IC/P-13 · Stability of Axisymmetric Plasmas in Closed Line Magnetic Fields

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Abstract: The stability of axisymmetric plasmas confined by closed poloidal magnetic field lines is considered. The results are relevant to plasmas in the dipolar fields of stars and planets, as well as the Levitated Dipole Experiment, multipoles, Z pinches and field reversed configurations. The ideal MHD energy principle is employed to study stability of pressure driven Alfvén modes. A point dipole is considered in detail to demonstrate that equilibria exist which are MHD stable for arbitrary beta. Effects of sound waves and plasma resistivity are investigated for Z pinch and point dipole equilibria by means of resistive MHD theory. Kinetic theory is used to study drift frequency modes and their interaction with MHD modes near the ideal stability boundary for different collisionality regimes. Effects of collisional dissipation on drift mode stability are explicitly evaluated and applied to a point dipole and hard core Z pinch. The role of finite Larmor radius, equilibrium sheared flows, and drift reversed particles in modifying ideal stability thresholds is examined.

IC/P-14 · Current Drive by Neutral Beams, Rotating Magnetic Fields and Helicity Injection in Compact Toroids

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Abstract: A Monte-Carlo code is used to study neutral beam current drive in Spheromaks. The exact particle trajectories are followed in the self-consistent equilibria calculated including the beam current. Reducing Z(eff) does not increase the current drive efficiency because the reduction of the stopping cross section is compensated by an increase in the electron canceling current. Significant changes in the safety factor profile can be produced with relatively low beam currents. Minimum dissipation states of a flux core spheromak sustained by helicity injection are presented. Helicity balance is used as a constraint and the resistivity is considered to be non-uniform. Two types of relaxed states are found; one has a central core of open flux surrounded by a toroidal region of closed flux surfaces and the other has the open flux wrapped around the closed flux surfaces. Non-uniform resistivity effects can be very important due to the changes they produce in the safety factor profile. A hybrid, fluid electrons particle ions, code is employed to study ion dynamics in FRCs sustained by rotating magnetic fields.

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