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Using synthetic diagnostics to analyze NIMROD simulations of DIII-D QH-mode[1] JACOB KING, ALEXEI PANKIN, SCOTT KRUGER, Tech-X Corp, XI CHEN, KEITH BURRELL, ANDREA GAROFALO, RICH GROEBNER, General Atomics, GEORGE MCKEE, ZHENG YAN, University of Wisconsin — Understanding of H-mode operation regimes without edge localized modes (ELMs) requires validated simulation of the nonlinear fluctuation dynamics. The extended-MHD NIMROD code is used to simulate the dynamics of an Edge Harmonic Oscillation (EHO) during DIII-D quiescent H-mode (QH-mode) discharge 163518. EHOs observed in nonlinear MHD simulations have $n = 1$ and $n = 2$ as dominant modes akin to the observed dynamics in DIII-D. Using the diagnostics in DIII-D to constrain the most accurate equilibrium reconstruction creates a MHD-stable initial state. Hence, the experimental equilibrium for the DIII-D discharge 163518 is modified to include two levels of instability drive by increasing the experimental pressure gradient and associated bootstrap current. A synthetic beam-emission spectroscopy (BES) diagnostic shows that the amplitude of the experimental density perturbations is between the computed density perturbation amplitude for the two levels of instability drive. We discuss how validation of edge instabilities requires an understanding of transport, instability, and careful consideration of how codes are mathematically formulated to create the proper numerical experiments, and how local measurements can help guide this effort.

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Jacob King
Tech-X Corp

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