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Measuring the cascade rate in anisotropic turbulence through 3rd order structure functions.

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We employ the Von-Karman-Howart-Yaglom-Politano-Poquet (KHYPP)law, to compute the cascade rate by means of 3rd order structure functions in homogeneous, forced, DNS at high resolution.
We consider first the isotropic case (no guide field) and verify that the cascade rate is consistent with the dissipation rate. Then we consider an anisotropic case (with guide field) for which the isotropic KHYPP law does not apply. We compute the parallel and perpendicular cascade rates and find that the latter basically accounts for the total dissipation rate, as expected for anisotropic turbulence. Also, the cascade rate derived from the isotropic law is found to be a good approximation for the total cascade rate.
Recent works have shown that the hypothesis of stationary turbulence must be probably relaxed in the solar wind. We present preliminary results on the measure of the cascade rate in the expanding solar wind, obtained with DNS of MHD turbulence in the expanding box model. Such model incorporates the basic physic of expansion thus inducing anisotropies driven by both the magnetic field and expansion, along with an energy decrease due to the conservation of linear invariants (angular momentum and magnetic flux). The correction due to non-stationary conditions is found to be important and to become negligible only at small scales, thus suggesting that solar wind measurements over-estimate the actual cascade rate.