Transport and turbulence study based on the ion-neutral collisions and its application to KSTAR

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As a new method of charge and particle transport analysis for the magnetized plasmas the gyro-center shift (GCS) theory has been developed. GCS theory is based on the momentum exchange of ion-neutral collisions such as charge exchange reactions which result in the radial current and turbulence generation so that GCS theory can explain the radial electric field (E_r) formation and the high confinement mode (H-mode) transition in tokamak [1-2]. This paper presents the summary of recent GCS theory development including the validity against the quasi-neutrality and an experimental study of momentum transfer on KSTAR with analysis based on the GCS theory. The experiment was performed for the different NBI sources in order to verify the influence of in-out momentum input asymmetry in a same flux tube and its result is indicated in Fig.1.

Fig.1 poloidal velocity measurements by the microwave imaging reflectometer (MIR) and the beam emission spectroscopy (BES) on KSTAR and comparison with the calculation by GCS theory.

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