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PROMINENCE ERUPTION ON 22 AUGUST 2006 OBSERVED WITH THE H_α CORONAGRAPH IN NAO ROZHEN

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Abstract. An eruptive prominence (EP) on 22 August 2006 was observed with the Hα coronagraph in the National Astronomical Observatory (NAO) – Rozhen, Bulgaria. The kinematic pattern of the EP was studied and the basic parameters of its eruption were determined. The associations of the EP with the filament oh the solar disc and solar radio events are presented.

1. BACKGROUND

The EP occurred at the southwestern solar limb (S16° W) between 04:28 UT and 11:00 UT. The eruptive event presents seven successive eruptions during that time interval (Table 1). Each eruption, after first one, reaches smaller maximum height than previous one. The eruptions run at an angle of 45° about the limb and show two distinctive phases: rising phase and post-eruptive phase, when the prominence plasma flow back to the chromosphere by the same trajectory (Fig.1).

The eruptions are associated with a filament located at the western end of an active region NOAA 10904 at approximately the same place. The EP is associated with some activity events in solar radio emissions at 164 MHz (Nancay Radioheliograph) and 17 GHz (Nobeyama Radioheliograph).

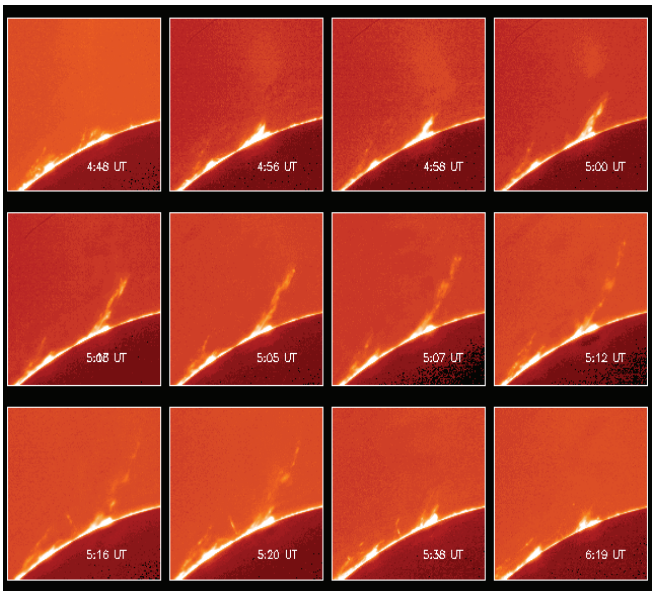

Figure 1: A sample of the EP observed on 22 August 2006 between 04:29 and 08:43 UT.

Table 1: Time of the onset and H_{max} of the seven successive eruptions of the eruptive event.

UT	Time (min)	Eruption Number	Remark
04:47:55	19,1	1	start
05:13:21	44,6		H_{max}
06:22:09	113,4	2	start
06:53:08	144,4		H_{max}
07:21:15	172,5	3	start
07:32:56	184,2		H_{max}
07:49:34	200,8	4	start
08:03:44	215,0		H_{max}
08:06:03	217,3	5	start
08:19:51	231,1		H_{max}
08:24:20	235,6	6	start
08:31:26	242,7		H_{max}
08:33:07	244,3	7	start
08:35:15	246,5		H_{max}

2. OBSERVATIONS

The EP was observed in NAO Rozhen by 15-cm coronagraph with Hα filter (1.8 Å bandpass). The coronagraph (Fig. 2) has 225 cm focal length of the main objective and an effective focal length of its optical system of 450 cm. The resolution of Hα filtergrams is of about 2". The images were registered with digital camera Canon EOS 350D (8 Mpxs). The first eruption was registered with an average cadence 1.3 minutes. The registered images, at maximal camera resolution, have size of 3456x2304 pxs and one pixel corresponds to size of 6.4 x 6.4 μм.

