

EGU22-11566 — Inverse transfer of magnetic helicity in isothermal supersonic turbulence — Link to publications —

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Funding:



Computational resources:

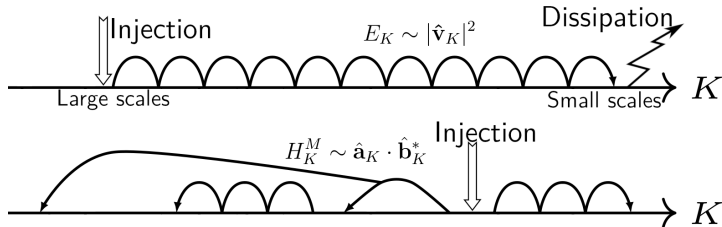


MAX PLANCK COMPUTING & DATA FACILITY

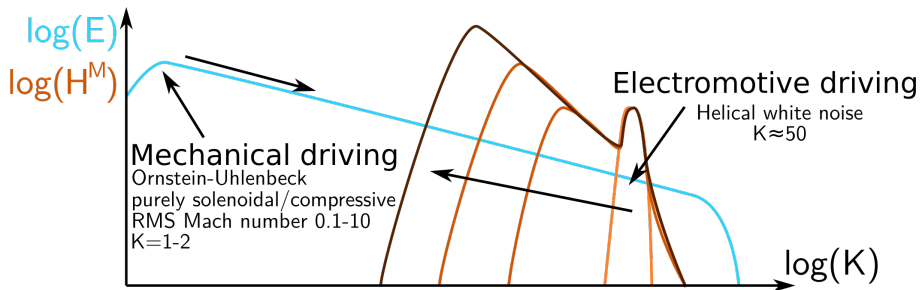
RECHENZENTRUM GARCHING DER MAX-PLANCK-GESELLSCHAFT



NORDEUTSCHER VERBUND FÜR HOCH- UND HÖCHSTLEISTUNGSRECHNEN



- 3D hydrodynamic turbulent systems “destroy coherence”, but 3D magnetohydrodynamic ones generate large scale magnetic structures (cf dynamo effect and **inverse transfer of magnetic helicity**).
- Most studies of the inverse transfer of magnetic helicity: in incompressible or subsonic/transonic case.
- Many geophysical/astrophysical systems: supersonic, shocks, compressible effects.
- **How compressibility (Mach number and driving type) affects the inverse transfer of magnetic helicity?**



- **Direct numerical simulations** of ideal isothermal (single-fluid) MHD equations.
- **Fourth-order** numerical solver: *Verma, Teissier, Henze & Müller, MNRAS 482, 2019*

- Spectral scaling laws (*Teissier & Müller, JFM 915, 2021*):
 - ▶ Fourier spectra of magnetic helicity become **flatter** for higher compressibility. The effect is significantly stronger for purely compressive mechanical driving than for purely solenoidal one.
 - ▶ Fourier co-spectra of Alfvén velocity and its curl display **almost the same** scaling law over a wide range of Mach numbers and forcing type.
 - ▶ “Alfvénic balance”: equipartition in terms of kinetic and magnetic energies and helicities found in incompressible MHD **extended to compressible MHD**.
- Shell-to-shell transfers (*Teissier & Müller, JFM 921, 2021*)
 - ▶ **Three phenomena** in the global picture of the inverse transfer of magnetic helicity: direct local transfer, inverse local transfer, inverse nonlocal transfer,
 - ▶ Each is mediated by **clearly distinct scales** of the velocity field.
 - ▶ **Role of the compressive velocity field**: direct local transfer and nonlocal inverse transfer only.

Thank you very much!