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# Rapid Distortion Theory in astrophysical turbulence

Sergey Safonov and Arakel Petrosyan
Space Research Institute RAS, Moscow, Russian Federation

In this report, we study statistical properties of astrophysical turbulent plasma flows using Rapid Distortion Theory (RDT). The core assumption is that the turbulence responds to the external distortion so fast, that inertial and viscous forces result in a negligible change in velocity distribution. Thus it is assumed that the response to the external effect takes place in the time interval much smaller than turbulence decay time. This allows to linearize equations and to derive equations for second moments of turbulence. We apply RDT to incompressible turbulent MHD flows distorted with external magnetic field and linear velocity shear in cases of rotating and non-rotating plasma. It is shown that even with a strong nonlinearity many properties of turbulence can be qualitatively studied using a linear theory. A closed system of linear equations for velocity and magnetic field fluctuations is derived. Development of initially isotropic turbulence and transition to anisotropy are studied. Equations for fluid, current and cross helicity are derived. Differences in cases of rotating and non-rotating flows are discussed. Changes introduced by considering Hall effect are discussed.