TALL CORONAL JETS SEEN OCCASIONALLY IN Hα

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Abstract. Some features of tall coronal jets observed at rare occasions in H_α above the solar limb after the prominence eruptions are discussed. The jets usually reach the height of a few hundred thousands kilometers above the solar surface and exibit filamentary structure.

Key words: Thin Prominences – Dynamics

H_α coronagraphic observations on the solar limb reveal at some rare occasions tall, thin jets of surge-like appearance oriented more or less vertically to the limb. They reach a height of a few hundred thousands kilometers and were found to be formed from a number of fine filaments. During the evolution those structures shoot up very similarly like surges do but reach much higher altitudes. Therefore, the mechanism of their ejection should be very similar to that of the surge one. The material of a surge is injected into a loop and propagates along one arm of such a loop or, at rather rare occasions, along the whole magnetic tube. The material of jets sems to be ejected from the photospere and/or subphotospheric layers along a bundle of fine magnetic filaments being stretched out, in this case, high in the corona during a late phase of the prominence eruption. Nevertheless, there is also another possibility to account for the observed grow of the H_α coronal jets. Namely, the material of a quiescent or an active region prominence being initially lifted up high to the corona by a process of eruption of the magnetic system associated originally with these prominences, is forced by the gravitational forces to fall down and in consequence to accumulate in the lower part of the fine magnetic filaments stretched by the eruption. This process of material accumulation in the fine magnetic filaments may give the impression of the apparent upward motion of material in the jet column.

Evolutional behaviour and some peculiarities of H_α coronal jets are discussed here and exemplified by an example of the jet observed with the Large Coronagraph (LC) and Solar Horizontal Telescope (SHT) at the Astronomical Institute of Wroclaw University on 10 October 1991.

About 3 hours before formation of the coronal jet (at 1050 UT) an eruptive prominence was observed at S08-W90 with LC (Fig. 1) very close to the jet position. The jet started to form at about 1345 UT at the limb location S01-W90. The jet was very likely formed in the northern leg of the eruptive prominence, during a late phase of eruption. Then the magnetic filaments forming the northern leg of the erupting arch

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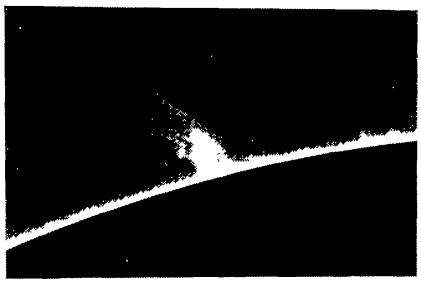

Figure 1. An eruptive prominence observed in H_α with LC at S08-W90 on 10 October 1991 at 1056 UT - about 3 hours before formation of the coronal jet.

was displaced to the north by at least 85 Mm (to the location S01-90W) by the effect of the horizontal expansion of the prominence during its vertical eruption (Rompolt, 1984 and 1990).

A sequence of pictures illustrating the initial phase of evolution of the coronal jet taken with SHT through a 0.5 Å H_α filter is shown in Fig. 2. Evolution of the jet in

