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TH/P2-22: Transport Analysis of Oscillatory State for Plasma Dynamics in Helical Plasmas

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The formation mechanism of transport barriers is important issue to realize improved confinement modes in toroidal plasmas. In helical plasmas, two kinds of the oscillation for the plasma quantities are experimentally observed. Firstly, the limit cycle phenomena in the temporal evolution of the electrostatic potential, namely the electric pulsation, have been observed in the core region. Related with the electric pulsation, the electron internal transport barrier is observed in the electron temperature profile. Therefore, the physical mechanism, which realizes the oscillatory plasma state, is critical for the study of improved confinement modes. Secondly, the density limit oscillation in the helical device was reported. The achievable limit of the density due to the radiation collapse has been studied, because the strong degradation of the confinement occurs if the radiation collapse happens. Dynamics of the radial structure for the plasma quantities are important for the study of the density limit. The temporally self-generated oscillation of the radial electric field has been shown as a simulation result in the core region of helical plasmas. The clear transport barrier in the radial profile of the temperature is obtained in the core region, which is associated with the oscillation of the radial electric field. Dynamics of the temperature gradient are shown during the self-generated oscillation to compare the experimental results. The temporal evolution of the density profile is newly included in a simulation when the radiative loss is calculated in the edge region of helical plasmas. Two kinds of the stationary states are studied. One is dominated by the transport loss and another is dominated by the radiative loss. The dependence of the achieved density limit on the heating power is derived, when the temporal evolution of the density is calculated. The dependence of the critical density on the heating power when the temporal evolution of the density profile is included alters compared with the case with the temporally fixed density profile. The multiple solutions of the radial electric field, which satisfy the ambipolar condition, are obtained in the edge region of helical plasmas. Progress in the study of the density limit oscillation in the edge region is reported.

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