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# Preliminary plasma core transport analysis of optimized internal inductance steady-state H-mode discharges in EAST

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The optimized internal inductance advanced tokamak scenario has been developed both theoretically [1] and experimentally [2] motivated by previous confinement improvement studies of high internal inductance plasmas [3-6].In the last EAST campaign, a class of moderately high internal inductance steady state H-mode discharges with fully non-inductive current drive has been achieved using pure radio-frequency heating. The energy confinement enhancement factor H89 is observed to increase with the internal inductance. This kind of plasmas has peaked electron density and temperature profile in plasma core and q profile flat in the near-axis region with $q_0 > 1$. Thermal transport analysis in plasma core has been performed by using of TRANSP code, which uses EFIT reconstructed equilibria constrained by current profile from an 11-channel far infrared laser polarimeter interferometer and kinetic profiles from a Thomson scattering system ($T_e$, $n_e$) and a tangential X-ray crystal spectrometer ($T_i$). Preliminary results from TRANSP give very low electron thermal diffusion coefficient in the plasma core. Besides, role of ECRH/CD on the formation of the plasma current profile is also investigated by simulation of a discharge with ECRH shut down during the plasma current flat top. Preliminary results show that ECR power deposited at ρ=0.1, which raise up the electron temperature in plasma core to help LHW deposit also near plasma center and therefore enhance core heating. Conclusion can be drawn from the simulations that the confinement improvement in plasma core is due to higher poloidal field in the plasma core and larger magnetic shear in the outer half of the plasma when the internal inductance is relatively high.

Gyrokinetic simulations on physical mechanisms leading to the high confinement in high internal inductance plasmas on EAST have been performed. The simulations use GYRO code for linear analysis to identify the most unstable modes (and the sub-dominant modes as well, if necessary) in different radial regions (i.e. confinement region: $\rho\sim0.2-0.5$; no-man's land near pedestal top: $\rho\sim0.8-0.85$). TEM-like modes are dominant in the near-axis confinement region, like $\rho\sim0.2, 0.3$. The highest growth rate appears at $k_y\rho_s\sim0.5$. The growth rate of this mode decays towards short wavelength. It also decays when the collisionality is artificially scaled up. The simulation results confirm that the growth rate of most unstable mode becomes lower in the radii closed to magnetic axis, which has higher pressure gradient and lower thermal diffusivity. This is consistent with the experimental observation of central peaking electron temperature profile. The transition of dominant mode from TEM-like to ETG in the confinement region is identified as the radii increases. In the no-man's land near pedestal top, the dominant unstable mode is found to be ITG. Further analysis will focus on the parametric dependence of the mode features on major physical quantities, e.g. the local magnetic shear. A comparison between optimized (high) li case and normal (relatively low) li case will also be discussed.

References

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