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Transverse Cascade and Sustenance of Turbulence in Keplerian Disks with an Azimuthal Magnetic Field[1] D. GOGICHAISHVILI, University of Texas at Austin, G. MAMATSASHVILI, Helmholtz-Zentrum Dresden-Rossendorf; Tbilisi State Univ.; Ilia Sate Univ, W. HORTON, University of Texas at Austin, G. CHAGELISHVILI, Ilia State Univ.; Tbilisi State Univ., G. BODO, INAF/Osservatorio Astrofisico di Torino — The magnetorotational instability (MRI) in the sheared rotational Keplerian explains fundamental problems for both astrophysics and toroidal laboratory plasmas. The turbulence occurs before the threshold for the linear eigen modes. The work shows the turbulence occurs in nonzero toroidal magnetic field with a sheared toroidal flow velocity. We analyze the turbulence in Fourier k-space and x-space each time step to clarify the nonlinear energy-momentum transfers that produce the sustenance in the linearly stable plasma. The nonlinear process is a type 3D angular redistribution of modes in Fourier space a transverse cascade rather than the direct/inverse cascades. The turbulence is sustained an interplay of the linear transient growth from the radial gradient of the toroidal velocity (which is the only energy supply for the turbulence) and the transverse cascade. There is a relatively small vital area in Fourier space is crucial for the sustenance. Outside the vital area the direct cascade dominates. The interplay of the linear and nonlinear processes is generally too intertwined in k-space for a classical turbulence characterization. Subcycles occur from the interactions that maintain self-organization nonlinear turbulence. The spectral characteristics in four simulations are similar showing the universality of the sustenance mechanism of the shear flow driven MHDs-turbulence.

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Wendell Horton
University of Texas at Austin

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