§24. Strike Point Pattern on Local Island Divertor Head

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The Local Island Divertor (LID) is one of the divertor concepts [1-3], 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.

We carried out Monte Carlo simulation based on the test particle representation in order to investigate a strike point pattern of ions on the Local Island Divertor (LID) head in the Large Helical Device configuration. The pattern on the LID head is numerically observed by tracing the guiding center orbits of the test particles in the fixed magnetic field under effects of the Coulomb collision [4-6]. Here the vacuum magnetic field is used to calculate the orbits, the magnetic axis is located at R_0=3.6m and the strength of magnetic field at the axis is B_0=3T. Consider the situation that the test particles are mono-energetic protons with Et=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. We assume that the pitch angle scattering is dominant compared with the other effects of the collisions, and neglect effects of the electric field. We also assume that all of the test particles start from the magnetic flux surface located at the edge of the core region, which is very close to the island separatrix, and the particles are distributed uniformly on the surface.

When the collision frequency of the edge plasma is estimated as $\nu = 8.4\times10^3\ s^{-1}$ (collisional), 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. Note that the strength of pattern is not symmetric as shown in Fig.1. Here the test particles are assumed to be absorbed completely into the head when arriving at the surface of the head. On the other hand, when the collision frequency becomes $\nu = 9.0\times10^2\ s^{-1}$ (collisionless), the strike point pattern is drastically changed as shown in Fig.2. The pattern becomes almost symmetric and corresponds to the shape of the island on the LID head.

In this article, we neglect effects of electric field, energy scattering, charge exchange, etc. These effects will be discussed in future work.

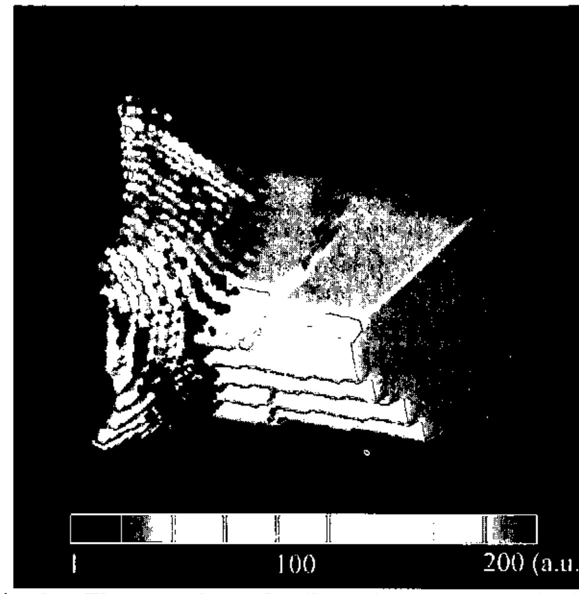

Fig. 1. The rear-view of strike point pattern on the head for the collisional regime.

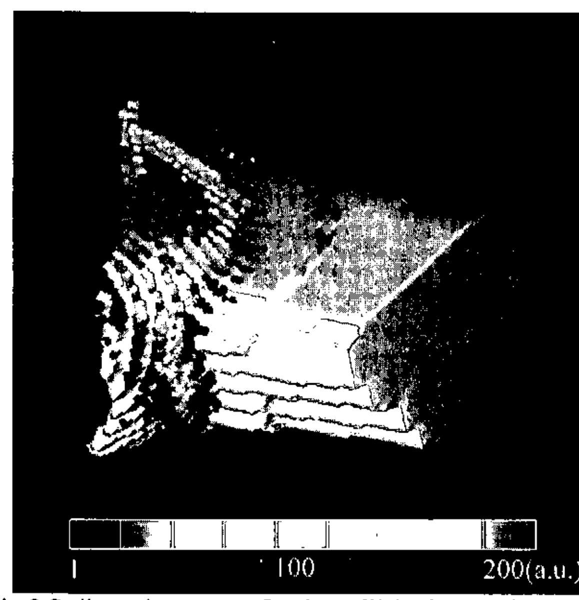

Fig.2 Strike point pattern for the collisionless regime.

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