Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

The Dynamics of Magnetic Flux Ropes from a Topological Two-Fluid Point-of-View SETTHIVOINE YOU, University of Washington — The dynamics of interaction between magnetic flux ropes generally involves localized reconnection regions where non-MHD regimes apply, with observations frequently showing strong flows and cascading magnetic activity. To bridge the gap between a global model based on MHD magnetic helicity conservation and localized models with non-MHD dynamics, a two-fluid global model is constructed for flux rope dynamics based on the transport of relative canonical helicity. The derivation shows that electron canonical helicity can be converted into ion canonical helicity in such a way as to preserve the total canonical helicity. In effect, the two-fluid model generalizes the ordinary transfer of magnetic helicity between two connected magnetic flux ropes to the transfer of canonical helicity between two connected canonical flux ropes. The transfer mechanism is a generalized "battery effect" due to enthalpy potential differences on surfaces separating the two canonical flux ropes, resulting in the coupling of helical magnetic fields to helical plasma flows. The model shows how a given helicity injection can be channelled into the magnetic flux component or the vorticity flow component of the canonical flux rope, as observed in counter-helicity merging experiments.

Setthivoine You
University of Washington

Date submitted: 20 Jul 2012 Electronic form version 1.4