A local gyrokinetic study of turbulent transport in a negative triangularity DEMO

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This work compares the Ion Temperature Gradient (ITG)-driven turbulent transport in DEMO-relevant plasmas with positive and negative triangularity δ. We performed local nonlinear gyrokinetic simulations of multiple pairs of equilibria derived from EU DEMO scenarios. We found that negative δ reduces the heat flux relative to positive δ, when holding the plasma profiles constant. This indicates that negative δ stabilizes ITG-driven turbulence, similar to past numerical [1, 2] and experimental [3, 4, 5] results for Trapped Electron Mode (TEM) turbulence. This is significant as it was thought that, since flipping the triangularity strongly affects the trapped particle trajectories, its benefits might be limited to TEM-driven turbulence. Nevertheless, by swapping individual geometric coefficients of the gyrokinetic equation, it appears that the change to particle trapping is still the dominant physical effect behind the benefits of negative δ in the ITG regime. Additionally, the magnitude of the change caused by flipping the magnetic geometry is found to increase with minor radius, which is intuitive because of the stronger triangularity near the plasma edge. Lastly, the stiffness of the temperature profiles was found to be similar between positive and negative δ at the minor radial locations considered, which is consistent with past studies of the TEM turbulence in TCV [6, 7].

References

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