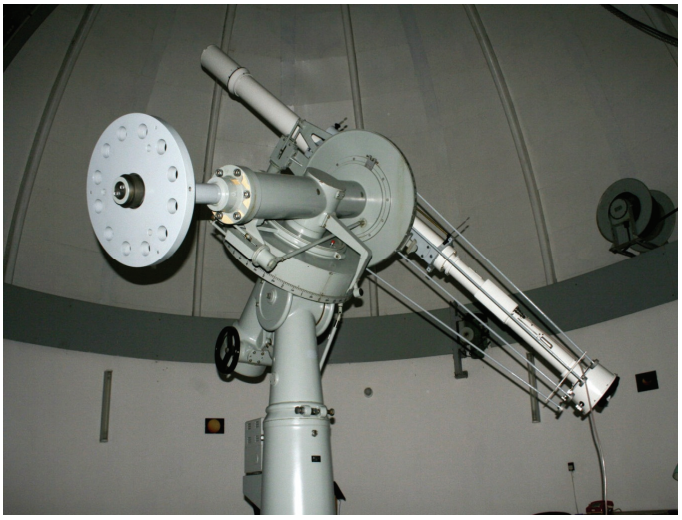

Figure 2: The 15-cm Hα coronagraph mounted in the solar tower at NAO Rozhen, Bulgaria.

3. RESULTS

This work presents the kinematic pattern of the first of the seven eruptions of the event on 22 August 2006. The first eruption presents two main phases: eruption and post-eruption ones. During the eruption phase, the EP rises with almost constant velocity of 153 km/s and it reaches a maximum height of 270 000 km at 05:13 UT (Fig.3a). During the post-eruptive phase, the EP shows return motion by the same trajectory with an increasing velocity that reached a value of about 300 km/s near the solar limb (Fig. 3b). The kinematics of the eruptive process is summarized in Table 2.

The EP shows a specific behavior during its eruptive activity. The presence of several successive eruptions during its observations suggests recurrent eruptive activity like those of the surges. However, in contrast to the surges where the time

between successive eruptions is approximately one hour, this time for the EP progressive increases from 94.3 min between the first two eruptions to 8.7 min between last two eruptions (see Table 1). On the other hand, the prominence plasma visible in Hα line clearly outlines a helical twisted structure of the prominence body that is typical for the eruptive prominences, while the surges occur in approximately radial magnetic field (Roy 1973a, b).

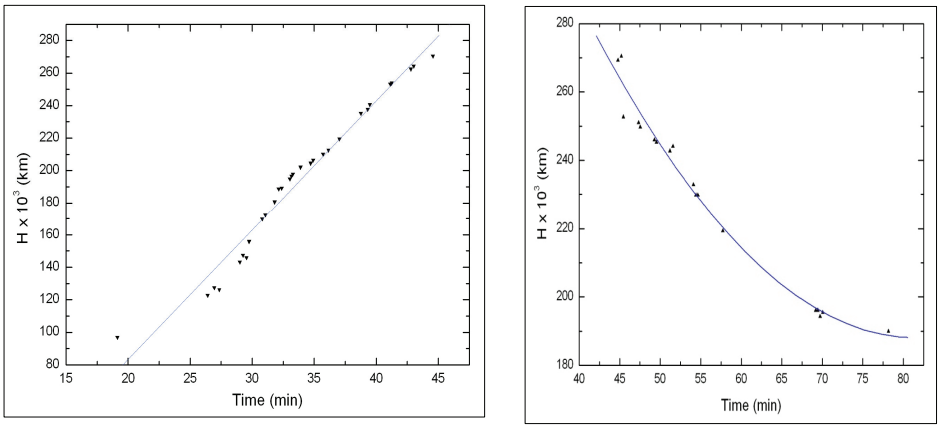

Figure 3: (*left***)** Height-Time diagram of the EP eruptive phase. *(right***)** Height-time diagram of the EP post-eruptive phase. The time is given in minutes after 04:28 UT.

