Gyrokinetic Particle Simulation of Fast Electron Driven beta-induced Alfvén Eigenmode*

Wenlu ZHANG[1,2], Junyi CHENG[1,2], Yang CHEN[1,2], Zhihong LIN[3,4]

Email：wzhang@iphy.ac.cn

[1]Institute of Physics, Chinese Academic of Science, Beijing 100190, China

[2]University of Science and Technology of China, Hefei, Anhui 230026, China

[3]University of California, Irvine, CA 92697, USA

[4]Peking University, Beijing 100871, China

A verification and validation study is carried out for a sequence of fast-electron driven beta-induced Alfven eigenmode (e-BAE) in HL-2A tokamak plasma. The fast electron driven beta Alfvén eigenmode (e-BAE) in toroidal plasmas is investigated for the first time using global gyrokinetic particle simulations, where the fast electrons are described by the drift kinetic model. The phase space structure shows that only the processional resonance is responsible for the e-BAE excitations while fast-ion driven BAE can be excited through all the channels such as transit, drift-bounce, and processional resonance. Radial symmetry breaking around the rational surface is observed as expected due to the non-perturbative effects in the kinetic simulations, and the poloidal mode structure shows a different rotation direction for e-BAE and i-BAE simulations, this is due to the different direction of toroidal procession in the e-BAE and i-BAE excitations.

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