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Predictive models for fast ion profiles relaxation in burning plasmas[1] NIKOLAI GORELENKOV, PPPL, W.W. HEIDBRINK, UC Irvine, J. LESTZ, M. PODESTA, PPPL, M. VAN ZEELAND, GA, San Diego, R.B. WHITE, PPPL — The performance of the burning plasmas is limited by the confinement of superalfvenic fusion products, alpha particles, which are capable to resonate with the Alfvénic eigenmodes (AEs). Two techniques based on linear AE stability theory are developed to evaluate the AE induced fast ion relaxation. The first is the reduced quasilinear technique or critical gradient model (CGM) where marginally unstable (or critical) gradient of fast ion pressure is due to unstable AEs. It allows the reconstruction of fast ion pressure profile and compute their losses. The second technique is called hybrid that is also based on NOVA-K linear stability computations of TAE (or RSAE) mode structures and growth rates. AE amplitudes are computed from the nonlinear theory perturbatively and used in numerical runs. With the help of the guiding center code ORBIT the hybrid model predicts the relaxation of the fast particle profiles. We apply these models for NSTX and DIII-D plasmas with the neutral beam injections in order to validate the models. Both methods are relatively fast ways to predict the fast ion profiles in burning plasmas and can be used for plasma modeling prior to building experimental devices such as ITER.

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