Whistler wave destabilization by a runaway electron beam in COMPASS

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Runaway electrons (RE) are typically generated during plasma disruptions in tokamaks and they represent a serious issue for the integrity of the device [1]. Several strategies have been proposed to control and suppress RE beams in tokamak plasmas, such as the use of massive gas injection, pellet injection or use of resonant magnetic perturbations [2]. An alternative strategy to control the RE beam energy was proposed, which relies on the resonant interaction between high energy electrons and whistler waves [3]. The mechanism of destabilization of electromagnetic waves by a RE beam was proposed in 2006 [4], but a first direct observation of RE-driven whistler waves in a tokamak plasma was performed only in 2018 in DIII-D [5] and a detailed study of radiofrequency emissions in presence of a RE beam was carried out more recently in FTU [6]. Here a model for the description of plasma waves destabilization in presence of a RE beam in COMPASS is proposed. Two different situations are considered: the one in which the waves are spontaneously generated inside the RE beam and the one in which the waves are injected from the outside by an antenna. Wave propagation is calculated using the ray-tracing method [7]; the linear growth rate of the wave is calculated using analytical formulas [8] . Multiple reflections of the wave inside the plasma are followed and the positions of maximum wave amplification are identified. Considerations on the optimal wave injection strategy are made.

References

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