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Current and pressure gradient triggering and nonlinear saturation of low-n edge harmonic oscillations in tokamaks ANDREAS KLEINER, Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543, USA, JONATHAN GRAVES, EPFL, Swiss Plasma Center (SPC), Lausanne, Switzerland, DANIELE BRUNETTI, Istituto di Fisica del Plasma IFP-CNR, Milano, Italy, WILFRED ANTHONY COOPER, EPFL, Swiss Plasma Center (SPC), Lausanne, Switzerland, SERGEI MEDVEDEV, Keldysh Institute for Applied Mathematics, Russian Academy of Sciences, Moscow, Russia, ANTOINE MERLE, EPFL, Swiss Plasma Center (SPC), Lausanne, Switzerland, CHRISTER WAHLBERG, Department of Physics and Astronomy, Uppsala University, Uppsala, Sweden — It is shown that non-axisymmetric free-boundary equilibrium computations represent nonlinearly saturated external kink modes and external kink-like sidebands coupled to pressure-driven infernal modes. In this study, two different driving mechanisms for external kink type-modes are identified. It is found that standard current-driven external kinks are linearly unstable, and nonlinearly stable in a wide parameter range, especially where $q_{edge} < m/n$. But, where standard current-driven kinks are linearly stable coupling of pressure-driven infernal modes can cause instability, and their upper sideband drives edge corrugations that appear to have external kink features. Both types of modes are identified with the VMEC equilibrium code, and the spectra are compared favorably with those of linear numerical approaches and analytic methods. Pressure-driven external infernal modes are shown to robustly occur in sophisticated modeling where the separatrix effect on the q profile is accounted for.

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