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Kelvin–Helmholtz instability in solar jets observed by *Hinode* and *SDO*/AIA

Ivan Zhelyazkov
Sofia University, Bulgaria

It is well established by observations that the solar atmosphere is a highly complicated region that is magnetically structured and contains various kinds of jets. Those jets have been observed by a numerous instruments on board of spacecrafts like *Hinode* and the *Solar Dynamic Observatory* (*SDO*). The axially moving along the background magnetic field solar jets supports the propagation of magneto hydrodynamic (MHD) modes characterised by their azimuthal mode number *m*. The stability of these MHD modes crucially depends upon the flow speed of the jets. When the jet's speed exceeds some critical value, the propagating MHD mode becomes unstable and the developing instability is known as Kelvin–Helmholtz (KH) instability. The KH instability exhibits itself as a vortex sheet that evolves near jet's boundary and notably this vortex sheet causes the conversion of the directed flow energy into the turbulent energy. The triggered by the KH instability wave turbulence is considered to be one of the main mechanisms of the coronal heating. Here, we consider the conditions under which the KH instability can arise in a EUV jet situated on the west side of NOAA AR 10938 and observed by three instruments on board *Hinode* on 2007 January 15/16. The jet was observed around Log T_e = 6.2 with up-flow velocities exceeded 150 km/s. We have modelled that EUV jet as a vertically moving magnetic flux tube (untwisted and weakly twisted) and have studied the propagation characteristics of the kink (m = 1) mode and the higher MHD modes with azimuthal mode numbers m = 2, 3, 4. It turns out that all these MHD waves can become unstable at flow velocities in the range of 112–114.8 km/s. It is interesting to note that similar results have been obtained in studying KH instability in soft X-ray jets observed by the soft X-ray telescope aboard *Yohkoh*. No less intriguing is the study of KH instability in rotating, tornado-like solar jets. Very recently, we have investigated the occurrence of KH instability in a twisting solar polar coronal hole jet observed by *SDO*/AIA. The time-evolution study of a jet event of 2010 August 21 showed the appearance of small moving blobs on the right side boundary of the rotating jet, whose temporal evolution in their initial stage was found to be about 2–4 minutes. Modelling the jet as a weakly twisted magnetic flux tube with rotation velocity of 136 km/s and axial speed of 114 km/s, we have obtained that a higher (m = 12) MHD mode can become KH unstable with wavelengths of 10 and 12 Mm and instability evolution times of 4 and 2 min, respectively, in a very good agreement with the observations.

Biography

Ivan Zhelyazkov has completed his PhD from the Lebedev Institute of Physics, Moscow and Post-doctoral studies as an Alexander von Humboldt Fellow from Ruhr Universität Bochum, Universität Essen and Leibniz-Institut für Astrophysik Potsdam. He has worked also as a Post-doc at the University of St. Andrews and the Centre for Mathematical Plasma Astrophysics of KU Leuven. He is Professor of Plasma Physics at Sofia University. He has published more than 100 papers in reputed journals and has been serving as an Editorial Board Member of the *Bulgarian Journal of Physics*. He is member of the Union of the Scientists in Bulgaria, Union of the Physicists in Bulgaria, Institute of Physics, London, European Physical Society and Individual Member of the International Union of Radio Science (URSI).

izh@phys.uni-sofia.bg

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