ABOUT POLAR EJECTION EVENTS AND SURGES

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ABSTRACT

$H_\alpha$-time sequences and CCD spectra of observations taken with the 16’ NSO/SP coronograph are revisited in the light of recently obtained HeII polar surge sequences taken with EIT-SOHO. We interpret small polar surge events seen in $H_\alpha$ as the cool counterpart of a more extended coronal phenomenon which could be the result of an explosive release of energy of magnetic origin. The dynamical behaviour of small ejecta could also be considered as a microsurge in the frame of evolving loops assuming a preferential heating at their top. Accordingly, the occurrence of ejecta with large upward velocities should be considered as an exception and need careful and critical analysis.

1. INTRODUCTION

In order to understand coronal heating (apparently continuously supplied), and the mechanism that produces the solar wind, dynamic and explosive events near the solar surface (lower corona) have to be considered as possible sources, besides high and/or intermediate frequency dissipation of MHD-Waves (e.g. Baudin et al., 1996). Dynamic events in form of nanoflares, being ubiquitously seen at the solar limb, were already suggested by Parker (1988). The newly described SXR polar Coronal Flashes and jets (Koutchmy et al., 1997) seem here to be valid candidates as well many very small scale phenomena reported in EUV. Here we try to establish their possible relation to simultaneous $H_\alpha$ observations.

2. HeII POLAR SURGES AND TRANSIENT BRIGHTENINGS (FLASHES)

2.1. Analysis of a time series of EIT - HeII frames of a selected part on the disk

We extracted from the EIT archive a time series taken on the N-polar region, which includes a C.H., using the HeII/SIXI - 304 channel working in a partial mode. Every frame is taken with a 30 sec exp. time in a cadence close to 1mn. Many transient brightenings are seen; because of their rather short lifetimes we also call them “flashes”. We choose several typical events (all on the disk) as shown in fig.1 marked from A to I. Their respective light curves are given in fig.2; We used different integration areas to measure the instantaneous flux, given by the number of pixels in both radial and tangential direction. The highest resolution is 1x1 px which is barely limited by the effect of solar rotation (not removed). Brightenings are observed having typical lifetimes from 4 to 6 mn to more than 15 mn. Note the event “D” which is recurrent with a period of the order of 15 mn. It appears that these HeII events are not just clusters of spicules but rather different eruptive events resembling to small surges.

2.2. Analysis of time series taken simultaneously in HeII and $H_\alpha$ near the limb

From a comparison of single shot pairs of simultaneous images (fig.3.) it is difficult to ascertain any detailed relation between observed HeII events and a corresponding $H_\alpha$ counterpart. Only the time series (fig.4.) reveal a definite relation: The HeII surge appears first, while the corresponding $H_\alpha$ event is seen as brightening about 10 mn later. Both events start with an intensity enhancement at the base, with subsequently expansion upwards, then fading first in $H_\alpha$ and then (about 5 mn later) in HeII. A blob (cloud) appears over the region in the late $H_\alpha$ phase. A detailed description of the $H_\alpha$ ejections is found in Koutchmy and Loucif, 1992, and Loucif (1994); our typical example is shown in fig.5. The small polar surge phenomenon may be considered as the cooler counterpart of a more extended coronal phenomenon which could be the result of an explosive release of energy of magnetic origin. We now think that the dynamical behaviour of small ejecta could also be interpreted in the frame of evolving microflaring loops, assuming a preferential heating at their top. Accordingly, the occurrence of ejecta with large upward velocities should be considered as an exception and need a more careful and critical analysis.


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Figure 1. Several typical events (on the disk) marked from A to I.

Figure 2. Light Curves of Several Typical HeII Flashes - 304 Å - EIT/SOHO - 1px = 2.55"
Figure 3. Well developed polar surges simultaneously observed in Hα and HeII 304.

Figure 4. Time series of simultaneously observed frames of polar surge phenomena in Hα and HeII 304.

3. CONCLUSION

The apparent correlation between the described HeII-EUV Impulsive Events and their counterpart in Hα needs a careful assessment before any definite scenario be proposed. It is not clear indeed they can be valid candidates to explain the fast solar wind.

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