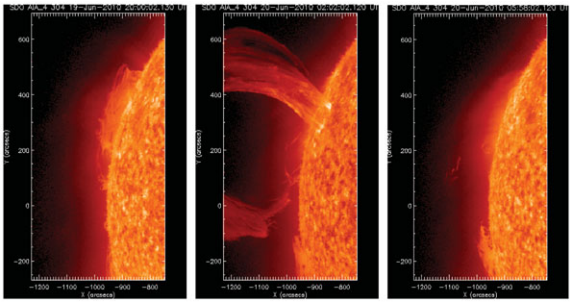

Figure 1. AIA 304 Å observations of the NE eruption at (from left to right) 20:00UT (2010-06-19), 02:02UT, and 05:58UT (2010-06-20).

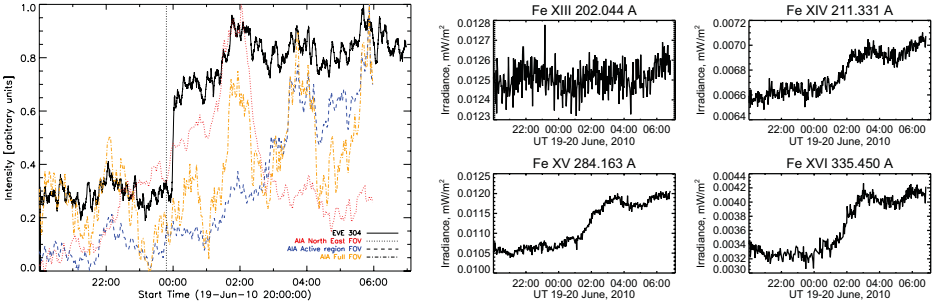

Figure 2. Left: Light curves from EVE and AIA at 304 Å for the 20 June 2010 event. The sudden increase in EVE 304 Å at 00:00UT is an artefact, but the irradiance increase before 02:00UT correlates with the AIA signal from the NE prominence. The vertical dotted line shows the start of the eruption. **Right:** Four EVE lines, at different Fe ionization states, that are well-observed and show hints of the prominence activity.

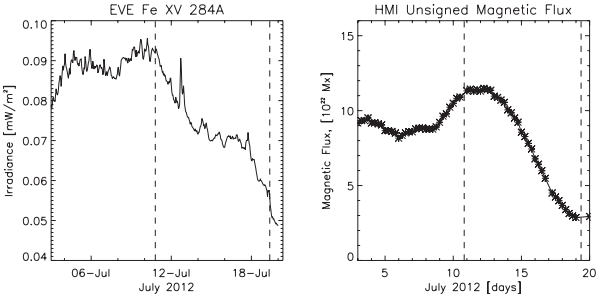

Figure 3. Irradiance in Fe XV 284 Å, and total unsigned magnetic flux of the whole solar disk.

AR NOAA 11520 was at the disk center and away from the visible disk. The latter can be used as a quiet sun level for studying the AR properties.

3. Conclusions

EVE data can be used to analyse individual large-scale events, such as prominences and active regions. We believe that other and much better examples will be found in future surveys. The signatures are difficult to interpret without AIA, but the combination of these instruments should provide good characterizations of different solar features, for which the full EVE spectroscopy can be deployed for physical characterizations.