README

In the Download Folder there are four subdirectories: 256, HI, ldec, and 3PCF

In folder 256:
Herein contains the simulation snapshot files. We used a third-order-accurate hybrid essentially nonoscillatory (ENO) scheme (see Cho & Lazarian 2002, 2003) to solve the ideal MHD equations in a periodic box. We present 3D numerical experiments of compressible (MHD) turbulence for a range of Mach numbers. The Mach number to be defined as the mean value of the ratio of the absolute value of the local velocity V to the local value of the characteristic speed cs or V_A (for the sonic and Alfvenic Mach number, respectively). We divided our models into two groups corresponding to sub-Alfvenic b=1.0) and super-Alfvenic (b=0.1) turbulence. This is indicated in the files names.

For each group we computed several models with different values of pressure (P, as indicated in the file names.). We ran 6 compressible MHD turbulent models, with D=256x256x256 resolution, for several crossing times (listed in the file name) to guarantee full development of energy cascade.

b1p.01, D=256, Ms~7, MA~0.7
b1p.032, D=256, Ms~4, MA~0.7
b1p.1, D=256, Ms~2, MA~0.7
b1p.32, D=256, Ms~1.2, MA~0.7
b1p1, D=256, Ms~0.7, MA~0.7

b.1p.01, D=256, Ms~7, MA~2.0
b.1p.032, D=256, Ms~4, MA~2.0
b.1p.1, D=256, Ms~2, MA~2.0
b.1p.32, D=256, Ms~1.2, MA~2.0
b.1p1, D=256, Ms~0.7, MA~2.0

We drive turbulence solenoidally, at wave scale k equal to about 2.5 (2.5 times smaller than the size of the box). This scale defines the injection scale in our models in Fourier space to minimize the influence of the forcing on the generation of density structures. The simulations are in code units, are scale-free, and can be scaled to physical units according to the prescription outlined in Hill A., et al. 2008 (see also the appendix of Mckee et al. 2010). We do not set the viscosity and diffusion explicitly in our models. The scale at which the dissipation starts to act is defined by the numerical diffusivity of the scheme.

These simulations are provided free to use with proper reference.

Please reference the following papers for use:
Cho & Lazarian 2003: http://adsabs.harvard.edu/abs/2003MNRAS.345..325C

Burkhart et al. 2009: http://adsabs.harvard.edu/abs/2009ApJ...693..250B
And the CATS release paper: Burkhart et al. 2020

If you have questions, would like additional parameters, resolutions, or snapshots, please email: Dr. Blakesley Burkhart at b.burkhart@rutgers.edu

In folder HI:

Using the same simulation set up as the simulations presented in folder 256, we present HI column density maps (units: cm^-2) for an MHD turbulent box irradiated by isotropic/beamed UV field. This analysis was performed in Bialy, Burkhart & Sternberg (2017, ApJ, 843, 92). This paper should be cited when using these synthetic observations.

Description:
The UV radiation photo-dissociates H2 and produces an HI layer at the cloud boundary. The HI column density of this layer depends on the UV intensity, gas density and dust absorption cross section. Turbulence produces density fluctuations in the gas resulting in fluctuations in the HI column density for different lines of sight. See Bialy, Burkhart & Sternberg (2017, ApJ 843 92) for details.

Assumed Parameters in the files
M_S=4.5 (sonic Mach number)
M_A=0.7 (Alfvenic Mach number)
I_{UV}=1.3 (UV intensity in Draine Units)
σ_g=1.9e-21 cm^2 (dust absorption cross section in the Lyman-Werner band which is typical for Galactic dust-to-gas ratio)
<n>=30 cm^{-3} (n fluctuates such that s.t.d(n/<n>)~M_S/3)
L_{dec}/L_{HI}=0.1 (equivalent to τ_{dec}=~0.1, or ~10 density fluctuations along an HI column)

In folder ldrive:

We include density files at resolution 1024x1024x1024 similar to the set up in folder 256 but with different driving scales. We include driving scales at k=2.5, k=5 and k=7. Please cite Bialy and Burkhart 2020 and the CATs release paper when using these simulations.

In folder 3pcf:

Portillo et al. (2018) calculated the three point correlation function (3PCF) of the simulations found in folder 256 using the Fourier transform approach presented in Slepian & Eisenstein (2016). The 3PCF is the excess product of density in triples of grid cells at the corners of triangles of certain shapes and includes phase information that is missed in the power-spectrum. See the methods paper for a more detailed description of the files and the 3PCF calculation. Please cite Portillo et al. (2018, ApJ, 862, 119) and the CATs release paper (Burkhart et al. 2020) when using the 3PCF data.