THRESHOLD FOR METASTABLE TEARING MODES IN DIII–D

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At sufficiently high poloidal beta β_θ and low collisionality, $m/n = 3/2$ tearing modes are excited in the DIII–D tokamak by a $q = 1$ sawtooth crash perturbation. The resulting islands of full radial width w are long lived and reduce global confinement (and β_θ) by up to 30%. These are tearing modes produced by the perturbed neoclassical bootstrap current destabilization of a seed island arising from the $m/n = 2/2$ sawtooth precursor. The tearing modes are metastable. Even if the modes are conventionally stable, i.e., $\Delta' < 0$, for sufficiently high β_θ, there is a range of island widths w above some threshold value over which the modified Rutherford equation predicts island growth. This threshold value increases with collisionality. Both "transport" and "polarization" threshold models are compared to experiment. The transport model gives the correct scaling with experiment, but the threshold island w_d is 3 to 9 times too small depending on whether ion or electron parallel heat transport is used. The polarization model threshold island w_g gives good agreement with experiment utilizing an approximately hyperbolic tangent transition from collisionless to collisional regimes.