Non-Linear 3D Hybrid Kinetic-MHD Simulations of Alfven Eigenmodes in the ASDEX Upgrade Tokamak

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Recent experiments in the ASDEX Upgrade (AUG) tokamak have shown that externally applied 3D fields may be used to control Toroidally Induced Alfven Eigenmodes (TAE) in neutral beam heated discharges with elevated q-profile and low collisionality. TAEs have been fully suppressed or excited in identical discharges with n=2 3D fields by varying their poloidal spectrum. The non-linear 3D hybrid kinetic-MHD MEGA code has been applied to these discharges to identify the underlying mechanism in a fully 3D geometry. MEGA simulations reproduce some key aspects of the experiments such as the mode frequency, radial structure and the dependence of the AE activity on the poloidal spectrum of the externally applied 3D fields. The wave-particle resonances responsible for the TAE drive and affected by the externally applied 3D fields have been identified using full orbit simulations. A synthetic Fast-Ion Loss Detector (FILD) diagnostic has been included in MEGA by implementing the AUG 3D wall for numerical particles.