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Hamiltonian and Lagrangian approaches to hybrid kinetic-fluid plasmas CESARE TRONCI, Department of Mathematics, University of Surrey, UK, P.J. MORRISON, IFS, University of Texas at Austin, EMANUELE TASSI, CPT, University of Marseille, FR — The development of multiscale multiphysics models is required in different contexts of plasma physics, from fusion theory to space plasmas. Indeed, plasmas are often found to consist of two different species: a cold (fluid) species and a hot (kinetic) component. Several modeling efforts over the last two decades culminated in the formulation of two main types of hybrid kinetic-fluid models: current-coupling schemes (CCS') and pressure-coupling schemes (PCS'). Although CCS' conserve energy exactly, PCS' (used in simulations) require certain approximations that break exact energy conservation. In this work, we formulate new PCS models, whose exact energy conservation is guaranteed by an appropriate Hamiltonian (and Lagrangian) structure. A comparison of Hamiltonian and non-Hamiltonian models is then presented, in terms of linear and non-linear stability.

P. J. Morrison
University of Texas at Austin

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