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STEREO and SDO observations of six solar jets.

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Abstract: We present an analysis of recent observations of several solar jets observed in the Extreme Ultraviolet (EUV) at the solar limb with STEREO A/B and the Solar Dynamics Observatory (SDO). We fit height-time diagrams at all wavelengths and calculate the temporal evolution of the jets' speed and acceleration. The results are discussed in relation to possible jet formation mechanisms.

1 Introduction

In this paper we study 6 solar jets observed on the following dates: (i) 06/30/2010; a spectacular jet in the north solar pole, (ii) 25/06/2010; a total of four solar jets, two polar and two active region jets, and finally (ii), 02/11/2008; a big jet in the north solar pole. For each jet, we analyse simultaneous images from STEREO EUVI-A and B, at four wavelengths (171Å, 195Å, 284Å, 304Å) and images from the SDO/AIA telescope suite, all at 304Å, when available. Our goal is to study the evolution and the basic physical properties of these six jets, as in [1]. We identify a cool and a hot component in each jet, while the shape of the jets indicate twist along the fieldlines. Magnetic mechanisms may play a significant role in the triggering and evolution of those events as in [2].

Table 1: Velocity and acceleration of the jets derived using a polynomial interpolation

		Initial Velocity (km sec^{-1})	Acceleration (km sec^{-2})
SDO	Precursor 2010/06/30	155	0.13
	Jet 2010/06/30	250	0.17
	NorthWest Jet 2010/06/25	760	0.16
	SouthWest Jet 2010/06/25	94	0.03
	SCH Jet 2010/06/25	440	0.09
	Precursor SCH 2010/06/25	150	0.21
STEREO	Jet 2010/06/30	240	0.14
	NCH 2010/06/25	60	0.04
	SCH 2010/06/25	84	0.04
	Jet 2008/11/02	150	0.06

2 Data Analysis and Results

In order to examine the temporal evolution of each jet, we apply a polynomial interpolation to our height versus time data:

$$h(t) = h_0 + u_0 t - \frac{1}{2} a t^2 \quad (1)$$

In this way, we find the initial height of the jet, its speed and acceleration, as shown in Table 1.

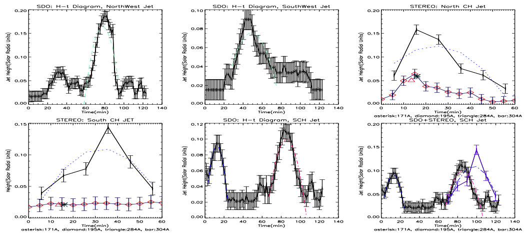
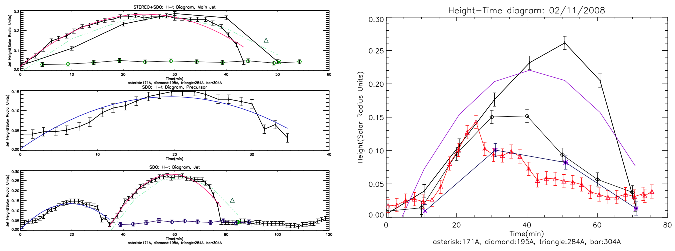


Figure 1: Top left: SDO data for the NorthWest jet (304Å: line). The green curve is the polynomial interpolation at 304Å. Top middle: SDO data for the SouthWest (304Å: line). The green curve is the polynomial interpolation at 304Å. Top right: STEREO A, B data for the North Coronal Hole jet (174Å: star, 195Å: diamond, 284Å: triangle, 304Å: line). The blue dashed curve is the polynomial interpolation at 304Å. Bottom left: STEREO A, B data for the South Coronal Hole jet (174Å: star, 195Å: diamond, 284Å: triangle, 304Å: line). The blue dashed curve is the polynomial interpolation at 304Å. Bottom middle: SDO data for the South Coronal Hole jet (304Å: line). The red dashed curve is the polynomial interpolation at 304. Bottom right: Overall diagram which contains all the data for the jet and the precursor with their corresponding polynomial interpolations at 304Å.



(a) (b)

Figure 2: (a) Polar jet of 2010/06/30: Top: Data from STEREO A, B and SDO (174Å: star, 195Å: diamond, 284Å: triangle, 304Å: line) with the corresponding polynomial interpolation. SDO data (304Å: line). The blue curve is the polynomial interpolation of the precursor of the jet at 304Å. Bottom: Overall diagram (except for the STEREO data for the main jet, due to congestion of the graph), (b) Polar jet of 2008/11/02: Height-time diagram of the jet based on data from STEREO A, B (174Å: star, 195Å: diamond, 284Å: triangle, 304Å: line). The purple curve is the polynomial interpolation at 304Å.

We have obtained detailed height-time diagramms of 6 solar jets, as shown in Figs. 1 and 2. The sample of the analysed jets has revealed a range of time evolution, initial velocities, heights and accelerations, as well as involved magnetic topologies. In two of the six solar jets we clearly observe recurrency (Fig.1 bottom middle and right, Fig.2 (a) bottom) and twisting, which may suggest magnetic reconnection as the triggering mechanism. In all events we find a rather short time range (≈35-75 mins) during which these explosive events are triggered and evolved. The jets reach a maximum height which exceeds ≈10% of the Solar radius, for either the precursor of the main jet, or, the smallest events. The jets' maximum height can reach ≈30% of the radius of the Sun for the larger events, which are mainly located at the solar poles. The involved velocities are less than the escape speed from the Sun at the given height, with the exception of a specific event (NorthWest Jet 2010/06/25) with great inclination where the velocity exceeds the escape velocity from the Sun at that height. As for the jets decelerations, we conclude that for all of the analyzed events the magnitude of the solar gravitational acceleration is greater than the involved acceleration in any jet or its precursor. For all the events, we find that gravity forces act as to decelerate the jets. Further investigation is required to reveal the triggering mechanism(s) that lead to the onset of the jets and affect their subsequent evolution.

References

[1] Nistico, G., Bothmer, V., Patsourakos, S., Zimbardo, G., 2010: Annales Geophysicae, 28, 687-696.

[2] Archontis, V., Tsinganos, K., Gontikakis, C.,: 2010, Astronomy and Astrophysics, 512, id.L2.