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A Weakly Nonlinear Theory for the Magnetic-Rayleigh–Taylor Instability[1] D. E. RUIZ, D. A. YAGER-ELORRIAGA, D. B. SINARS, S. A. SLUTZ, M. E. CUNEO, K. PETERSON, R. VESEY, Sandia National Laboratories — The magnetic-Rayleigh–Taylor (MRT) instability is ubiquitous in magnetically-driven cylindrical Z-pinch implosions. In this work, we present a weakly nonlinear theory for the MRT instability. The model is obtained via an asymptotic expansion of a Lagrangian describing the fully nonlinear dynamics. After introducing a suitable choice of coordinates, it is shown that the theory can be casted as a canonical Hamiltonian system, whose Hamiltonian is calculated up to the fourth order in the perturbation parameter. The resulting theory captures harmonic generation, as well as the initial stage of the MRT instability saturation. Comparisons of this theory to fully nonlinear hydrodynamical simulations and to experiment are discussed.

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