Geophysical Research Abstracts
Vol. 14, EGU2012-3856, 2012
EGU General Assembly 2012

Shell-Reduced MHD: weak and strong turbulence

R. Grappin (1,2) and A. Verdini (3)

(1) Paris Observatory, Luth, Meudon, France (roland.grappin@obspm.fr), (2) LPP, Polytechnique, (3) SIDC, Observatoire Royal de Bruxelles

MHD turbulence with guide field B_0 is studied using the shell model for Reduced MHD, with the aim of characterizing the scaling, and anisotropy of RMHD at high Reynolds number. A basic prediction of anisotropic turbulence theory (critical balance or CB) is that, in presence of large enough B_0, the 1D perpendicular energy spectrum should exhibit a $k_\perp^{-2}$ scaling characteristic of weak nonlinear coupling at large scales, followed by a break and a $k_\perp^{-5/3}$ scaling at smaller scales. Previous numerical simulations never obtained such double spectra, but instead displayed single power-laws with a monotonous increase of their index when B_0 was increased. In the present work we observe for the first time the double scaling, possibly thanks to the high Reynolds number reachable in shell models. A corollary of the CB theory is that a $k_\parallel^{-2}$ spectrum develops in the range with strong $k_\perp^{-5/3}$ scaling, characterizing spectral anisotropy. In our study, we find that, although the basic paradigm of the CB are verified, the parallel spectrum differs, showing an over-excitation of parallel modes, due to high-frequencies of the large perpendicular eddies. This proves on the one hand that the CB theory is well adapted to the RMHD model but on the other hand that the model is richer than previously thought.