



Friday October 25th, 2013
4:10 – 5:00 pm, EPS108

“Flux ropes and the 3D dynamics of magnetic field lines”

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Abstract:

In our plasma universe, magnetic structures coexist and interact with hierarchies of spatial and time scales. Local values of magnetic field substantially exceed the averaged (several micro-Gauss averaged over the entire universe) quantities. Magnetic field can be annihilated by magnetic reconnection and generated by dynamo. Classical Coulomb collisions are much too infrequent to account for any of this behavior. This state of affairs is typically described with a magnetized, collisionless, single fluid model called magnetohydrodynamics (MHD). However there is a universal tendency to develop filaments of electric current and tubes of magnetic field lines that helically wrap around a magnetic axis. These flux ropes are twisted along their own axis and writhe or gyrate like the twisted up rubber band that drives the propeller in a balsa wood airplane toy. Flux ropes are ubiquitous structures on the sun, the rest of the heliosphere, astrophysical objects, and laboratory plasmas, and form basic building blocks for 3D magnetic dynamics. We show experimental data including movies that display interactions of flux ropes via twist, writhe, braids, and bounces. We have used the Relaxation Scaling Experiment (RSX) to study flux ropes, and have found many new features involving unexpected 3D dynamics and boundary conditions, kink instability driven reconnection, non linearly stable but kinking flux ropes, large flows, and shear flow induced magnetic fields. Much of the physics and dynamics are irreducibly three dimensional (3D) and require models beyond MHD.

Host:

Jiong Qiu

*****Refreshments served in the EPS second floor lobby at 3:45*****
