Observation of intrinsic plasma current generated by electron temperature gradient driven turbulence in stationary high electron energy confinement plasmas

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High-$\beta_{\theta e}$(a ratio of the electron thermal pressure to the poloidal magnetic pressure) steady-state long pulse plasmas with steep central electron temperature gradient are achieved in the Experimental Advanced Superconducting Tokamak (EAST). An intrinsic current is observed to be modulated by the electron temperature gradient driven turbulence. This turbulent current is generated in the counter-current direction when the turbulence amplitude increases above a threshold, and can reach a maximum ratio of 25% of the bootstrap current at the q=1 rational surface (q is the safety factor). This maximum value leads to the destabilization of an m/n=1/1 mode which by counteraction reduces the turbulence level (m and n are the poloidal and toroidal mode number, respectively). These observations suggest that the self-regulation system including turbulence, turbulent current, and m/n=1/1 mode is a contributing mechanism for sustaining the steady state long pulse high-β_e regime.

References

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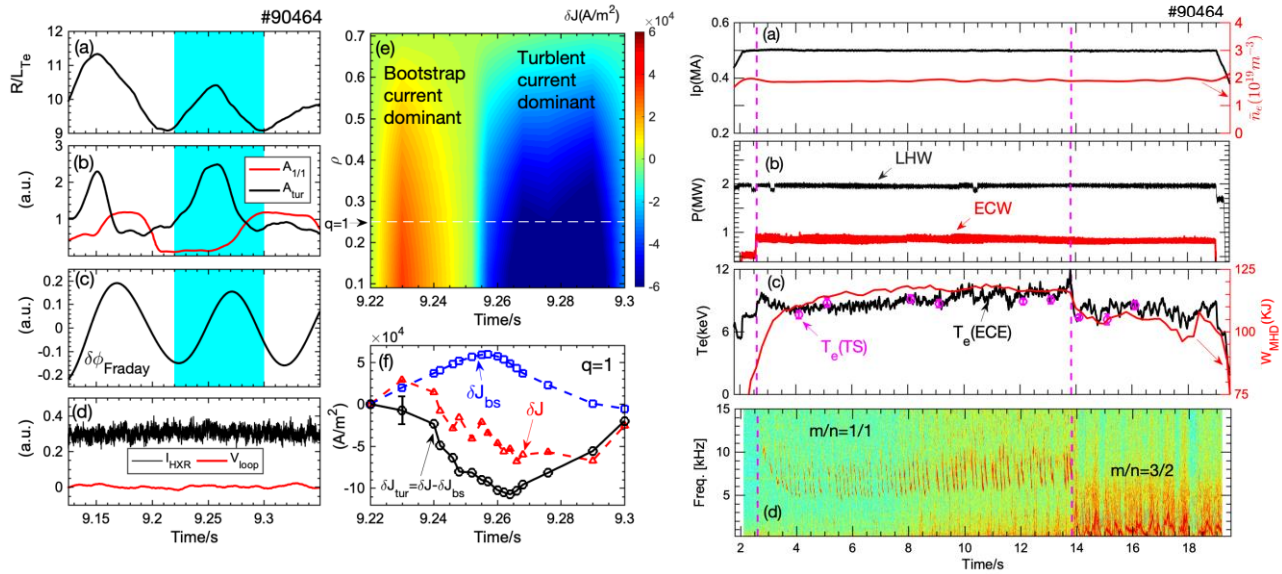

Figure 1: Turbulence and Turbulent current (Left Column), and the Operating plasma scenario (Right Column)