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The Mochi project: a field theory approach to plasma dynamics and self-organization¹ SETTHIVOINE YOU, JENS VON DER LINDEN, ERIC SANDER LAVINE, ALEXANDER CARD, EVAN CARROLL, University of Washington — The Mochi project is designed to study the interaction between plasma flows and magnetic fields from the point-of-view of canonical flux tubes. The Mochi Labjet experiment is being commissioned after achieving first plasma. Analytical and numerical tools are being developed to visualize canonical flux tubes. One analytical tool described here is a field theory approach to plasma dynamics and self-organization. A redefinition of the Lagrangian of a multi-particle system in fields reformulates the single-particle, kinetic, and fluid equations governing fluid and plasma dynamics as a single set of generalized Maxwells equations and Ohms law for canonical force-fields. The Lagrangian includes new terms representing the coupling between the motion of particle distributions, between distributions and electromagnetic fields, with relativistic contributions. The formulation shows that the concepts of self-organization and canonical helicity transport are applicable across single-particle, kinetic, and fluid regimes, at classical and relativistic scales. The theory gives the basis for comparing canonical helicity change to energy change in general systems.

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