High Bootstrap Current Fraction Optimized ℓ_i Advanced Tokamak Operational Mode

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Abstract

Equilibrium and stability analyses have identified tokamak configurations with conventional safety factor profiles at moderately high ℓ_i ($\ell_i \sim 1.0$), with the axis safety factor $q_0 > 1$, high β ($\beta_N \sim 3.5$–4.0), and high bootstrap current fraction ($f_{BS} \sim 50$–70%), which are stable to high n ballooning modes everywhere and to the ideal $n = 1$ kink without the requirement of wall stabilization. These configurations require only modest central current drive for maintaining a steady state and are compatible with Advanced Tokamak (AT) operation. Strong plasma shaping is crucial for achieving the high β operation.

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