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Nonlinear simulations of toroidal Alfvén eigenmodes in the presence of tearing modes

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Abstract

A hybrid simulation is carried out to study nonlinear dynamics of $n = 1$ toroidal Alfvén eigenmodes(TAEs) with the $m/n = 2/1$ tearing mode(TM) evolved. It is found that $n = 1$ TAE is excited by isotropic energetic particles at the linear stage and reaches the first steady state due to wave-particle interaction. After the saturation of the $n = 1$ TAE, the mode continuously grows and reaches second steady state due to multiple tearing mode-mode nonlinear coupling, especially, the $n = 0$ component plays a very important role in tearing mode saturation. Furthermore, strong low frequency tearing mode activities make the TAE frequency chirping structure weak due to tearing mode resonances spreading in phase space.

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