

# Investigation of pre-flare role of Ellerman bombs in solar active regions

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**Abstract.** Ellerman bombs or moustache are known as short-living fine emission structures associated with a local energy release in solar atmosphere. The relation between the moustaches and flare has been discussed since the moment of the moustaches discovery. The recent results of the Flare Genesis Experiment demonstrated that this problem is still actual and attractive. We took into account the possibility of different mechanisms of their origin (thermal and non-thermal) by using spectro polarimetric data obtained in summer 1999 and carried out analysis of Ellerman bomb's role in flare activity of the Sun by the example of the several active regions.

**Keywords.** solar flare, moustaches, pre-flare activity

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## 1. Introduction

Ellerman bombs or moustaches are enigmatic phenomena in the solar atmosphere. The relation between the moustaches and flare has been discussed since the moment of the moustaches discovery (for example, Severny, 1968). The recent results of the Flare Genesis Experiment (Georgoulis *et al.*, 2002; Schmieder *et al.*, 2002) attracted attention to this problem again.

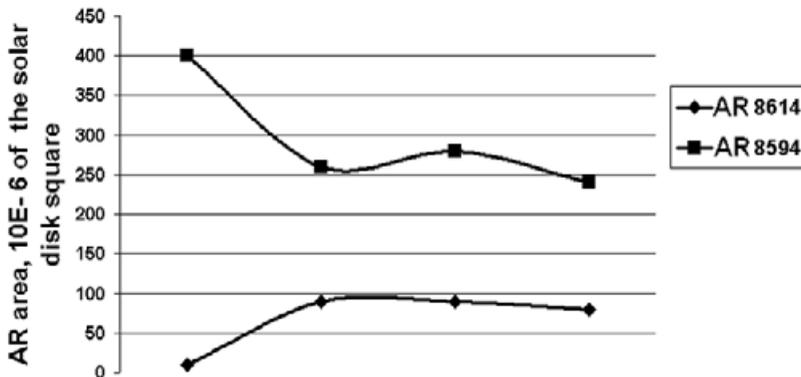
There are the several models suggesting explanation for so fast and at the same time so local energy release. The polarization observations take up the special place among the methods of the moustache investigation. For example, only they allow to extract moustaches which emission were excited by beams of energetic particles. The peculiarity of current study was to choose the moustaches most possibly produced by energetic particle beams. Then we analyzed if something has been changed in flare activity in after "non-thermal" Ellerman bombs observation or not. Obtained results were compared with flare activity evolution after observation of Ellerman bombs which has not indication of non-thermal electron beam presence.

## 2. Observational data

For our investigation we used spectropolarimetric observations of 164 moustaches obtained by Large Solar Vacuum Telescope in summer 1999. The criterion for selection of Ellerman bombs with most probable non-thermal mechanism of origin was a linear polarization in H $\alpha$  line center. A information about possible mechanism of Ellerman bomb origin was gotten from Zharkova & Kashapova (2005). Results are presented in Table 1. The flare activity evolution was investigate 7 days before and after moment of moustaches observation. Thus, during this period we take into account all flares (H $\alpha$  flares, hard and soft x-ray flares) occurred in active region (AR) where the moustaches were

**Table 1.** The time of observation and location of moustaches with significant polarization

DATE	AR	UT
22.06.1999	8594	5:49–5:50
27.06.1999	8598	9:38
28.06.1999	8611	7:50–7:55
04.07.1999	8614	8:46–9:26
14.07.1999	8627	7:10–7:28
06.08.1999	8656	1:11–1:13
09.08.1999	8662	9:14

**Figure 1.** Evolution of AR area during the study period for cases of flare activity increase (AR 8614) and absence of considerable changes (AR 8594).

found. For this purpose we used data from the flare observation catalogues by GOES, Yohkoh and BATSE.

### 3. Preliminary conclusions

- Flare activity increase was not revealed in AR where Ellerman bombs with thermal mechanism excitation were observed.
- A flare activity response was ambiguous in AR where Ellerman bombs with non-thermal mechanism excitation were observed.
- During current study, a rise of flare activity was revealed only for AR with the small (less than 100 millionths of the solar hemisphere) and developing area where Ellerman bombs with non-thermal mechanism excitation were observed (Fig. 1).

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