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Numerical Study of Alfvén Eigenmodes in a High-Beta Toroidal Plasma[1] ANDREAS BIERWAGE, LIU CHEN, SHUANGHUI HU[2], Department of Physics and Astronomy, University of California, Irvine, CA 92697, U.S.A. —
Discrete toroidal Alfvén eigenmodes trapped in α-induced potential wells (so-called αTAE) and their interaction with trapped energetic ions is studied numerically. Here, $\alpha = -q^2 R\beta'$ is a measure for the pressure gradient. Previous investigations using positive magnetic shear ($s \equiv rq'/q > 0$) are extended to the $s < 0$ negative shear regime. It is found that αTAEs exist as bound states (radially and along the field line) regardless of the sign of s. While for $s > 0$ αTAEs tend to be localized in the bad-curvature region ($|\vartheta| < \pi/2$), for $s < 0$ αTAEs tend to peak at the top and bottom ($\vartheta \sim \pm\pi/2$), and also have larger amplitudes in the good-curvature region. These quasi-marginally stable modes can be excited by trapped energetic ions through resonance with the precessional drift or bounce-precession resonances, whereby excitation is easier for $s > 0$. Extensions to regimes with low magnetic shear and the inclusion of thermal ions are currently underway in order to study the properties of αTAEs near the minimum of the safety factor q in reversed-shear configurations and near the second ballooning stability boundary. Corresponding results will be reported as they become available.

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