§18. Effect of Magnetic Axis Shift on Neoclassical Transport in Helical Torus

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During more than two decades, a number of analytical and numerical approaches have been developed to study the neoclassical transport in toroidal helical systems. Analytical descriptions of neoclassical transport are effective because they give clear physical insight associated with various transport and/or loss mechanisms. However, the derivation of the most of these analytical formulae are originally based on a number of assumptions such as so-called frequency ordering, which leads somewhat disconnected expressions for the transport coefficients in different collisionality regimes. On the other hand, lots of numerical methods have been discussed to avoid some of these assumptions and to determine the transport coefficients over the wide range of collisionality regime. Among these studies there are the Monte-Calro simulations, the methods based on the bounce-averaged Fokker-Planck equation, namely, FPSTEL, FLOCS, and numerical code by solving the drift kinetic equation, DKES. A general solution of the ripple- averaged kinetic equation; GSRAKE is also developed.

In the previous paper, the effect of radial electric field on neoclassical transport has also been analyzed in detail when a boundary layer and/or resonance are present. Furthermore, great efforts have been undertaken to optimize magnetic configurations associated with the reduction of neoclassical transport.

In this work, we study the neoclassical transport in typical configurations such as inward-shifted configuration of LHD device by solving the bounce averaged Fokker-Planck equation (CHD1). The magnetic field is calculated by using the MAGN code for fixed coil currents. Then, the transport coefficients are evaluated for a realistic magnetic field relevant to the operation parameters of the LHD experiment. It is shown in Fig.1 that the diffusion coefficient decreases as the magnetic axis is shifted inwardly. Here, $R\omega_E / \nu = 1.0 \times 10^{-3}$ is assumed.

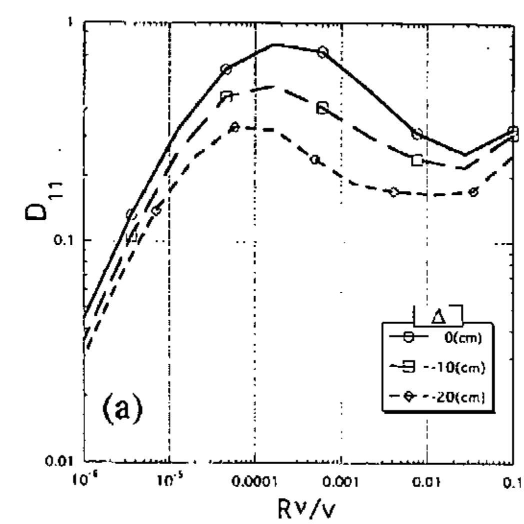

Fig.1 Collisionality dependence of the diffusion coefficient for several Magnetic axis shift (0cm, -10cm and -20cm).