§32. Advanced Divertor Concept — RF Divertor

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The design of divertor is one of the most difficult problems of the fusion reactor systems. The roles of divertor are safe heat removal from core plasma region, particle control and improving of core plasma confinement.

The application of radio-frequency (RF) forces to divertor plasma is proposed for the improvement of its relevance to reactors. RF fields are applied at the entrance of closed divertor rooms. Ponderomotive forces sustain high density scrape-off plasma which screens the penetration of neutral atoms into core plasma regions, and create positive electrostatic potential in scrape-off plasma region which suppresses the penetration of impurity ions from divertor rooms. Ponderomotive force for electron is also applied to prevent the upstream flow of cold electrons from divertor rooms to scrape-off regions.

We introduce simplified 1-D model for the LHD divertor as shown in Fig.1(b) to study the features of rf divertor plasma flow analytically and numerically. As basic equations, we use the multi-fluid equations and Poisson equation. Time evolution of divertor plasma flow is solved numerically with ponderomotive force effects. Potential barrier to stop the upstream flow of impurity is sustained at entrance of divertor room. Density of scrape-off plasma is also sustained in high level compared to the case of no rf fields. These results are summarized in [1].

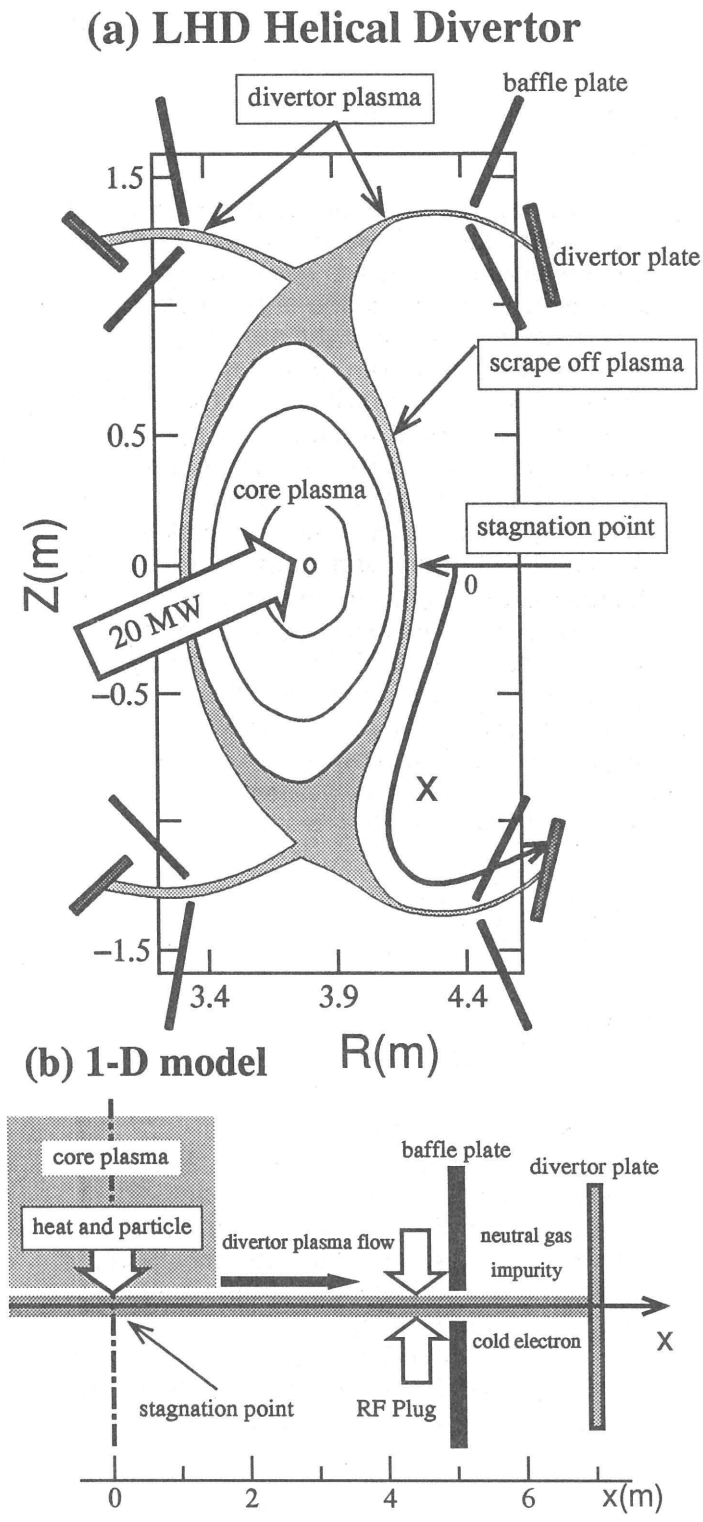

Fig.1 (a) Magnetic field configuration of LHD including divertor field lines. (b) 1-D model for divertor plasma flow. Coordinate x represents the distance from the stagnation point to divertor plate. Divertor plasma is assumed to be symmetric with the stagnation point ($x = 0$).

Reference

1) Watanabe,T., Watari, T. and Ohyabu, N., Fusion Engineering and Design, **26** (1995) 365.