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Pedestal stability and broadband turbulence spectrum analysis of wide pedestal quiescent H-mode scenario[1] ZEYU LI, ORAU/GA, XI CHEN, KEITH BURRELL, CHRIS MUSCATELLO, GA, XUEQIAO XU, BEN ZHU, LLNL, TOM OSBORNE, RICHARD GROEBNER, GA, BRAIN GRIERSON, PPPL/GA, DIII-D TEAM — Wide pedestal QH-mode discovered on DIII-D in recent years is characterized by a stationary and quiescent H-mode with a pedestal width exceeding EPED prediction by 25%. Simulations carried out by BOUT++ six-fields reduced MHD model demonstrate that two fluid effects may be key to understanding the physics of the wide pedestal QH-mode, which drive two kinds of MHD-scale instabilities in different radial locations: one is a peeling-ballooning mode modified by two fluid effects at the peak pedestal gradient position; the other is a drift Alfven wave (DAW) at the pedestal top which is driven unstable when electron dynamics is included, and therefore imposes a limit on the pedestal height. Detailed turbulence ω-k power spectrum analyses in different radial locations show a reasonable agreement among BES/MIR experimental measurements on directions of multiple-modes rotation, frequency range and wave number. In order to study micro-scale turbulence transport dynamics, simulations using gyro-kinetic code CGYRO find trapped-electron mode (TEM) unstable inside the pedestal region, which may be regulating the density and temperature gradients of wide pedestal QH-mode. This work presents improved physics understanding of the pedestal stability and turbulence dynamics for wide pedestal QH-mode.

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