Localization of 3-D kinetic Alfven wave and turbulent spectra in the solar corona region

Garima Patel[1], R. Uma[1], R.P. Sharma[1].

[1]*Department of Energy Science and Engineering, Indian Institute of Technology Delhi, New Delhi 110016, India.*

Email Address: garimaptel999@gmail.com

Abstract—

Magnetic reconnections and the Kinetic Alfven Waves (KAW) are expected to play important role in coronal heating but the proper methodology to describe the heating of solar corona is still being browsed by the Solar physicist. Different magnetic structures interact with the KAW to plays its role in the occurring of this dramatic Corona heating. We proposed a 3D model of Kinetic Alfven wave which is propagating in magnetic reconnection region encounters the Harris current sheet profile with taking into consideration of ponderomotive effects and non-linearity in the solar corona. This Model equation is solved numerically using the finite difference method in time and pseudospectral in spatial domain with the predictor-corrector method. The numerical simulation shows that the field structure feels a slow change without the nonlinearity whereas the presence of nonlinearity causes a rapid change. And approaching towards quasi-steady state, it generates a fully chaotic structure which are signals of turbulent filamentation with temporal evolution. We have also obtained the semi-analytical solution for these localized structures which shows the transverse scale size to be comparable to electron inertial length.

1: Bale, S. D. et al. 2019. "Highly Structured Slow Solar Wind Emerging from an Equatorial Coronal Hole." *Nature* 576(7786): 237–42. http://www.nature.com/articles/s41586-019-1818-7.

2: Chaston, C. C. et al. 2005. "Drift-Kinetic Alfvén Waves Observed near a Reconnection X Line in the Earth's Magnetopause." *Physical Review Letters* 95(6): 065002. https://link.aps.org/doi/10.1103/PhysRevLett.95.065002.

3: Shi, Chen et al. 2021. "Parker Solar Probe Observations of Alfvénic Waves and Ion-Cyclotron Waves in a Small-Scale Flux Rope." *The Astrophysical Journal* 908(1): L19. https://iopscience.iop.org/article/10.3847/2041-8213/abdd28.