Observation and characterization of electron cyclotron wave's effect on toroidal rotation in EAST L-mode discharges

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Abstract

Toroidal rotation velocity and its shear play an important role in the control of confinement and stability in tokamaks. However, in ITER and future fusion reactor, there is insufficient NBI torque to make plasma rotate rapidly enough. Therefore it is important to develop other actuators to drive plasma rotation. The study of spontaneous rotation with little or low external toroidal momentum input is one promising way. Change of plasma toroidal rotation caused by electron cyclotron wave (ECW) injection has been observed on EAST. It is found that the core toroidal rotation velocity increased in the co-current direction when ECW was injected into ohmic plasmas under different toroidal injection angles (co-current, counter-current and perpendicular) along with the rise in the plasma temperature and stored energy. The profile of electron temperature, ion temperature and toroidal rotation velocity gradually become peaked. Change of toroidal rotation in the core increases with the ECW injection power. Different behaviors were observed when ECW was injected to LHCD target plasmas, where electron temperature and rotation profile becomed peaked, while the ion temperature profile turned flat after ECW injection, suggesting different transport characteristics in energy and momentum. Although the mechanism of effect of ECW on toroidal rotation is still unclear, some possible reasons, such as positive electric field, pressure gradient and the residual stress, which may result in the co-current direction change, are discussed.