Table 2: Basic kinematics parameters of the first eruption of the EP

Parameter	**Eruptive phase**		**Post-eruptive phase**	
	Onset	End	Onset	End
UT	04:47:55	05:13:21	05:13:34	05:46:48
Velocity km/s	153		230	302
Acceleration m/s^2	0		32	32

The EP on 22 August 2006 is associated with a part of a filament located at the western end of an active region NOAA 10904 (Fig. 4). The EP appeared along the polarity inversion line (PIL) of NOAA AR 10904 (S12°W91°) during its last stage when AR's magnetic configuration is α/β according to the Hale classification (Hale and Nicholson, 1938). Eight soft X-ray flares of class C appeared in the AR on 20 and 21 Aug 2006. The filament erupted part was situated along the PIL

in the AR 10904 (Figs. 5 and 6). The filament has almost ring shape that encircles the positive magnetic polarity in the east of the PIL. Therefore, the filament has a "normal" magnetic configuration.

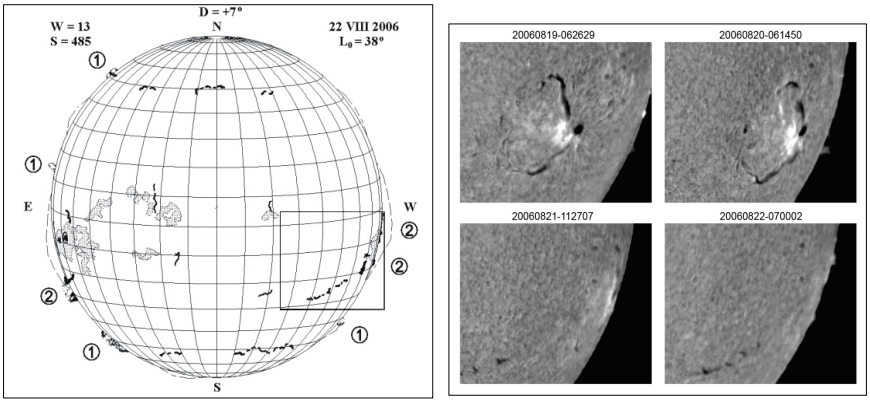

Figure 4: (*left*) Daily chart of the Sun from the Bulletin "Solnechnye Dannye" of Pulkovo Observatory. (*right*) Kanzelhöhe Solar Observatory Hα filtergrams of the NOAA AR 10904 between 19 and 22 Aug 2006.

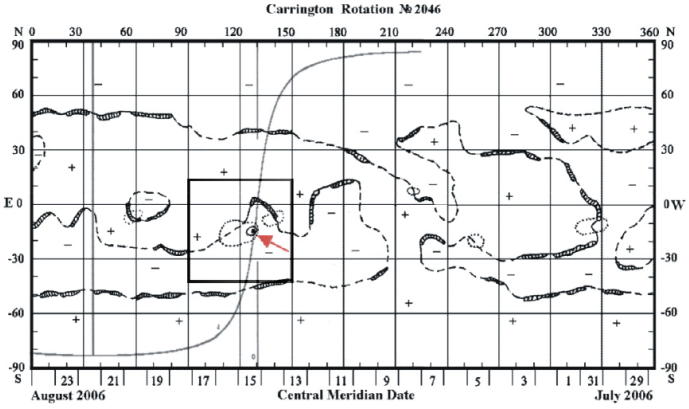

Figure 5: Pulkovo Hα synoptic chart of the filament channels with the over-layered solar limb for the date 22 August 2006. The red arrow indicates the EP position (see electronic version).

