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On the nonlinear generation of zonal flows by turbulence in stellarators GABRIEL PLUNK, Max Planck Institute for Plasma Physics, ALEJANDRO BAÑON NAVARRO, University of California Los Angeles, THOMAS BIRD, General Atomics — Stellarators are a relatively fresh context in which to study zonal flows. As in tokamaks, the presence of these flows is thought to lessen the intensity of turbulence and transport. An interesting question is how the peculiarities of magnetic geometry affect the interaction between turbulence and zonal flows. In this work we investigate this question theoretically, and by direct numerical simulation. We generalize the secondary instability theory of Rogers, et al (2000) to allow for arbitrary magnetic field geometry, and test its predictions directly against gyrokinetic simulations. Our theoretical findings suggest that the turbulence should be less effective at driving zonal flows when it is localized within a flux surface, and we present a series of linear and nonlinear simulations demonstrating this effect. Because turbulence in stellarators tends to be spatially localized by features of the magnetic geometry, like the variation of curvature and shear, we argue that weaker zonal flows should be generally expected. However, this effect may be balanced by the enhancement of other saturation mechanisms unrelated to zonal flows, acting to lower the overall intensity of the turbulence.

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