CORONAL STRUCTURES OBSERVED IN X-RAYS (NIXT) AND Hα SURGES

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Abstract

Ground-based coordinated observations with the Multichannel subtractive double pass spectrograph (MSDP) and the heliograph in Meudon allowed us to portray the chromospheric intensity and velocity fields below coronal structures observed with the Normal Incidence X-ray Telescope (NIXT). On July 11, 1991 (eclipse day) we have identified in AR 6713 (N38 W 42) the X-ray signatures of the network, subflares, filaments and surges. The largest Hα surge has only weak emission in X-ray, while a weak Hα feature corresponds to a very bright x-ray subflare. We calculate the emission measures of these events and give some constraints on the triggering mechanisms of surges.

1. Introduction and Observations

The observations have been described in details by Schmieder *et al.* (1993, 1994a,b). We shall report them briefly. A recurrent surge (S) has been observed with the Meudon heliograph (Fig. 1). The figure 2 displays the X-ray image observed by NIXT at 63.5 Å, sensitive at $T=1$ and 3×10^6 K in the top pannel and in the bottom pannel the Hα image (composite of intensity and velocity) obtained with the MSDP operating at Meudon. The letter S indicates the large Hα surge and the X-ray weak signature, the letter G the X-ray microflare and the Hα weak intensity signature. Along the surge S and in G large Hα flows are detected. The microflare G is directly related to a chromospheric dynamical event. This may be an exemple of dynamism without evident energy transport.

2. Model

The data set described above provides a unique opportunity to test models of surges and, in particular, models in which the motions are driven by gas pressure gradients. The