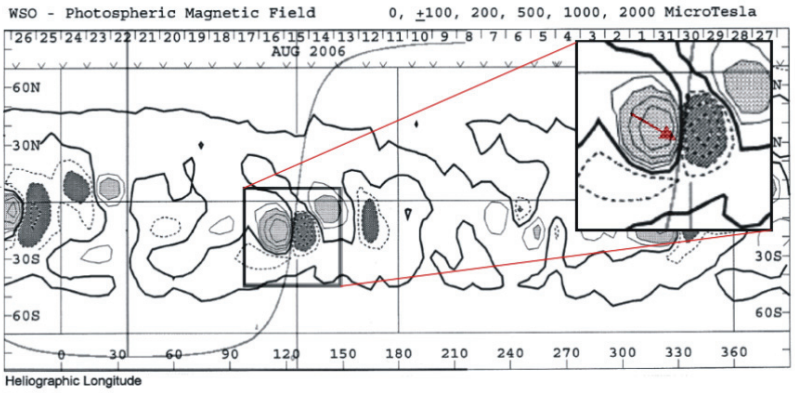

Figure 6: WSO synoptic chart of the photospheric magnetic field with the over-layered solar limb for 22 August 2006. The red arrow in the enlarged selected field indicates the EP position (see electronic version).

The EP is associated with the solar radio emissions at 164 MHz and 17 GHz. The Nancay radio images at 164 MHz (Fig. 7) indicate expanding loops (EL) inside a CME-like large magnetic system, which are observed because they are illuminated by the gyro-synchrotron emission of MeV accelerated electrons. The source and direction of movement of EL are the same as those of the EP on 22 August 2006. The Nobeyama radio images at 17 GHz show the radio analog of the EP on 22 August 2006 at the time when the first eruption in Hα reaches a maximum height (Fig. 8, left). The right images on Fig. 8 show the EP radio analog at the time when the second eruption in Hα reaches a maximum height.

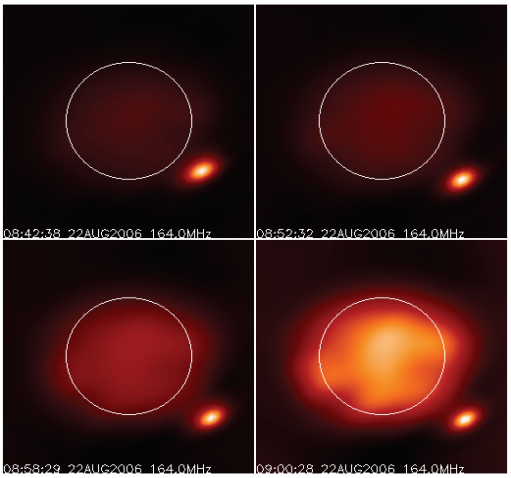

Figure 7: Nancay radio images of the Sun at 164 MHz on 22 August 2006.

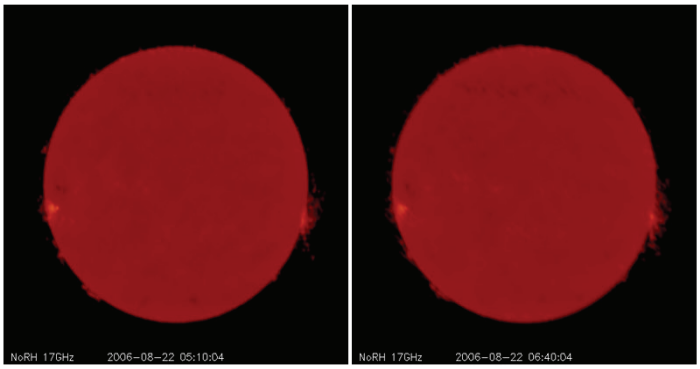

Figure 8: Nobeyama radio images of the EP on 22 August 2006 at 17 GHz.

4. CONCLUSIONS

The EP on 22 August 2006 is interesting case that presents series of seven successive eruptions during the observation time. The first eruption of the EP shows two distinctive phases: eruptive phase with constant velocity 153 km/s and post-eruptive one, during which the EP shows return motion by the same trajectory with increasing velocity reaching 300 km/s near the limb. The EP presents an erupted part of an active region filament with a "normal" magnetic configuration. There is no association of the EP with coronal mass ejection {CME) but the EP is associated with radio structures at 164 MHz, which suggest expanding loops inside a CME-like large magnetic system. In the forthcoming study, the kinematic patterns of the next six eruptions will be studied and compared with those of the first eruption of the prominence.

Acknowledgments

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