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Analysis of Radial Electric Field Formation by Asymmetry of Neutral Beam Injection on KSTAR and NSTX Based on the Gyro-Center Shift

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An analysis of radial electric field formation in the core region of tokamak is developed based on the gyro-center shift (GCS) theory and its calculation is compared with experimental measurements on KSTAR and NSTX. The GCS theory suggests the radial electric field formation by the perpendicular component of neutral beam injection (NBI) momentum input [1]. Most of induced ExB drift is balanced with the parallel rotation so that the plasma rotation is purely toroidal but there are regions where the induced radial electric field generates poloidal rotation since the neutral beam is injected into the same flux tube with different pitch angles when it propagates into inboard side and outboard side. The poloidal rotation measurements from beam emission spectroscopy (BES) and microwave imaging reflectometer (MIR) for the edge region and x-ray imaging crystal spectrometer (XICS) for the core region with analysis using NUBEAM code will be presented on KSTAR. The profile measurement of poloidal velocity by charge exchange recombination spectroscopy (CHERS) on NSTX is also compared with the calculation based on GCS theory.

[1] Lee K C 2009 Plasma Phys. Control. Fusion 51 065023

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