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Theory      Experiment

**A New Resistive Response to 3-D Fields in Low Rotation H-modes**, R.J. Buttery, R.J. La Haye, *General Atomics*; H. Reimerdes, *Columbia U.* – A new resistive response to 3-D fields is identified in low rotation H-modes that are far from ideal MHD  $\beta$  limits. The response increases as natural ( $\Delta'$ ) tearing stability limits are approached, either by lowering plasma rotation or by raising  $\beta$ . This leads to 2/1 tearing modes that degrade performance, with threshold fields to trigger modes falling to zero as the natural tearing limit is approached. These applied static 3-D field appear to act through rotation braking to decrease intrinsic tearing stability, thereby leading to formation of rotating modes at modest  $\beta_N \sim 1-2$  in low torque plasmas. A formalism has been developed based on the observed physics mechanisms to account for the 3-D field threshold scaling. Further scans have been executed in toroidal field and density to determine coefficients of this scaling in torque-free H modes. These yield a more adverse toroidal field scaling for future devices than previous Ohmic studies, though the main increase in field sensitivity comes about because of proximity to the natural tearing  $\beta$  limit at  $\beta_N \sim 2$ .

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