Magnetic-field scaling of turbulence-driven shear flows in a linear magnetized plasma

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Abstract

Previous experimental studies carried out in a cylindrical helicon plasma device demonstrated the existence of an azimuthally symmetric radially sheared plasma fluid flow sustained by the Reynolds Stress against viscous damping in an Argon plasma at a magnetic field of 1 kG. In this work, the development of such flows is studied by applying velocimetry to fast-framed images for a variety of magnetic fields. Spectral analyses of the Reynolds Stress, obtained from direct Langmuir-probe measurements, are carried out to complete the turbulence analysis. These experimental results are compared with a self-consistent force-balance equation including the actions of the Reynolds Stress and collisional damping, providing a direct experimental test of the basic theoretical picture of drift-wave/shear-flow interactions.