Abstract Submitted
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Computational Investigation of Extended-MHD Effects on Tokamak Plasmas[1] JACOB R. KING, SCOTT E. KRUGER, Tech-X Corp. — We present studies with the extended-MHD NIMROD code of the tearing instability and edge-localized modes (ELMs). In our first study we use analytics and computations to examine tearing in a large-guide field with a nonzero pressure gradient where previous results show drift effects are stabilizing [Coppi, PoF (1964)]. Our work finds three new results: (1) At moderately large ion gyroradius the mode rotates at the electron drift velocity and there is no stabilization. (2) With collision-less drift reconnection, computations must also include electron gyroviscosity and advection. And (3) we derive a dispersion relation that exhibits diamagnetic stabilization and describes the transition between the electron-fluid-mediated regime of (1) and the semi-collisional regime [Drake and Lee, PoF (1977)]. Our second study investigates the transition from an ideal- to an extended-MHD model in an ELM unstable tokamak configuration. With the inclusion of a full generalized Ohm's law the growth rate is enhanced at intermediate wave-numbers and cut-off at large wave-numbers by diamagnetic effects consistent with analytics [Hastie et al., PoP (2003)]. Adding ion gyroviscosity to the model is stabilizing at large wave-numbers consistent with recent results [Xu et al., PoP (2013)].

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