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Nonlinear Dynamics of Fast-electron Driven Beta-induced Alfven eigenmode JUNYI CHENG, WENLU ZHANG, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China, ZHIHONG LIN, Department of Physics and Astronomy, University of California, Irvine, California 92697, USA, DING LI, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China — The fast-electron driven beta-induced Alfven eigenmode (e-BAE) has been routinely observed in HL-2A tokamak. We study e-BAE for the first time using global gyrokinetic GTC simulations, where the fast electrons are described by the drift kinetic model. Frequency chirping is observed in nonlinear simulations in the absence of sources and sinks, which provides a new nonlinear paradigm beyond the standard bump-on-tail model. Analysis of nonlinear wave-particle interactions shows that the frequency chirping is induced by the nonlinear evolution of the coherent structures in the fast electron phase space, where the dynamics of the coherent structure is controlled by the formation and destruction of phase space islands in the canonical variables. Furthermore, we put forward a new theory frame to demonstrate that the evolution of chirping phenomenon is essentially induced by balance and destruction of net shear flow in the toroidal direction combined by the background shear flow and perturbed shear flow, which provides a novel and clear physical image.

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