DIIID locked mode disruption

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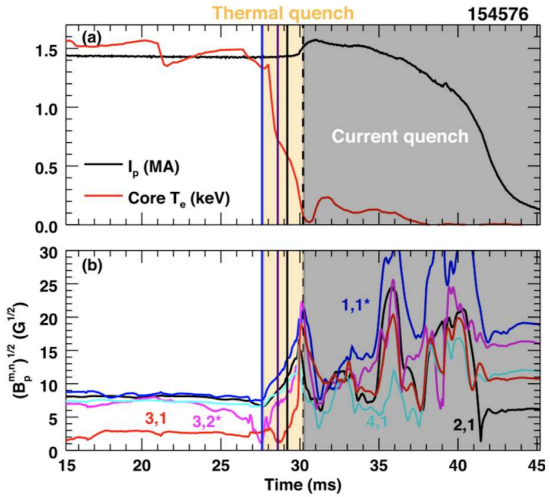
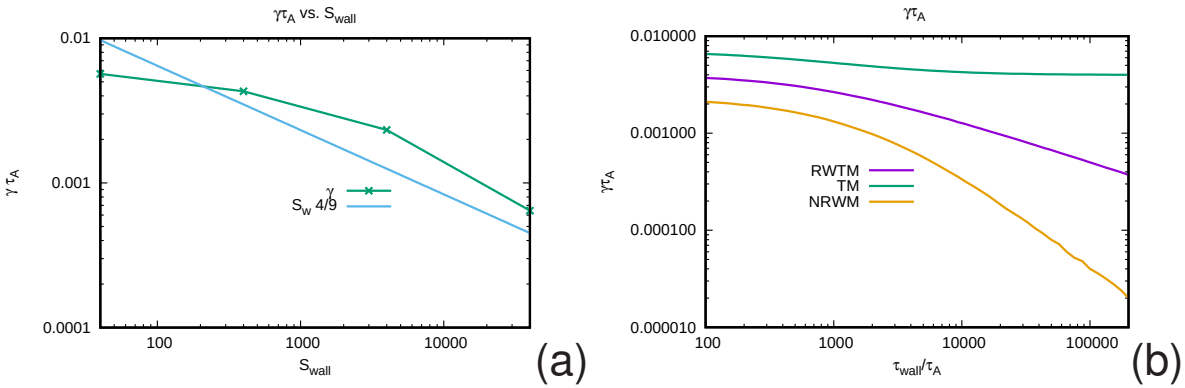


Locked mode DIII-D disruption, shot 154576 [Sweeney *et al.*NF 2018]. Disruption precursor is produced by tearing modes.

The TQ could be produced by a resistive wall tearing mode. The disruption thermal quench time time $\tau_{TQ} \approx .5\tau_{wall}$, suggests a form of RWM.

In JET shot 81540 [Strauss,2021 $\tau_{TQ} \approx .3\tau_{wall}$, TQ time $\tau_{TQ} = 1/\gamma$, where γ is mode growth rate.

Linear M3D-C1 resistive wall simulations of DIIID 154576



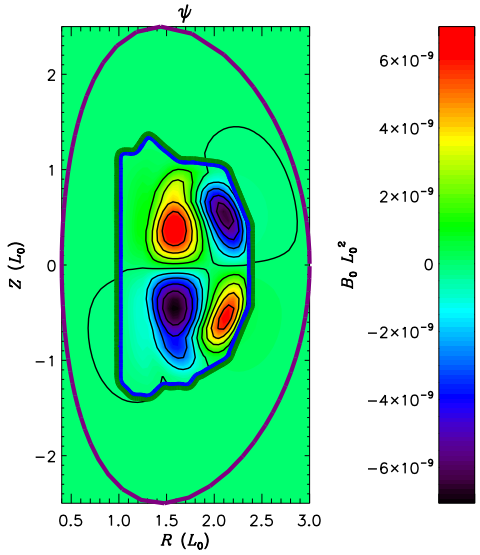
(a) $\gamma\tau_A$ in DIIID shot 154576 as a function of $S_{wall} = \tau_{wall}/\tau_A$ from M3D-C1 linear simulations. $\tau_{wall} = d_{wall} r_{wall}/\eta_{wall}$.

(b) solutions of (1) with $\Delta_0 = 1$, and TM: $\Delta_1 = 1$, RWTM: $\Delta_1 = 0$, and NTWM: $\Delta_1 = -1/2$, The RWTM dispersion relation is

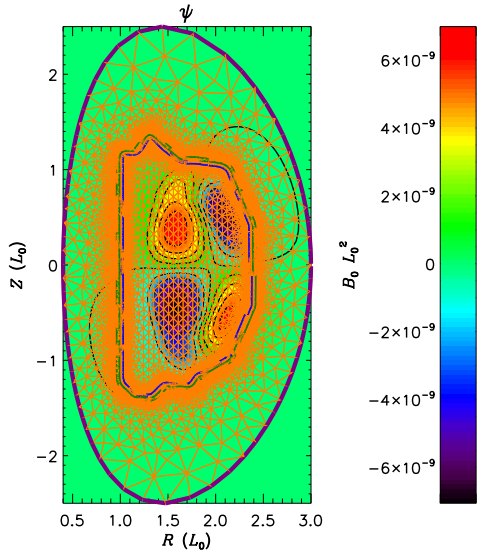
$$\hat{\gamma}^{5/4} S^{3/4} = \Delta_1 + \frac{\Delta_0}{\hat{\gamma} S_w + 1} \tag{1}$$

$\hat{\gamma} = \gamma\tau_A$, $x = (r_s/r_w)^{2m}$, $\Delta_0 = 2x/(1-x)$, $\Delta_1 = r_s \Delta'_w/m$, m is poloidal mode number, r_s is the rational surface radius, r_w is the wall minor radius, in a cylindrical geometry model.

(neo) NRWM: $\Delta_0 > -\Delta_1 > 0$, then $\gamma\tau_A = -(\Delta_0 + \Delta_1/\Delta_1) S_w^{-1}$. If $\Delta_0 + \Delta_1 \leq 0$, there are no unstable solutions of (1).



(a)



(b)

(a) perturbed ψ in (a) above. The mode is $(2,1)$. A constant η was used in the plasma. The mode penetrates the resistive wall.

(b) mesh used in the simulations. Thick wall model needs high resolution,

Nonlinear simulations in progress.