Magnetohydrodynamic turbulence in plasma shear flows

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Onset and sustenance of turbulence in shear flows is quite complex and important problem in magnetohydrodynamics and plasma physics, since such flows are ubiquitously found in laboratory, engineering devices (e.g. tokamak) as well as in astrophysical objects (e.g. accretion discs, rotating plasma in star's interier, solar wind, etc). Therefore, research in MHD turbulence of plasma shear flows represents one of the broadest and most significant branches of modern plasma physics. Recent developments have demonstrated that due to flow shear turbulence is anisotropic and its spectral dynamics is more diverse than that of isotropic and homogeneous turbulence (Kolmogorov's theory). It became apparent that in purely hydrodynamical shear flows, which are spectrally stable according to modal theory, onset and maintenace of turbulence is a consequence of subtle balance between linear and nonlinear dynamics. This relatively new route to turbulence transition, named as bypass scenario, characterizes subcritical turbulence in modally stable shear flows. In this talk I will describe the dynamics of MHD turbulence in a spectrally stable flow of magnetized plasma with the help of modern numerical simulations. A detailed analysis of specific spectral dynamics of developed turbulence associated with shear is performed in 2D wavenumber space. It is shown that the turbulence's spectum is anisotropic different from that of homogeneous and isotropic turbulence and is characterized by direct as well as transverse cascades of power. The occurence of transverse cascades in shear flow turbulence represents one of our new results, that has not been considered in the lirerature. Adopted here more general treatment of turbulence problem in plasma shear flows in two or three dimensional wavenumber space, without performing angle averaging, allows us to gain a deeper insight into turbulence's anisotropic spectrum as well as in which directions energy cascade proceeds due to non-linearities.