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**Hamiltonian theory of the nonlinear collisionless tearing mode**[1]

F.L. WAELBROECK, P.J. MORRISON, Institute for Fusion Studies, U. Texas, E. TASSI, D. GRASSO, Dipartimento di Energetica, Politenico di Torino — The Hamiltonian formalism constitutes an effective framework for investigating the dynamics of fluid models. A particularly appealing feature of the Hamiltonian formalism is that it readily provides first integrals of the equations governing the configuration and propagation of nonlinear structures such as magnetic islands and solitary waves [1]. Here a newly developed noncanonical Hamiltonian formulation for a two-fluid model describing collisionless reconnection is used to investigate the effects of electron inertia on the nonlinear growth of the collisionless tearing mode. A variational principle is used to obtain a pair of equilibrium equations that take the form of coupled nonlinear elliptic equations for the magnetic flux and the ion stream-function. These equations generalize the Grad- Shafranov equation of MHD. The equilibrium solutions and conservation laws are used to calculate the saturation amplitude of the collisionless tearing mode and the result is compared with numerical simulations.

[1] F. L. Waelbroeck, P. J. Morrison and W. Horton, Plasma Phys. Control. Fusion **46**, 1331 (2004).

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