H-mode transition Analysis of NSTX based on the E_r formation mechanism by the gyrocenter shift

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The radial current generated by the ion-neutral momentum exchange has been analyzed to be responsible for the radial electric field (E_r), the turbulence transport, and the low confinement mode (L-mode) to high confinement mode (H-mode) transitions on the edge of tokamak plasmas. In this analysis of gyrocenter shift the plasma pressure gradient and the neutral density gradient are the major driving mechanism of the radial current and the electric field is formed as the source of the return current to make an equilibrium condition. When there is turbulence the small scale ExB eddies induce the cross-field transport. Finally the origin of turbulence is interpreted that it comes from the friction between the plasma and the neutrals so that the Reynolds number determines the state between laminar flow (H-mode) and turbulent flow (L-mode). The confinement time from the EFIT equilibrium of the national spherical torus experiment (NSTX) is compared with the density fluctuation level measured by the far infrared tangential interferometry/polarimetry (FIReTIP) to verify the turbulence induced diffusion coefficient from the theory of gyrocenter shift. In this paper theoretical explanation and the comparison with experimental data including the Reynolds number on the NSTX H-mode transitions will be presented.

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