

A Non-Helical Dynamo — MHD Simulations of Dynamo Action by a Non-Helical Flow

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Abstract. We illustrate that helicity is not a necessary ingredient for fast dynamo action; we use the stagger-grid method of Galsgaard, Nordlund and others (e.g. Galsgaard & Nordlund 1997, and applied to dynamos by e.g. Dorch 2000): we solve the full MHD equations including a forcing term that keeps the kinetic energy at an approximately constant level. A 3-d flow with no mean helicity (an ABC-like flow without cosines, cf. Galloway & Proctor 1992) is implemented and it turns out that apart from the high growth rate in the linear regime (compared to kinematic dynamo action, cf. Archontis & Dorch 2003a), the dynamo saturates at a level significantly higher than the intermittent turbulent dynamos (cf. Archontis & Dorch 2003b); namely at exact energy equipartition. During the linear regime, several kinematic modes are present, e.g. a sheet/vortex-mode and a mode that resembles the ABC "double cigar" mode (e.g. Dorch 2000). In the non-linear regime, the magnetic topology is not symmetric, but the initial structure of the velocity field is retained. The presence of helicity is not a requirement for dynamo action but it is rather the stretching ability of the flow that amplifies the magnetic energy in an exponential manner (Archontis & Dorch, in preparation).

A miniature copy (A4) of the poster may be downloaded (MS PowerPoint) from the following URL:

<http://www.astro.ku.dk/~dorch/posters/JD03.ppt>

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References

- Archontis, V., Dorch, S.B.F. & Nordlund, Å. 2003a, *A&A*, 397, 393
Archontis, V., Dorch, S.B.F. & Nordlund, Å. 2003b, *A&A*, 410, 759
Dorch, S.B.F. 2000, *Physica Scripta*, 61, 717
Galloway, D. & Proctor, M. 1992, *Nature*, 356, 691
Galsgaard, K. & Nordlund, Å. 1997, *J. Geophys. Rev.*, 102, 219