

# Study of the structures of the explosive events in the UV

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**Abstract.** We analyze Si IV 139.37 nm emission line during solar Explosive Events (EE) near the center of the solar disk with the aim to study the structure of the sources of EEs observed at the VUV. The observations were made by SUMER, on board SoHO, with a raster regime of six EW positions that allowed us to identify the times and EW, NS positions of the maximum amplitude of each EE. Based on one dimensional NS distributions at three different wavelengths (blue, central and red) for times around each maximum we have identified three different shapes of the sources. Also, It was found that the maximum at the blue wing is attained after the maxima at red and central wavelengths.

**Keywords.** Sun: UV radiation, corona, activity, techniques: spectroscopic

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## 1. Introduction

A class of some sudden increase of VUV emission in small spatial scale (2–4 arcsec) that take place at the solar TR are referred to as Explosive Events (EEs). EEs occur in 1 – 4 minutes (Kirk *et al.* 1994), sometimes with line wing increases that denote flows of 100 – 250 km/s (Innes & Toth 1999).

EEs have been observed with a rate of occurrence of more than 1000 per second all over the solar disk (Brueckner & Bartoe 1983) which could give a non negligible input of energy for Coronal Heating.

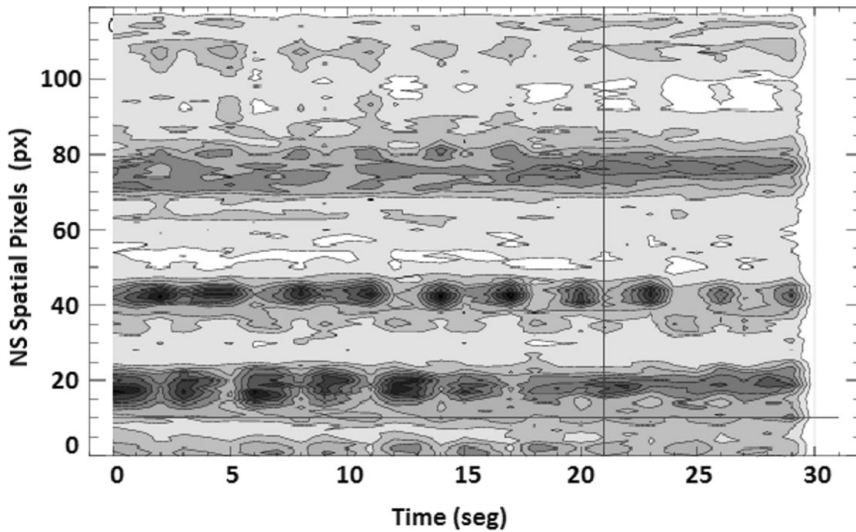
The extension of the EEs has been studied considering the region where the amplitude of the area covered by the slit was maximum, but it has not been verified if the observed increase corresponds to the maximum attained over the extension of the EE (Mendoza-Torres, Torres-Papaqui & Wilhelm 2005).

In studying the structure (projected on the disk) of EEs it is important to know the actual extension. In order to do this, it is necessary to identify the events that really where sampled all the way during the increasing and decreasing phases and whose maximum became at the central regions of the observed field. Then, we are able to study the structure over such field.

A better knowledge of the source structure can help us to identify the energy transport between the layers of the Sun around the TR, (Chae *et al.* 1998a).

## 2. Observations

We selected SUMER data for the Si IV line at 139.37 nm (Wilhelm *et al.* 1995 in a raster regimen that produces spectra for a field of 120''NS × 6''EW of June 20th



**Figure 1.** Plot of amplitude as function of NS position and time. It may be seen that EEs take place at some preferential locations.

1996, where Coronal Holes and Active Regions were not observed, with an integration of 5 seconds at each position.

### 3. Data analysis and results

From the 2.5 h of SUMER data for June 20th, 1996 we selected EEs based on some criteria. In such a way we selected EEs for which both the rising and the decreasing phases were observed and whose maximum was not observed at the extremes of the field. With these restrictions we get a sample of 41 EEs (Table 1). For the selected EEs, one dimensional NS distribution profiles were made for the amplitude at the central wavelength of the line and for wavelengths at both wings (blue and red) for times around the maximum. This method does not require to fit Gaussians in order to identify flows. We have seen that EEs are observed at some given preferential locations (Fig. 1).

