Gyrokinetic pedestal studies varying shaping in AUG

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The pedestal region in tokamak plasmas plays a critical role in determining overall confinement and performance, yet the interplay between turbulence and plasma shaping within this region remains to be fully understood. In this work, we present a comprehensive characterization of pedestal instabilities and their sensitivity to plasma shaping effects using the gyrokinetic code GENE [1,2]. We consider a well documented ELM-y H-mode discharge at two different times while varying pedestal shaping parameters at constant β_{pol} [3]. In order to maintain the value of β_{pol} the heating power (2 MW ICRH and 4-10 MW NBI) was reduced during the higher shaping phase. Key turbulence modes, including kinetic ballooning modes and electron temperature gradient (ETG) modes, are identified with local linear simulations and compared between the differently shaped scenarios to assess their impact on transport and stability. Global nonlinear fully electromagnetic simulations reveal a significant contrast between the high and low shaping cases, with ExB shear stabilization exhibiting a much stronger effect in the former. At electron scales, the nature and impact on transport of ETG modes is assessed, confirming a significant amount of transport driven by these modes, highlighting ion frequency ETG and comparing with reduced models. Finally, parallel magnetic fluctuations are found to only produce mild changes in transport for the parameters considered.

References

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