

DIII-D Shaping Demonstrates Correlation of Intrinsic Momentum with Energy

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Scaling of intrinsic rotation in DIII-D H-mode plasmas demonstrates a strong correlation with the ion temperature (T_i) and stored plasma thermal energy, indicating a coupling between the turbulent intrinsic momentum flux and the turbulent energy flux [1]. The empirical scaling [1] of intrinsic rotation with plasma stored energy has been recently explored by novel experiments on DIII-D that utilize relatively small variations in the plasma shape, namely the triangularity, to modify the intrinsic rotation. Shape variation modifies the turbulent transport, rather than via changes in the auxiliary heating power. These H-modes are heated by ECH with no external torque input. Balanced torque blips from neutral beams [1] measure the ion flow velocity and T_i . Higher energy and intrinsic angular momentum are correlated with higher triangularity. The measured results follow the recently established DIII-D empirical scaling [1]. Turbulent density fluctuations in the pedestal region show a significantly higher level in the lower triangularity, lower confinement phases, possibly the source of greater transport. Changing triangularity is more subtle than the up/down symmetry change experiments in TCV [2]. In DIII-D, we postulate that ExB shear likely provides the dominant symmetry breaking necessary for a net turbulent momentum stress, rather than the shaping, per se.

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[1] J.S. deGrassie et al, Phys. Plasmas 23, 082501 (2016).

[2] Y. Camenen et al, Phys. Plasmas 16, 062501 (2009).

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