KINK OSCILLATIONS OF TWISTED CORONAL MAGNETIC LOOPS

M.S. Ruderman[1,2], J. Terradas[3], J.L. Ballester[3]

[1]*Solar Physics and Space Plasma Research Centre (SP^{2}RC), University of Sheffield, Hicks Building, Hounsfield Road, Sheffield S3 7RH, UK,*
[2]*Space Research Institute (IKI) Russian Academy of Sciences, Moscow, Russia,*
[3]*Departament de Física, Universitat de les Illes Balears, 07122 Palma de Mallorca, Spain*

After the coronal loop kink oscillations were first observed in 1998 by TRACE, they have remained among most important wave phenomena in the solar atmosphere. First theoretical works dealing with coronal loop kink oscillations used the simplest model of coronal loops, which is the a homogeneous straight magnetic tube with the straight homogeneous magnetic field. Then more sophisticated models started to be used. These models take into account such effects as the density variation along the loop, the loop expansion, and curvature. One important effect is the twist of magnetic field lines. This effect was studied long ago in relation to the tube stability. Later it was considered in studies of magnetohydrodynamic wave resonant absorption. The first studies of the effect of magnetic twist on waves in magnetic tubes were published relatively recently. They mainly concerned propagating waves. At present there are only two publications studying the effect of twist on standing waves. The first article considered standing kink waves in a thin tube with the constant axial magnetic field inside and outside the tube, and the azimuthal magnetic field inside the tube with the magnitude proportional to the distance from the tube axis. In the second paper the magnetic twist was present only inside an annulus inside the tube. In this work we study standing kink waves in a thin magnetic tube with the magnitude of the azimuthal field proportional to the distance from the tube axis inside the tube, and inversely proportional to this distance outside the tube. Such a magnetic field is created by the electrical current with constant density inside the tube. We derive the dispersion equation for propagating waves. Then we construct the solution describing the standing waves as a superposition of two waves propagating in two opposite directions with the same frequencies and different wave numbers. We investigate dependence of properties of standing waves on the parameters of the equilibrium state.