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Nonlinear interaction between BAE and BAAE YAQI LIU, HUASEN ZHANG, Peking University, ZHIHONG LIN, University of California, Irvine — The beta-induced Alfven-acoustic eigenmode (BAAE) in toroidal plasmas is verified by GTC simulations. The BAAE can be excited by realistic energetic particle density gradient, even though the stable BAAE (in the absence of energetic particles) is heavily damped by the thermal ions. In the simulations with reversed magnetic shear, BAAE frequency sweeping is observed and poloidal mode structure has a triangle shape with a poloidal direction similar to that observed in tokamak experiments. When we decrease the tokamak size ITER to present-day tokamak, the most unstable modes change from BAAE to BAE (beta-induced Alfven eigenmode). For a certain tokamak size, BAE and BAAE coexist with similar linear growth rates. At nonlinear stage, BAE modes saturate first, while BAAE modes continue to grow until nonlinear modes with beating wave (sum of BAE and BAAE frequency) and positive frequencies are excited. In the long time simulation, amplitudes of BAE, BAAE, and beat waves oscillate, indicating mode energy nonlinearly transfers between them. Zonal fields suppress the mode coupling and energy transfer between BAE to BAAE, and reduce frequency chirping and saturation amplitudes. The growth rate of the zonal fields is about twice of the linear growth rate of BAE/BAAE.

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