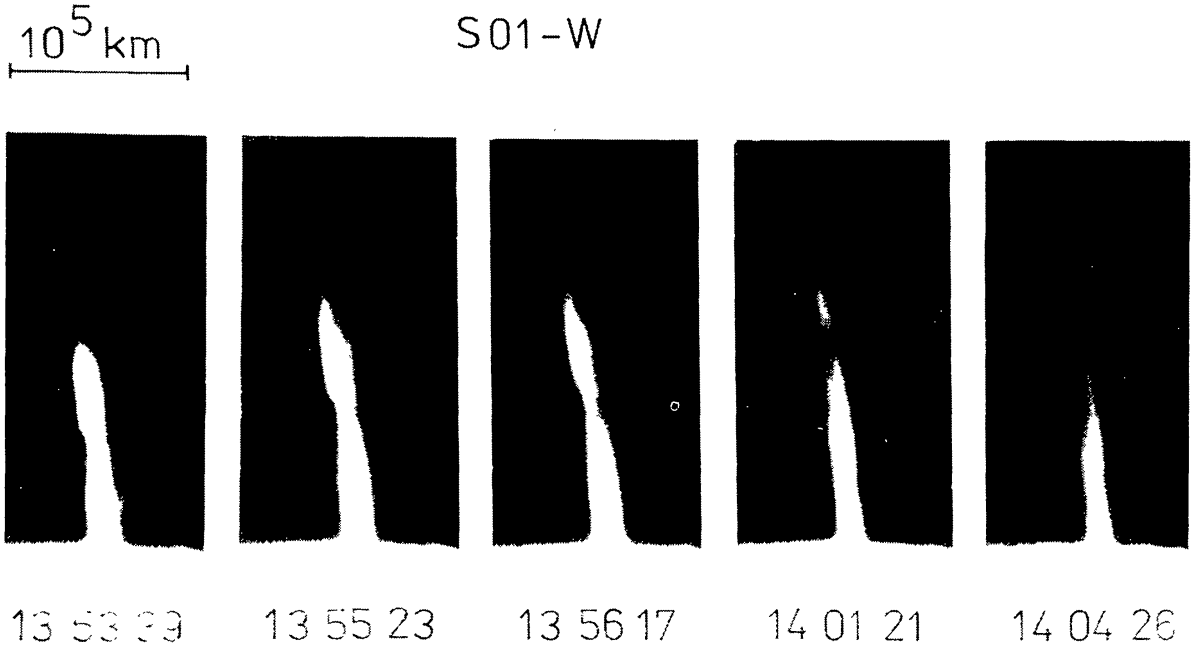

Figure 2. Early phase of evolution of the coronal jet recorded with SHT. A large surge (?) or prominence material (?) originally lifted high in the corona by the eruption and subsequently flowing down to the chromosphere along a bundle of magnetic filaments.

this phase resembles the evolution of a surge. The upward velocity determined for the apparent motion of the head knot of the jet is of 18 km/s only, in this initial phase of evolution. This is a rather low velocity value for the upward velocity of a typical surge.

High resolution sequence of H_α pictures of the coronal jet in a late phase of its evolution, taken through a 3 Å bandpass filter with LC, is presented in Fig. 3. The

material here is clearly seen to flow down. The measured velocity ranges from 50 km/s at around 1411 UT up to 130 km/s at 1420 UT.