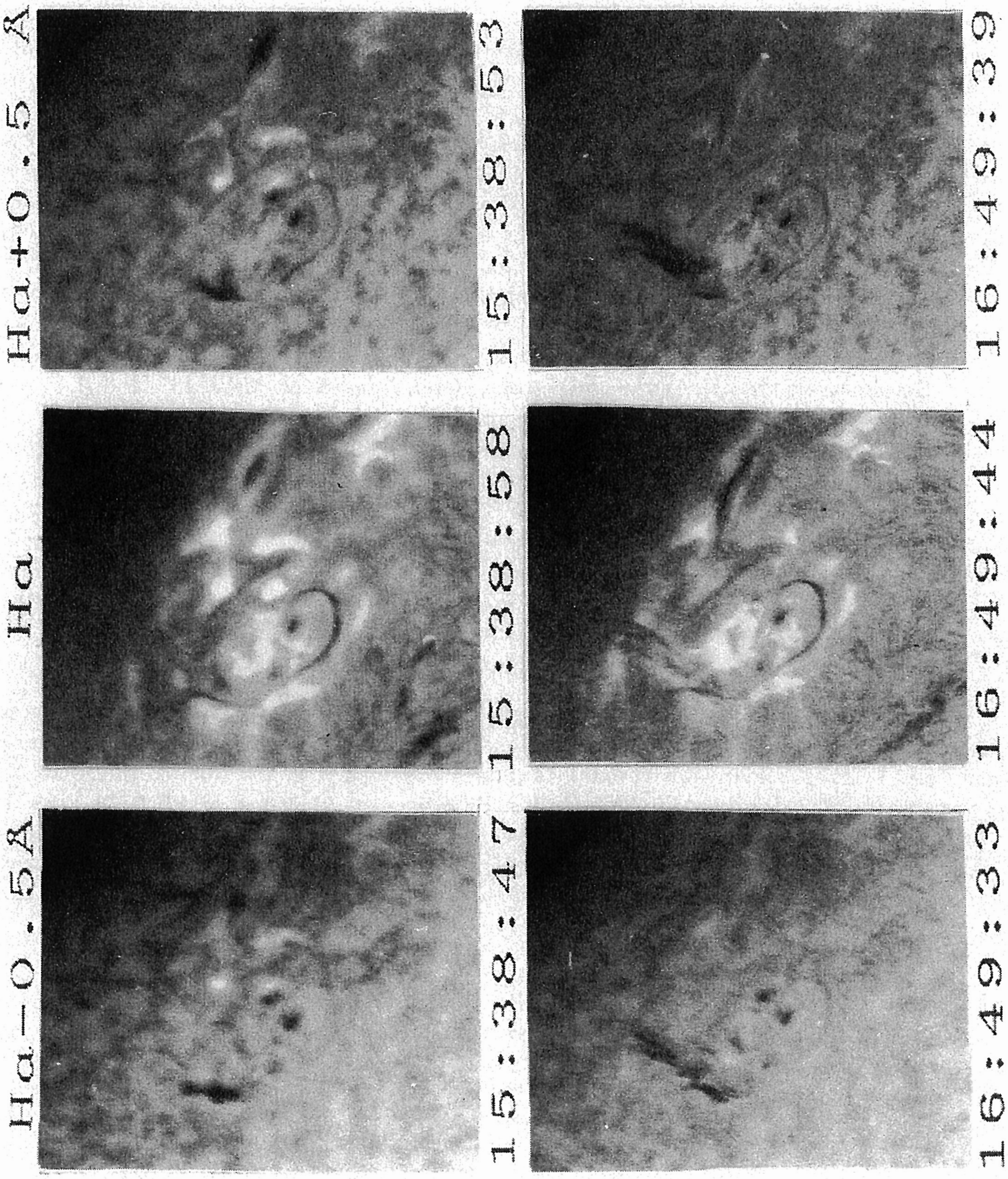

Fig. 1. Meudon 3-λ heliograms of AR 6713 on July 11, 1991

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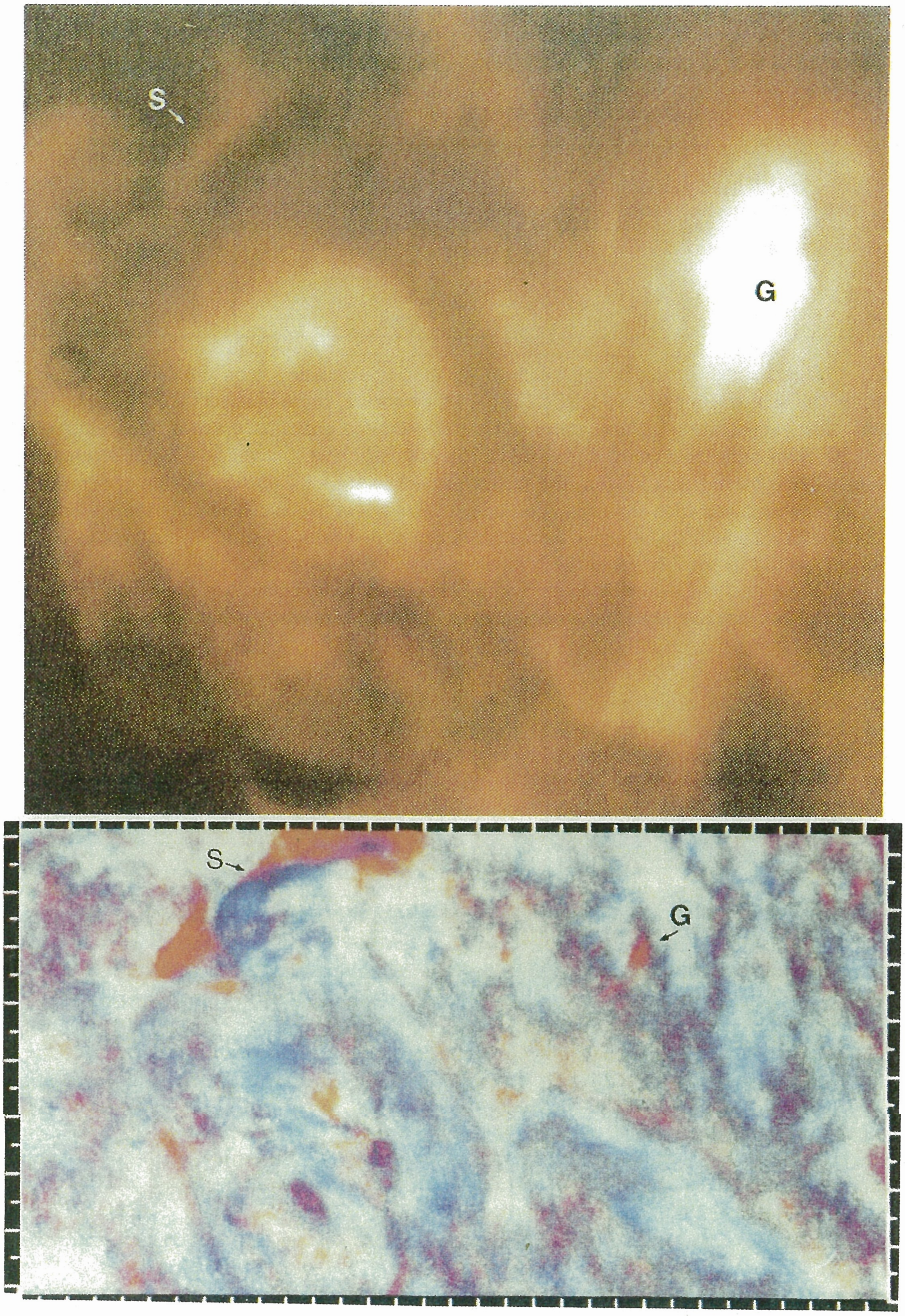

Fig. 2. Active region AR 6713 observed in X-ray with the NIXT and in Hα with the MSDP (blue/red corresponds to blue/redshifts)

problem is discussed self-consistently in order to understand the mechanism which increases the pressure at the surge base (see for more details Schmieder *et al.* 1994b). The basic idea is that if the surge is pressure driven, then the driver gas is expected to be visible in X-rays.

Table 1 Coronal Parameters Measured by the NIXT Instrument.

T_e (10^6K)	Relative Sensitiv.	Height (10^9 cm)	EI_{min} (10^{28}cm^{-5})	EI @ C –	EI @ G –	n_e @ C (10^9cm^{-3})	n_e @ G –
3.00	1.	15	0.56	3.4	67	1.5	6.6
2.0	0.63	10	0.9	5.4	108	2.4	11
1.5	0.90	7.5	0.6	3.6	72	2.4	11
1.0	4.5	5	0.13	0.82	14	1.2	5.5

If this temperature is well below 10^6K then the emission from the driver gas would be outside the sensitivity range of NIXT (Table 1). However, there are several arguments against such a low temperature. First, we note that the driving gas must have a temperature of at least 10^5 K in order to raise the plasma to the observed height if there is no injection of cool material from below. In addition, the radiative cooling time for plasma at that temperature is very short compared with the expansion time of the driver gas; consequently there would have to be continuous heating in order to maintain the driver temperature. A continuous heating, however, would inevitably drive the temperature to values well above 10^5K.

Note that the emission intensity, EI, is strongly dependent on the filling factors . If they are of order unity then the emission measure would be easily observable by NIXT.

3. Conclusion

Hence, our observations rule out the pressure driven models with large filling factors. On the other hand, if the filling factors are of order 10%, then EI is reduced by 4 orders of magnitude, and would not be observable by NIXT. An important question, therefore, is how we can evaluate the filling factors.

References

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