# A new view of the sawtooth instability and its relation to the internal kink mode

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**Abstract.** Analysis of equilibria reconstructed through consecutive cycles of the sawtooth ramp and crash phases of three different DIII-D experiments reveal a new view of the relation between the MHD stability and the tokamak sawtooth. The discharges comprised two low beta discharges with bean and oval shaped cross sections, and a single null ion cyclotron resonance frequency (ICRF) heated discharge, chosen since they have very different sawtooth characteristics. In particular, the ICRF-heated discharge exhibited giant sawteeth similar to those observed in the JET tokamak. The results are surprising in view of the conventional sawtooth picture. The ideal stability does not necessarily degrade during the ramp as the axis safety factor, $q_0$ decreases; instead, the sawtooth is generally triggered by weakening of the non-ideal stabilization through an increase in the local shear at the $q = 1$ surface. In both the oval discharge and the ICRF-heated discharge, the underlying ideal mode has characteristics more like the quasi-interchange mode. For the oval, this leads to the qualitatively different crash features observed experimentally compared to the bean. For the ICRF-heated discharge, the result has implications for giant sawteeth and suggests a re-interpretation of the giant sawtooth experiments in JET.

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