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Micro-instabilities and transport simulations of hot-ion mode on EHL-2

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EHL-2 is an ENN next-generation spherical torus aiming at studying p-B fusion reactions in magnetic confinement device. The design scenario is hot-ion mode with Ti0>20keV, Ti/Te>2, $n_e0\sim1.3\times10^{20}\mathrm{m}^{-3}$, Ip~3MA, Bt~3T. Hot-ion mode is believed to be crucial to p-B fusion due to its benefit on the reduction of the radiation. To achieve high ion temperature, we choose NBI as the major heating method during the current flat-top regime. Fluid simulations (ASTRA) reveal that the realization of hot-ion mode strongly relies on the relative heat transport level of ions and electrons, energy deposition fraction of NBI, and electron density. With P_NBI=15MW, E_NBI=80keV, hot ion mode with Ti0~25keV, Ti/Te>2 can be achieved by setting $\chi_i \sim \chi_e \geq \chi_i^{neo}$. For further understanding, both electro-static and electro-magnetic micro-instabilities under configuration of EHL-2 are studied using gyro-kinetic simulations (GENE). It is found that KBM/TEM dominate in ion scale, while ETG dominate in electron scale. Scanning of ITG with beta shows some new physics comparing with that of conventional tokamak operation regime. Detailed analysis is in progress.

Key words: micro-instability; transport; p-B; ST; EHL-2

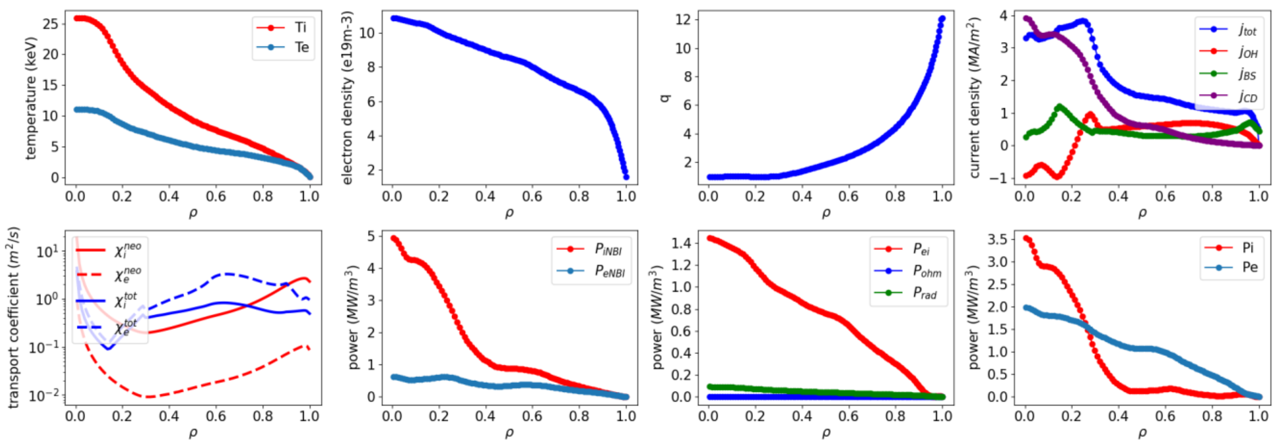

Figure 1 Radial profiles of temperature, electron density, safety factor, current density, transport coefficients and power balance in steady state of EHL-2 current flat-top regime.