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Influence of Stable Modes on Momentum Transport in Freely-evolving Shear Layers in MHD[1] ADRIAN FRASER, University of California, Santa Cruz, PAUL TERRY, ELLEN ZWEIBEL, University of Wisconsin - Madison, M.J. PUESCHEL, Institute for Fusion Studies, University of Texas at Austin, JACK SCHROEDER, University of Wisconsin - Madison — In shear flows that are unstable to the Kelvin-Helmholtz (KH) instability, linearly stable, inviscid modes are known to co-exist at the same large scales as unstable modes. While unstable modes draw energy from the shear flow and transport momentum down the gradient via turbulent stresses, stable modes transfer energy back and transport momentum up the gradient [A.E. Fraser, PhD Thesis, UW-Madison 2020]. Here we study the role these modes play in KH-driven turbulence in MHD using 2D, incompressible simulations of an unforced shear layer, so the flow gradient flattens as turbulent stresses broaden the layer. A uniform, flow-aligned magnetic field is wound up by large-scale vortices, generating small-scale fluctuations that enhance dissipation and layer broadening, even for very weak initial fields. We vary field strength and resistivity to study how these dynamics relate to stable mode excitation, finding the enhanced dissipation reduces the importance of stable modes and their up-gradient momentum transport. While the Reynolds stress is well-described by a truncated eigenmode expansion if stable modes are included, the Maxwell stress is not, reflecting the complexity of the field fluctuations relative to the KH-dominated flow fluctuations.

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