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Effects of density gradient caused by multi-pulsing CHI on two-fluid flowing equilibria of spherical torus plasmas T. KANKI, Japan Coast Guard Academy, M. NAGATA, University of Hyogo — Two-fluid dynamo relaxation is examined to understand sustainment mechanism of spherical torus (ST) plasmas by multi-pulsing CHI (M-CHI) in the HIST device. The steeper density gradient between the central open flux column (OFC) and closed flux regions by applying the second CHI pulse is observed to cause not only the $\boldsymbol{E}$x$\boldsymbol{B}$ drift but also the ion diamagnetic drift, leading the two-fluid dynamo. The purpose of this study is to investigate the effects of the steep change in the density gradient on the ST equilibria by using the two-fluid equilibrium calculations. The toroidal magnetic field becomes from a diamagnetic to a paramagnetic profile in the closed flux region while it remains a diamagnetic profile in the OFC region. The toroidal ion flow velocity is increased from negative to positive values in the closed flux region. Here, the negative ion flow velocity is the opposite direction to the toroidal current. The poloidal ion flow velocity between the OFC and closed flux regions is increased, because the ion diamagnetic drift velocity is changed in the same direction as the $\boldsymbol{E}$x$\boldsymbol{B}$ drift velocity through the steeper ion pressure gradient. As a result, the strong shear flow and the paramagnetic toroidal field are generated in the closed flux region. Here, the ion flow velocity is the same direction as the poloidal current. The radial electric field shear between the OFC and closed flux regions is enhanced due to the strong dependence on the magnetic force through the interaction of toroidal ion flow velocity and axial magnetic field. The two-fluid effect is significant there due to the ion diamagnetic effect.

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