

Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Toroidal rotation and halo current produced by disruptions¹

HENRY STRAUSS, HRS Fusion, LINDA SUGIYAMA, MIT, ROBERTO PACCAGNELLA, Istituto Gas Ionizzati del C.N.R, JOSHUA BRESLAU, STEPHEN JARDIN, PPPL — In several experiments including JET, it was observed that disruptions were accompanied by toroidal rotation. There is a concern that there may be a resonance between rotating toroidal perturbations and the resonant frequencies of the ITER vacuum vessel, causing enhanced damage. MHD simulations with M3D demonstrate that disruptions produce toroidal rotation. The toroidal velocity can produce several rotations of the sideways force during a disruption. Edge localized modes (ELMs) also produce poloidal and toroidal rotation. A theory of rotation produced by MHD activity will be presented. In the case of ELMs, the theory gives toroidal rotation Alfvén Mach number, $M_\phi \approx 10^{-2} \beta_N$. This is consistent with a scaling for intrinsic toroidal rotation in H mode tokamaks. It was also discovered on JET that disruptions were accompanied by toroidal variation of the plasma current I_ϕ . From $\nabla \cdot \mathbf{j} = 0$, the toroidal current variation ΔI_ϕ is proportional to the 3D halo current, $\oint J_n R dl$, where J_n is the normal current density at the wall. The 3D halo current is calculated analytically and computationally. A bound on $\Delta I_\phi / I_\phi$ is found, proportional to the halo current fraction and toroidal peaking factor.

¹Supported by USDOE and ITER.

Henry Strauss
HRS Fusion

Date submitted: 11 Jul 2013

Electronic form version 1.4