3D magnetic reconnection, mode locking, and flow in reversed-field pinch and tokamak.

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The causes and the effects of relaxation events in hot current-carrying plasmas, described via 3D nonlinear visco-resistive MHD modelling [1], are discussed both for reversed-field pinches and tokamaks.
Such hot plasmas show the tendency to develop a quasi-helical symmetry [2, 3], caused by the presence of a dominant MHD mode impressing its helical twist to the configuration. Nevertheless, localized imperfections in the magnetic and velocity fields pop up in regions where mode locking happens – regions where the phases of the MHD modes tend to get aligned – and they result in unbalances of the magnetic force that function as a trigger of the relaxation events, as observed also in the RFX-mod experiment [4].
This is followed by the classical features of magnetic reconnection, conversion of magnetic energy into kinetic and thermal internal energy, and observed as generation of waves, turbulence, and energization of particles.
The behavior of the plasma close to the locking location will be studied. The plasma velocity patterns in reversed-field pinches and tokamaks will be compared. The intense outburst of plasma current and electric fields, localized around the maximum locking region [1], will be described, focusing on their relations with the topology of the magnetic field using lagrangian indicators like connection length and Lagrangian Coherent Structures.
A discussion will be encouraged regarding the impact of incorporating extended-MHD effects into the modeling results.

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