HIGH BETA PLASMA DISRUPTIONS IN SPACE AND LABORATORY PLASMAS

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Explosive magnetohydrodynamic (MHD) instabilities in laboratory plasmas, the solar corona and the Earths magnetosphere play a major role in disrupting configurations associated with magnetic confinement and plasma energy storage. Central to our approach to this problem is the fact that the presence of resonances in Hamiltonian systems can have a destabilizing effect on the system as a whole. In Tokamaks, toroidally localized, high-n (toroidal) ballooning modes are driven to instability due to toroidally localized changes in the pressure gradient caused by low frequency, low-n modes. As an example of generic high beta disruptions we shall examine the nonlinear stability of the magnetic field topology and possible nonlinear plasma instabilities that might occur in the near Earth magnetotail (8-10 RE) during the substorm growth phase. These nonlinear instabilities lead to the initiation of the substorm intensification at the Earthward edge of the plasma sheet. Central to our model are ultralow frequency (1-4 mHz), normal modes (shear Alfvén waves). The work we present is based, in part, on a Lagrangian-Hamiltonian approach, with possible further refinements on measures of nonlinear instability in MHD systems.