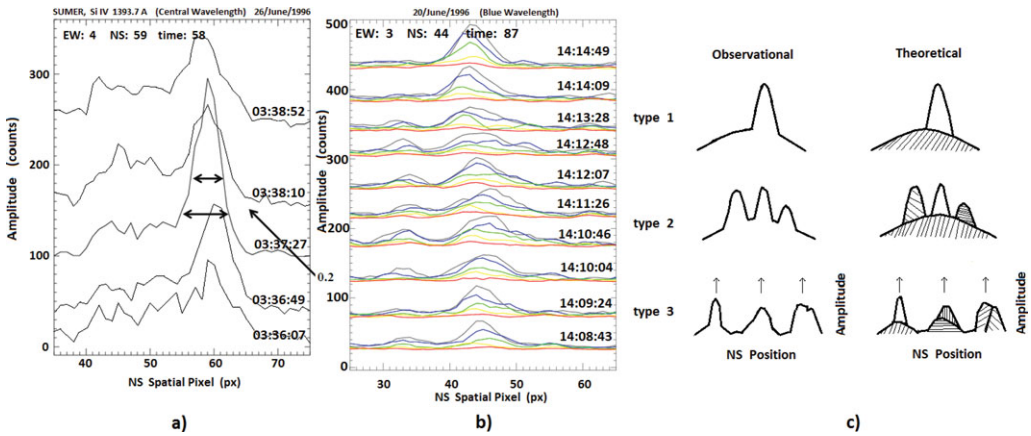
The extensions of the sources during the maximum at each of the wavelengths were estimated at 0.5 and at 0.2 of the maximum amplitude.

**Table 1.** Amount of EEs at the different wavelengths and combinations of them

<i>Component</i>	Amount	Combination	Amount
All	41	Blue-Central-Red	18
		Blue-Central	2
Blue	26	Blue-Red	5
		Central-Red	5
Central	26	Blue	1
		Central	1
Red	33	Red	5

Based on the NS distributions we noticed that one after another maxima can take place around a given location which means that an EE could be related to more than one

energy release. Most of the EEs have a component of low amplitude but large extension surrounding the maximum amplitude as shown in Fig. 2c.



**Figure 2.** a) NS Distributions for the growing, the maximum and the decreasing phase of an EE. An extended region with increased amplitude is observed during the EE, local variations at this region occur during the EE. b) Amplitude distributions around the time and location of the maximum amplitude of an EE. Increases at near locations are seen. c) Schematic representation of the possible sources that could be taking place for the different types of distributions observed to occur in the studied EEs.

We found out that 18 EE showed increases of the three wavelengths and fulfilled the selection criteria.

Expansion and displacement of the sources are sometimes seen after the occurrence of the maximum amplitude (Fig. 2b).

In most of the cases the blue maxima occurred after the central maxima (11 cases of 18 EEs). For the red component we found that in 7 of 18 occasions it took place as the central maxima (at the same time) and 4 of 18 red was attained before the central maxima (Table 1).

This behaviour and the spatial one (Fig. 2) around maxima seem to indicate that more than one energy releases take place or that it happens several up and down flows in one EE, possible in different locations and in different phases of the EE.

## References

- Innes, D. E. & Toth, G. 1999, *Solar Physics*, vol. 185, 127–141  
 Wilhelm, K. *et al.* 1995, *Solar Physics*, vol. 162, 189–231  
 Chae *et al.* 2003, *Journal of the Korean Astronomical Society*, vol. 36, 13–20  
 Brueckner, G. E. & Bartoe J.-D. F. 1983, *Astrophysical Journal*, vol. 272, 329–348  
 Chae, J., Wang, H., Lee, C., Goode, P., & Schuhle, U. 1998, *Astrophysical Journal*, vol. 504, 123  
 Mendoza-Torres, J. E., Torres-Papaqui, J. P., & Wilhelm, K. 2005, *Astronomy and Astrophysics*, vol. 431, 339–244  
 Brekke, P., Hassler, D. M., & Wilhelm, K. 1997, *Solar Physics*, vol. 175, 349–374  
 Dere, K. P. 1994, *Advances in Space Research*, vol. 14, 413–422