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TH/P6-17: Nonlinear Simulation of Energetic Particle Modes in JT-60U

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Global nonlinear simulations of intermittent large-amplitude events (ALE) observed in neutral-beam-driven JT-60U plasmas are performed. For the first time, simulations of these relaxation events are performed with realistic flux surface geometry and bulk plasma pressure. Comparisons with earlier results obtained with a circular plasma model and zero bulk pressure are made. It is found that plasma shaping reduces linear growth rates and initial saturation levels by factors 2-2.5. In agreement with theoretical predictions, a destabilizing influence of bulk pressure and stabilizing influence of compressibility is observed. Radial mode location and frequencies are comparable in all cases and agree with experimental results. During the first burst of mode activity (within 100 microseconds), energetic ion transport is reduced by a factor 3-4 due to shaping and finite beta effects. The first burst is followed by complicated dynamics, which vary from case to case. Interestingly, at the end of the relaxation event (after a few 100 microseconds), the cumulative loss of energetic ions from the central core region is comparable in all cases. Since the present study deals with a tokamak plasma subject to strong drive from energetic particles, the results are relevant to burning plasma research as will be pursued in JT-60SA and ITER.

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