Topological Changes in Magnetic Flux Surfaces during IDB-SDC Discharge in LHD

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A superdense core (SDC) plasma develops when a series of pellets is injected into the neutral beam heated plasma in the outward shifted configuration in LHD. The central density more than ~ 1×10^{21} m^{-3} and the central temperature about 0.3 keV are maintained by an internal diffusion barrier (IDB) formed in the core region, where the steep density gradient is seen. The critical ingredients for the IDB formation are strong edge pumping to reduce particle recycling and multiple pellet injection to ensure strong central fuelling. From the wide range magnetic configuration study, it has been found that the IDB-SDC mode can be obtained only in the outward shifted configuration where the ergodic layer surrounding the confinement region is very thick. During the IDB-SDC discharge, the large Shafranov shift due to the high central plasma pressure takes place, which strongly modifies the magnetic field structure. According to the HINT2 code which can deal with the three-dimensional equilibrium, the ergodization develops from the edge region to the core region with the increase in the central beta value. In the ergodic layer, it is expected to have different heat and particle transport properties from the region with perfectly nested flux surfaces. It is surely observed in the experiment that the region where the density and its radial gradient are low spreads outside the SDC. In order to see the relation between the magnetic field structure and the profile formation, resonant perturbation field was applied to the IDB-SDC plasma to modify the magnetic field structure. An interesting phenomenon was observed in the experiment, i.e., the low m (=1 or 2) islands generated by the perturbation field seem to be healed or ergodized during the density increasing phase. At the conference, the effect of ergodization on the IDB-SDC formation is discussed.