Description of global EGAM in the maximum of local frequency during current ramp-up discharges in DIII-D

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Abstract

Energetic-particle-induced geodesic acoustic modes, EGAMs (Fu, *Phys. Rev. Let.*, vol. 101, 2008, pp. 185002), driven by neutral beam injection (NBI), have been observed in many DIII-D tokamak experiments (Nazikian *et al.*, *Phys. Rev. Lett.*, vol. 101, 2008, pp. 185001). This mechanism has been theoretically investigated in (Qiu *et al.*, *Plasma Phys. Control. Fusion*, vol. 52, 2010, pp. 095003), using a sharp energetic particle distribution function, and in (Qu *et al.*, *Plasma Phys. Control. Fusion*, vol. 59, 2017, pp. 055018), where the dispersion relation and eigenmode behaviour were obtained for the situation of early beam scenario, that is, for times smaller than the beam slowing down time. In this work, we extend these studies determining the eigenmode for beyond the slowing down time, in a scenario with reverse safety factor q profile, where a small concentration of energetic ions can produce an off-axis maximum in the GAM dispersion relation. The characteristics of EGAM are analytically studied with the drift kinetic equation together with the MHD code NOVA. The toroidal energetic ion transit frequency, coupled with the GAM frequency, produces the maximum in

the dispersion relation where the eigenmode can be found. The quantitative correspondence of experimental results with the predictions of the proposed model is analysed.

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