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TH/P4-08: Rotation Breaking Induced by ELMs on EAST

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Spontaneous rotation has been observed in LHCD H-mode plasmas with type III ELMs (edge localized modes) on EAST, and it revealed that type III ELMs can induce the loss of both core and edge toroidal rotation. Here we work on the breaking mechanism during the ELMs. Several large tokamaks have discovered ELMs'filamentary structures. It revealed that the ELMs are filamentary perturbations of positive density formed along the local field lines close to the LCFS. Currents flowing in the filaments induce magnetic perturbations, which break symmetry of magnetic field strength and lead to deformation of magnetic surface, thus generate NTV (neoclassical toroidal viscosity) torque that affects toroidal rotation. We adopt 1cm maximum edge magnetic surface displacement from experimental observation, and our calculation shows that the edge torque is about 0.35 N/m2, and the core very small. The expected angular momentum density change is about 3.8N/m2, nearly 10 times larger than the calculation. Previous work on EAST has suggested that there is a mechanism at the edge that breaks the rotation, while the core rotation change is mostly likely related with momentum transport to the edge. In other words, NTV torque should have less impact on the core but great on edge, which corresponds with the calculation as well. In our calculation, we found that the core has little dependence on the magnetic surface displacement, while the edge relies on it heavily. The exact profile of the edge torque has uncertain that comes from the exact edge displacement profile and the accurate mode number. However, the magnitude of the edge NTV torque is still nearly 0.1-1N/m2, indicating it should been emphasized while considering rotation change. Further work including transport code is planned.

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