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Toroidally Non-uniform Formation of Edge-Transport-Barrier by Low-to-High Confinement Transition on the Compact Helical System

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Formation of edge transport barrier (ETB) by low-to-high confinement (LH-) transition is observed in the Compact Helical System (CHS) having three dimensional magnetic configurations. Recently, we tried to measure the radial structure of ETB and the characteristics of electrostatic fluctuations in the ETB region using four sets of triple-typed Langmuir probe (LP). The LPs were installed at two toroidally different upper ports (6U and 3U port), and torus outboard- and inboard-side ports (5O and 3I port).

ETB formation was studied in two different magnetic configurations which have circular (CF1) and vertically elongated (CF2) cross-section averaged over the magnetic surface. In the CF1 configuration, electron temperature (T_e) and density (n_e) profiles had flat or hollow structure in ETB region at the 6U section. On the other hand, flat or hollow T_e and n_e profiles were not observed at the 3U section. In the CF2 configuration, very flat profile in n_e was observed at 3I port section. The characteristics of fluctuations also are significantly different among data taken at these four toroidal sections. The rational surface of the rotational transform $\iota / 2\pi = 1$ resides in the flat or hollow region. It is speculated that the static m/n = 1/1 magnetic island in edge region would bring about thus toroidally non-uniform ETB structure and temporal evolution of fluctuations. This paper will discuss these peculiar observations in ETB formation and turbulent fluctuations on three dimensional plasmas.