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Analysis of weakly coherent mode in I-mode with the BOUT++ code

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The weakly coherent mode (WCM) in I-mode has been studied by six-field two-fluid model based on the Braginskii equations under the BOUT++ framework. The calculations indicate that a tokamak pedestal exhibiting a WCM is unstable to drift Alfven wave (DAW) instabilities and resistive ballooning mode. The nonlinear simulation shows promising agreement with the experimental measurements of WCM. The spectrum of the largest toroidal number mode n=20 at the location of the reflectometry agrees with the experimental data. The mode propagating in electron diamagnetic direction is consistent with the results from the magnetic probes, a large ratio of particle to heat diffusivity is consistent with the distinctive experimental feature of I-mode, and the value of the electron thermal diffusivity from simulation is almost as same as the effective thermal diffusivity from the experiment. The prediction of the WCM shows that free energy is mainly provided by the electron pressure gradient, which gives a well guidance for pursuing future I-mode studies.

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