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H-Mode Pedestal Scaling in DIII-D, AUG and JET[1]

MARC BEURSKENS, JET-EFDA, Culham Science Centre, OX14 3DB, Abingdon, UK, EURATOM/CCFE Fusion Association, Culham Sc. Centre, Abingdon, OX14 3DB, UK

In H-modes the edge pedestal width determines the height of the pressure pedestal if the pedestal gradient is limited by MHD stability. This study separately compares the temperature and density pedestal widths w_T and w_n from high spatial resolution measurements on DIII-D, AUG, and JET, with theory based models. The ExB velocity shear turbulence suppression predict $w_T/a \propto \rho*^{1/2}$ to w$_T/a \propto \rho*$ ($\rho* \propto \sqrt{T_i}/aB_T$), however, a combination of JET and DIII-D discharges indicated $w_T/a \propto (\rho*)^{-0.17\pm0.08}$, inconsistent with these theories. EPED1 couples kinetic-ballooning and peeling-ballooning constraints to set pedestal height and width giving $w_{T,n} \propto \beta_p^{1/2}$, $\beta_p = p_{ped}/(<B_p^2>/2\mu_0)$. DIII-D data shows a strong correlation with $w_{T,n} \propto \beta_p^{1/2}$, while JET data shows no strong β_p dependence. AUG data cannot exclude $w \propto \beta_p^{1/2}$ for w_T but does for w_n. The experimental scaling found in this study is beneficial for future fusion devices as the weak $\rho*$ scaling of w/a implies a scaling with machine size.

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