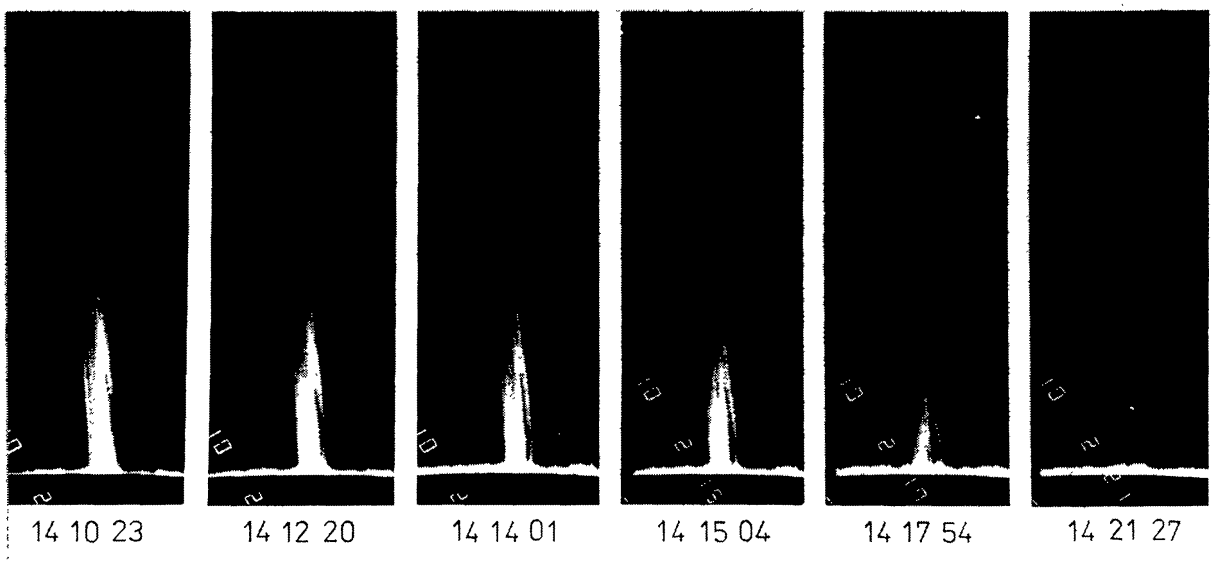

Figure 3. High resolution H_α pictures of the coronal jet taken with LC showing its appearance in the late phase of evolution.

The jet exhibits fine filamentary structure (Fig. 4). The width of the individual fine filaments forming the jet are in the range 750-1,400 km.

Figure 4. High resolution picture of the bottom part of the coronal jet taken with LC at 1410 UT.

One can identify on the original negatives about 7 fine filaments in the jet. The entire width of the jet (of the bundle of fine filaments) is of about 13,000 km. Accepting a cylindrical symmetry for the jet as well as for the fine filaments, a diameter of 1,000

km for the fine filaments, and 10 fine filaments in the jet (because of the effect of screening) one can get the filling factor of 1/17 for the jet.

The coronal jet initially formed, up to 1412 UT by the evidently twisted bundle of fine filaments undergone untwisting during the next 15 minutes, forming a divergent plume of filaments. Such a structure seems to be a consequence of untwisting during the process of eruption to a system of loops of an original prominence (QP) initially formed by a number of twisted and/or intertwined fine filaments (Rompolt, 1984, 1990).

A very similar event of two simultaneously growing very high coronal jets was recorded in H_α through a 3 Å filter with the Small Coronagraph (SC) of the Wrocław Astronomical Institute on 13 April 1980 at around 0905 UT (Fig. 5). The jets reached a height of 200 Mm and were formed after the ejection of a spray and a CME from the same limb region (Harrison *et al.*, 1988).

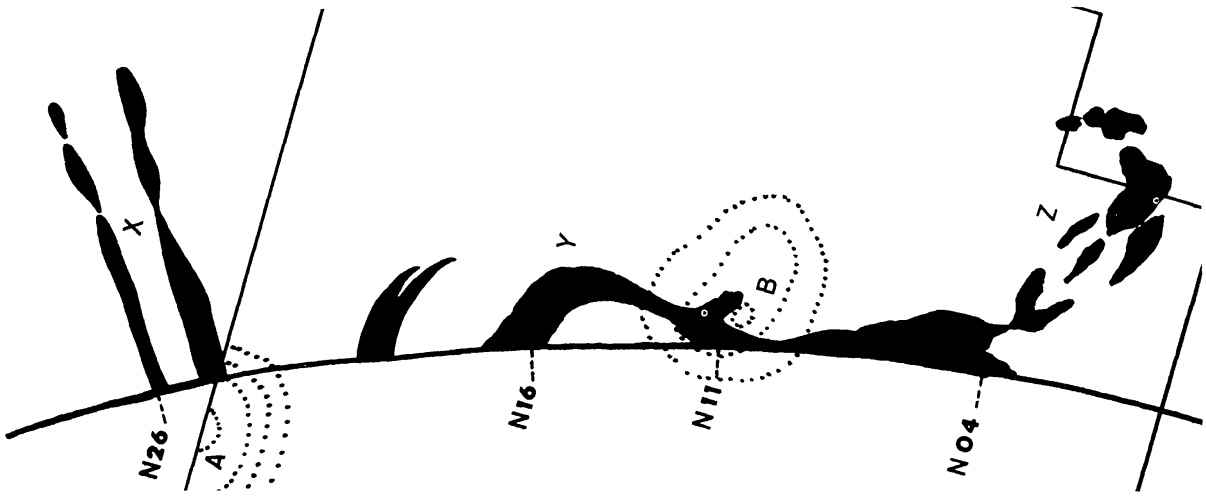

Figure 5. A schematic drawing of two very high coronal jets observed in H_α with SC on 13 April 1980.

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