Abstract Submitted
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Canonical field theory[1] SETTHIVOINE YOU, University of Washington — A new canonical field theory has been developed to help interpret the interaction between plasma flows and magnetic fields. The theory augments the Lagrangian of general dynamical systems to rigourously demonstrate that canonical helicity transport is valid across single particle, kinetic and fluid regimes, on scales ranging from classical to general relativistic. The Lagrangian is augmented with two extra terms that represent the interaction between the motion of matter and electromagnetic fields. The dynamical equations can then be re-formulated as a canonical form of Maxwell's equations or a canonical form of Ohm's law valid across all non-quantum regimes. The field theory rigorously shows that helicity can be preserved in kinetic regimes and not only fluid regimes, that helicity transfer between species governs the formation of flows or magnetic fields, and that helicity changes little compared to total energy only if density gradients are shallow. The theory suggests a possible interpretation of particle energization partitioning during magnetic reconnection as canonical wave interactions.

Setthivoine You
University of Washington

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