

## Full orbit simulation of RMP enhanced fast ion loss and progress in gyrokinetic simulation of Alfvén instabilities in KSTAR

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We report an enhancement of fast ion loss due to resonant magnetic perturbation (RMP) in KSTAR using full orbit following simulation. Experimental observations on KSTAR show the increase of fast ion loss by application of the RMP and the threshold behavior of the RMP amplitudes triggering rapid increase of fast ion loss. Full orbit simulations with non-axisymmetric perturbed equilibria by ideal plasma response reproduce the threshold-like behavior of the fast ion loss in the experiment, while the simulations with vacuum field approximation only show a small increase of the loss that are insufficient to account for the observation. This implies that a nonlinear mechanism is responsible for the fast ion transport in the presence of RMP. In addition, we report recent progress in the gyrokinetic simulation of Alfvén instabilities using global  $\delta f$  gyrokinetic PIC code gKPSP [1]. The gKPSP code has been recently extended to model energetic particle transport in interaction with Alfvén activities and thermal particle turbulent transport. We introduce general features and benefits of the gKPSP code and present initial simulation results on the excitation of Alfvén instabilities by energetic particles.

[1] J.M. Kwon et al., Nucl. Fusion 52 (2012) 013004