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TH/P6-27: Parameter Study of Parametric Instabilities during Lower Hybrid Waves Injection into Tokamaks

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In order to explain the density threshold problem in lower hybrid current drive (LHCD), the parametric instability (PI) of LH waves is considered especially in the scrape-off plasma layer. Many previous works are performed on this topic and some methods are proposed to diminish the PI thus enable the penetration of the coupled LH power in the core of high density plasmas. However, the dependence of the PI on local density and other parameters seems not consistent with each other, which might be due to different parameter regions or the employment of different physical model with different simplifications. Here, we will try to give a comprehensive parameter study of the nonlinear dispersion relation of the PI during the LHW injection into plasmas, and then discuss the physical mechanism involved. In this work the drift kinetic model and fluid model will be employed. The result with the coupling coefficient containing both E*B drift term and the E_parallel (E_par) coupling term, is compared to that with the coupling coefficient only including E*B drift term. Both numerical and analytical results show that the E_par coupling term becomes important for lower plasma density and smaller angle deta1 (the angle between the perpendicular wavevector of the lower sideband and the pump). Although the PI becomes most unstable at large angle deta1, the role of E_par coupling term might be important since considering the smaller angle deta1 usually corresponds to the convective loss caused by the inhomogeneity of plasmas and the pump power. The influence of other parameters such as the electron temperature and the LH pump power will be investigated in this work. Cases of the coupling to different low frequency modes, for example ion-sound and ion-cyclotron quasimodes will be discussed as well.

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