Reduced fast-ion transport in NT plasmas in the presence of TAEs at TCV with 3D nonlinear hybrid kinetic-MHD MEGA code

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Recent experiments at TCV have shown a strong mitigation of Toroidal Alfvén Eigenmodes (TAEs) in negative triangularity (NT) plasma compared to its counterpart experiment in positive triangularity (PT). In order to better understand the underlyuing physics mechanisms, non-linear simulations with positive (δ=+0.4) and negative (δ=-0.4) triangularities have been carried out with the hybrid kinetic-magnetohydrodynamic code MEGA [1]. Realistic and anisotropic initial fast-ion distributions have been used, showing a significant mitigation of the AE amplitude and growth rate. Synthetic fast-ion losses show a significant reduction in fast-ion heat loads in NT compared to the PT, using a 2D wall [2] for the TCV case. Significant differences are observed when comparing the power exchange between the confined fast-ion population and the modes, showing transit harmonics being strongly mitigated in the negative triangularity case. Single-*n* toroidal mode and multi-*n* simulations show that the leading mechanism for the fast-ion losses is the TAE activity, being a 3-fold smaller for the negative triangularity case. Different pitch-angle and energy distributions are studied to assess whether the effects are dependent on the initial fast-ion distribution in phase-space.

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