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Current Transport and Density Fluctuations at L-H Transition on EAST

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Plasma confinement and sustainment of a steady-state tokamak reactor depend on current density profile control to manage MHD instabilities. A number of operational scenarios have been identified for high-performance and high-beta tokamak operation. In these high-temperature plasmas, current transport may occur on time scales much faster than resistive diffusion. Anomalous current transport can arise from magnetic reconnection, self-generated current (dynamo effect) through various MHD effects and magnetic flux pumping or kinetic effects such as fast particles loss in a stochastic magnetic field. Understanding and controlling current transport in a long-pulse tokamak using ITER relevant actuators (NBI, LHCD) and sensors (Faraday-effect polarimetry), as is being pursued on EAST, becomes increasingly important and will provide a strong physics base for ITER operation scenario development. In this paper, we report on current profile evolution in EAST NBI driven plasmas where two neutral beams are injected, one during the current ramp phase and the 2nd during flattop. At the end of the current ramp phase, it is found that a flat q profile with q0˜1 is achieved with low magnetic shear in the core. It is observed that plasma current and density both relax on a timescale much faster than resistive time, even in the absence of sawtooth activity when H-L transition happens. Density fluctuations associated with magnetic perturbations (3/2) are observed as a precursor to the H-L transition are observed. It is likely that these modes play a role in fast current transport.

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