Excitation of Kink Oscillations of Coronal Loops by CMEs

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The possibility of the excitation of kink (transverse) oscillations of coronal loops by quasi-steady upflows of the coronal plasma, caused by coronal mass ejections (CME), proposed in [1], is demonstrated. When the magnetic field in the plasma that is dragged in the vertical direction by the upflow is parallel to the loop, the phenomenon of Alfvenic vortex shedding causes the appearance of a quasi-periodic horizontal force that is applied to alternating sides of the loop. The period of the force is determined by the flow speed and the loop's minor radius. Full MHD numerical simulations demonstrated that the Strouhal number, the dimensionless parameter constructed by the loop minor radius, the flow speed and the period of the self-induced oscillations, is about 0.2 for the plasma-beta ranging from 0 to 1 and for the flow speeds up to the fast magnetoacoustic speed. This estimation allows the Alfvenic vortex shedding frequency to be in resonance with the natural frequency of the standing kink modes of coronal loops, causing effective resonant excitation of kink oscillations. This model naturally explains the selectivity of the excitation of the oscillations, the observed dominance of the horizontally polarised mode, and the initial growth of the oscillation amplitude. This mechanism is supported by the observed association of almost all observed events of kink oscillations with coronal dimming.

References

[1] V.M. Nakariakov, M.J. Aschwanden and T. Van Doorsselaere, *Astron. Astrophys.* **502**, 661 (2009).