§9. Strike Point Pattern on Local Island Divertor Head

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The Local Island Divertor (LID) is one of the divertor concepts in the Large Helical Device (LHD) configuration [1, 2], and it utilizes an m/n=1/1 island formed at the edge region of the LHD. Control of the edge plasma by means of the LID is expected to realize the high temperature divertor operation (HT-operation). In the HT-operation, the neo-classical effect on the transport becomes important.

The Monte Carlo simulation based on the test particle representation has an advantage of appropriately treating the edge plasma transport in the three-dimensional field line structure with the island and ergodic zones [3]. We trace the orbits of the guiding centers of the test particles in the fixed magnetic field under the effects of the Coulomb collision [3], in order to numerically observe the distribution of the guiding centers in the configuration space. Here the vacuum magnetic field is used to calculate the orbits, the magnetic axis is located at $R_0 = 3.6$ m and the strength of magnetic field at the axis is $B_0 = 3$ T. Consider the situation that the test particles are mono-energetic protons with $E_t = 300$ eV, the distribution of the initial pitch angles of the particles is uniform, and the Maxwellian background plasma is uniform in the edge region including the island.

When the collision frequency of the edge plasma is estimated as $\nu = 8.4 \times 10^3$ s^{-1}, we find that the strike point pattern is caused by the diffusion to the outside of the torus and the peak of the strike point distribution is located at the edge of the head, as shown in Fig. 1. On the other hand, when the collision frequency becomes small and it is estimated as $\nu = 9.0 \times 10^2$ s^{-1}, the strike point pattern is changed as shown in Fig. 2. Distributions of the cosine of pitch angles $v_\parallel/|\boldsymbol{v}|$ of the test particles striking on the head are given in Fig. 3.

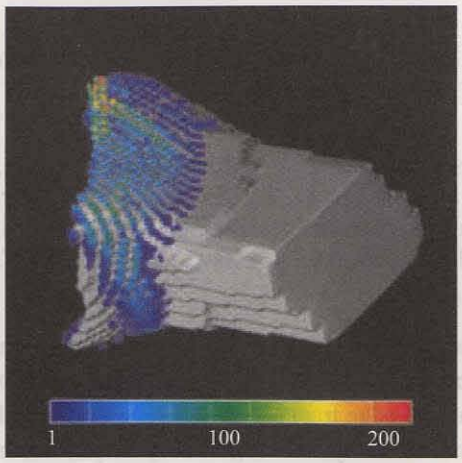

Figure 1: Strike point pattern for $\nu = 8.4 \times 10^3$ s^{-1}.

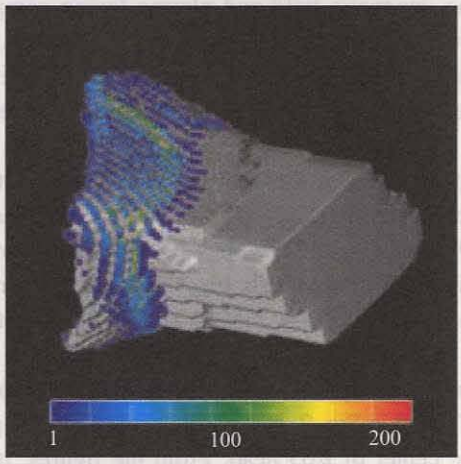

Figure 2: Strike point pattern for $\nu = 9.0 \times 10^2$ s^{-1}.

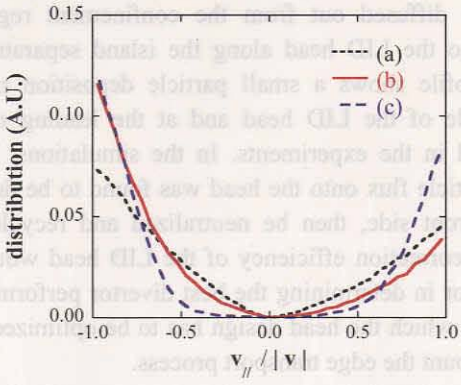

Figure 3: Distributions of the cosine of pitch angles $v_\parallel/|\boldsymbol{v}|$. (a) dotted line: $\nu = 7.8 \times 10^4$ s^{-1}, (b) solid line: $\nu = 8.4 \times 10^3$ s^{-1} and (c) dashed line: $\nu = 9.0 \times 10^2$ s^{-1}.

References

[1] Komori, A. et al. : Plasma Physics and Controlled Fusion Research, 1994 (IAEA, 1995).

[2] Ohyabu, N. et al. : J. Nucl. Mater. **220-222** (1995) 298.

[3] Kanno, R., Jimbo, S., Takamaru H. and Okamoto, M. : accepted for publication in J. Plasma Fusion Res. SERIES **6**.