

# Test Problems

Problems we will all have to address to understand star formation computationally:

*Turbulence, Magnetic Field, Sink Particles, Radiative Transfer*

## Goal for workshop and paper:

- Code comparison tests
- Key science questions

*Practical Goal:* Decide by Wednesday night what to include in the paper.

## Workshop structure:

10:00 - 10:20: We set the daily agenda

12:00 - 13:00: Main presentation/discussion

3:30 – 4:30 : Comparison of results

There are IDL and Fortran tools available. See the page “Reporting” in the wiki for details:

<http://kitpstarformation07.wikispaces.com/Test+Problem+Reporting>

For  $256^3$  IDL is tolerable (minutes per snapshot analyzed), but starting at  $512^3$  you should use Fortran procedures available (precompiled) at **datastar** (part of the CADAC setup at SDSC)

Please *convert your output to the original format* (raw binary):

- Direct use of tools
- Easier sharing of the output from different codes

*Reminders:* Upload to CADAC; Visualization tools

# Daily Topics

## **Monday (*Kritsuk, Padoan*):**

- Power spectra
- PDFs
- Structure Functions
- Images

## **Tuesday (*Krumholz, Nordlund*):**

- Clumpfind
- Sink Particles
- Radiative Transfer

## **Wednesday (*Brandenburg, Price*):**

- Turbulent Dynamos
- MHD in SPH
- Visualization Demos

# Monday's Assignment

## ***Power Spectra:***

- Average power spectra of  $u_x, u_y, u_z$  (use IDL tool or Fortran binaries)
- Make plots compensated by  $k^2$ , one per snapshot
- Power spectra of  $u_{x,y,z}$ ,  $\rho^{1/3} u_{x,y,z}$ ,  $\rho^{1/2} u_{x,y,z}$ ,  $\rho$ ,  $\ln(\rho)$ ,  $B_{x,y,z}$  (use Fortran tool)
- Power spectra of decomposed velocity field (solenoidal and compressible)

*Science:* Link to fragmentation (IMF slope) --> *Tuesday*

Comparison with observations

Physics of turbulence (supersonic cascade,  $E_c/E_s$ , bottleneck effect)

## ***PDFs:***

- $\ln(\rho)$ , plotted with Gaussian fit and estimated  $b$  parameter (use IDL tool)
- $u$ ,  $\Delta u$ ,  $|B|$
- Scatter plots of  $E_{\text{mag}} / E_{\text{kin}}$  versus  $\rho$

*Science:* Link to fragmentation (IMF peak and BD abundance)

Equipartition level for  $B$  (super-Alfvénic clouds) --> *Wednesday*

Comparison with observations

## ***Structure Functions:***

- Transversal and longitudinal structure functions of  $\rho$  (use IDL or Fortran tools)
- Structure functions of  $\rho^{1/3} u_{x,y,z}$ ,  $\log(\rho)$ , density masks

## ***Images:***

- Images of  $\log$  of projected density (three axis directions)
- Single front slice of  $\log(\rho)$  (not for SPH)
- Thick front slice (5% of box size)

*Science:* How far in time before the comparison can be only statistical?