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An intriguing chromospheric jet observed by Hinode: fine structures and evidence of unwinding twists

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Abstract. We present a chromospheric jet observed by the Hinode Solar Optical Telescope in unprecedented detail on 2007 February 09. The precursor of the jet is a bundle of material threads (0.5-2 arcsec wide) that extend almost horizontally above the chromosphere and appear to rotate about a common axis. This bundle first slowly and then rapidly swings upward, the transition of which coincides with the onset of an A5 flare. A loop grows simultaneously in these two stages at comparable rates and appears to rupture at the peak of the flare. The material bundle then swings back in a whip-like manner and develops into a collimated jet.

The material ejection in the jet takes place in three episodes during 1 hr. The amount and velocity (440 to 30 km/s) of the ejecta decrease with time. The material threads exhibit coherent, oscillatory transverse motions across the jet axis. These motions propagate upward with a phase speed of 740 km/s at the leading front. The transverse oscillation velocities range from 150 to 30 km/s, amplitudes from 6.0 to 1.9 Mm, and periods from 250 to 540 sec. The oscillations slow down with time and cease when the ejected material starts to fall back.

The falling material travels along smooth streamlines, no longer showing transverse oscillations. Some streamlines bypass a dome and presumably a null point, depicting an inverted-Y topology of the post-eruption magnetic field and suggestive of the occurrence of magnetic reconnection during the eruption. These observations are consistent with the scenario that the jet involves untwisting helical threads and sheds magnetic helicity into the upper atmosphere.