

§31. Structure of the Edge Plasma Region of the LHD

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We have studied numerically the structure of magnetic field lines and characteristics of particle orbits in the edge plasma region of the LHD.

Magnetic field line traces are plotted by perspective drawings from the CCD camera view point of LHD. Comparing the CCD camera view of LHD plasma and this perspective drawings of lines of force, it is confirmed that low temperature plasma is restricted only in the chaotic field lines region and high temperature (transparent plasma in visible light) is extending almost outer most magnetic surface, in steady state stage of LHD discharges. The almost outer most magnetic surface (lines of force tracing starting from the point ($R = 4.59m$, $z = 0, \pm 5 mm$, $\phi = 0$)) is shown in Fig.1 (a).

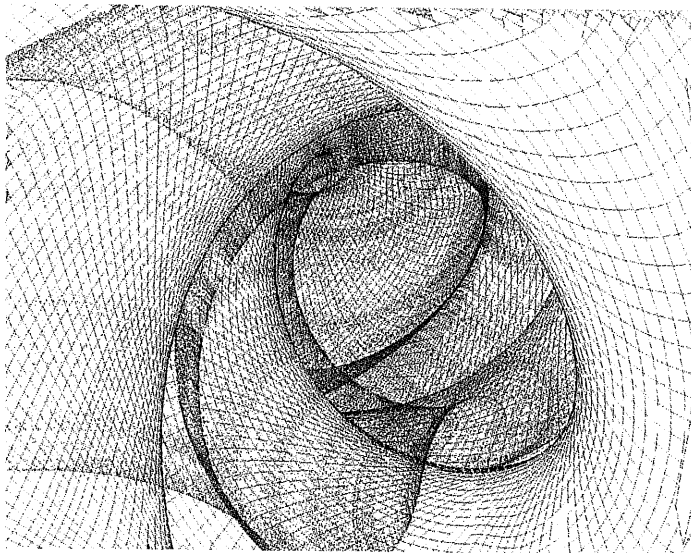


Fig.1 (a) A perspective drawings of the almost outer most magnetic surface

On the other hand, Fig.1 (b) shows field line tracings at chaotic field line region, which is in good agreement of brightening belts of the CCD camera view of LHD plasma.

Connection length of lines of force L_c in chaotic field lines region are calculated and confirmed that the magnetic field of LHD scrape off plasma has very long connection length (L_c is of the order of a few km as shown in Fig.2).

We have proposed a new edge plasma model of LHD based on the characteristic of particle orbits and magnetic field structures, that is the edge plasma of LHD is mixture of temporary staying plasma due to very long connection length of lines of force and mirror confined plasma. The mirror confined plasma is composed of reflecting particles, which have relatively large pitch angle. Numerical and theoretical studies shows that the reflecting particles can be confined in chaotic field line region outside of the last closed magnetic surface.

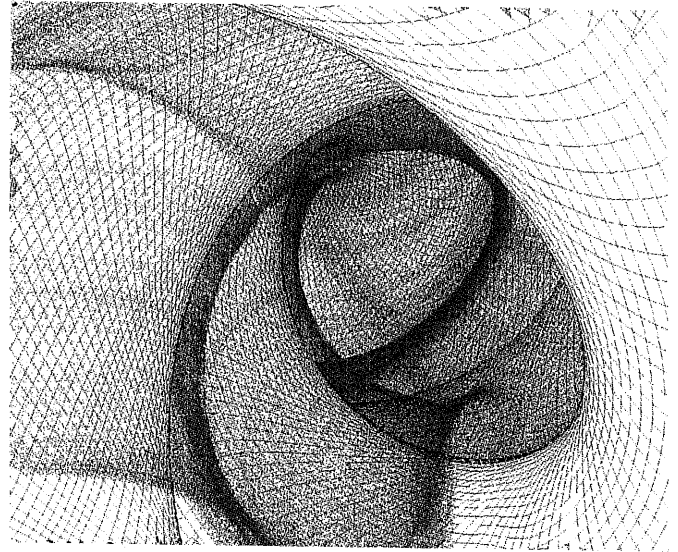


Fig.1(b) Perspective drawings of the chaotic field lines

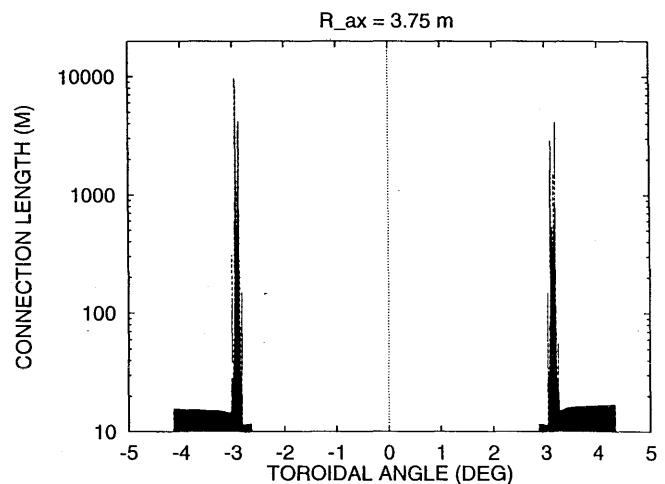


Fig.2 Connection length of field lines. Starting points of lines of force are placed at divertor legs regions on vacuum vessel wall.