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# Effects of 3D magnetic field on fast ion loss and Alfvenic activities in KSTAR

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We report observation and numerical analysis of fast ion loss and Alfvenic activities driven by 3D magnetic field in KSTAR. Experimental observation in KSTAR indicates a sudden increase of fast ion prompt loss by resonant magnetic perturbation (RMP) when the applied RMP field exceeds a threshold amplitude. Full orbit simulation with 3D perturbed equilibrium computed by the ideal plasma response reproduces the experimentally observed feature of RMP-induced prompt loss of fast ions and the existence of threshold RMP amplitude. Phase space analysis suggests that trapped and intermediate pitch passing particles modified from initial high pitch passing ones are responsible for the threshold behavior of the fast ion loss in the simulation. It is found that the phase space distribution of lost particles depends on the RMP field configuration. Another observation in KSTAR suggests that non-resonant 3D magnetic field can excite Alfvenic activities. In those discharges, up to 70% reduction of core toroidal rotation was achieved by 3D field driven magnetic braking, while change of kinetic profiles was not significant. Excitation of Alfvenic activities by 3D field is likely to depend on bulk plasma parameter and degrade confinement through enhancing fast ion loss and/or decreasing neutral beam power absorption. Role of 3D field in driving Alfvenic modes and correlation to plasma response will be discussed.

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