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**Gyrokinetic Particle Simulation of Fast Electron Driven Beta-induced Alfvén Eigenmodes** WENLU ZHANG, Institute of Physics, Chinese Academic of Science, Beijing 100190, China, JUNYI CHENG, University of Science and Technology of China, Hefei, Anhui 230026, China, ZHIHONG LIN, University of California, Irvine, California 92697, US — The fast electron driven beta induced Alfvén eigenmode (e-BAE) has been routinely observed in HL-2A tokamak. We study e-BAE for the first time using global gyrokinetic GTC simulation, 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 provide a new nonlinear paradigm beyond the standard “bump-on-tail” model. For weakly driven case, nonlinear frequency is observed to be in phase with particle flux, and nonlinear mode structure is almost the same as linear stage. In the strongly driven case, BAAE is also unstable and co-exists with BAE after the BAE saturation. 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. Zonal fields are found to affect wave-particle resonance in the nonlinear e-BAE simulations.

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