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Two-fluid equilibrium transition during multi-pulsing CHI in spherical torus T. KANKI, Japan Coast Guard Academy, M. NAGATA, University of Hyogo — Two-fluid dynamo current drive has been studied to achieve a quasi-steady sustainment and good confinement of spherical torus (ST) plasmas by multi-pulsing CHI (M-CHI) in the HIST device. The density gradient, poloidal flow shear, and radial electric shear enhanced by applying the second CHI pulse is observed around the separatrix in the high field side to cause not only the $\boldsymbol{E}$x$\boldsymbol{B}$ drift but also the ion diamagnetic drift, leading the two-fluid dynamo. The two-fluid equilibrium transition during the M-CHI in the ST is investigated by modelling the M-CHI in the two-fluid equilibrium calculations. The toroidal magnetic field becomes from a diamagnetic to a paramagnetic profile in the closed flux region due to the increase of the poloidal electron flow velocity in the central open flux column (OFC) region, while the diamagnetic profile is kept in the OFC region. The toroidal ion flow velocity is increased from negative to positive values in the closed flux region due to the increase in the drift velocity and the Hall effect. As the ion diamagnetic drift velocity is changed in the same direction as the $\boldsymbol{E}$x$\boldsymbol{B}$ drift velocity around the separatrix in the high field side through the negative ion pressure gradient there, the poloidal ion flow velocity is increased in the OFC region, enhancing the flow shear. The radial electric field shear around the separatrix is enhanced due to the strong dependence on the magnetic force through the interaction of toroidal ion flow velocity and axial magnetic field. The density is decreased in the closed flux region according to the generalized Bernoulli law and its negative gradient around the separatrix steepens.

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