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Nonlinear turbulent parallel momentum transport due to blobs

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Meso-scale size structures including the blobs in the edge plasma can not only transport particle and heat out, but may also contribute to the plasma poloidal/toroidal rotation, namely, the momentum transport.[1] Turbulent parallel momentum stress can be divided into three components, which are diffusive, covective and residual parts. In the presented work, the triplet nonlinear term is derived by using EDQNM method in 3D Hasegawa-Wakatani system. It is shown that the triplet nonlinear term is comparable to the quasilinear terms, i.e. the first two terms of quasilinear stress, in strong turbulence regime such as blobs. If the radial scale length of large edge coherent structure is bigger than its poloidal scale length, nonlinear residual stress can provide opposite torque with respect to the quasilinear ones and negative nonlinear diffusivity. These effects introduce inward momentum flux so that the rotation in edge region is possibly reversed and momentum is convected into core region. Moreover, it is found that nonlinear coupling for vorticity is the dominating mechanism in parallel momentum transport.

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