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Theoretic study of the nonlinear energetic particle mode dynamics in tokamaks

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In this work, the nonlinear dynamics of a single-*n* (toroidal mode number) coherent energetic particle mode (EPMs) driven by energetic particles via precession-bounce resonances are analyzed starting from a generalized fishbone like dispersion relation. To simplify the model, emphasis is put on investigating the early nonlinear phase of EPM structure near the beta-induced Alfven eigenmode gap, when avalanching occurs. Here, quantitative analysis on a threshold in drive and damping terms are established to analyze the onset of the early nonlinear regime by considering geometry of the plasma equilibrium and spatial nonuniformities, such as the non-circular section, *q* profile and energetic particle pressure gradient. Analysis aims to develop a reduced model of avalanching, which treats profile evolution and mode intensity evolution and spreading. The aim to predict the space and time scales of EPM avalanches.

References

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