Dynamics of ion temperature gradient modes in burning plasma conditions in the presence of energetic particles

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Résumé

The interaction between energetic particles (EPs) and ion temperature gradient (ITG) modes is investigated using the global particle-in-cell code ORB5. In this study, we broaden previous analyses to cover a wider range of EP temperatures, including conditions relevant to the burning plasma regime, as well as a more diverse set of EP distribution functions. Two primary stabilization mechanisms are identified, in agreement with earlier work: direct dispersion relation modification (DDRM), which is effective only at intermediate EP temperatures, and the dilution effect (DE), which does not depend on EP temperature and becomes dominant in the burning plasma regime ($T_f > 50,T_i$). The analysis is further extended to slowing-down EP distributions, which, in contrast, show no stabilization associated with DDRM. The results are additionally validated for an ITER pre-fusion operation scenario and compared with electromagnetic effects. In this case, EP-induced stabilization is found to be weaker than β $-$ $stabilization.Overall, these findings improve the understanding of EP -$
$-ITG interactions across an extended range of EP parameters relevant to burning plasmas, providing insight for pred$

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