3-D MODELS OF GALAXY MAGNETIC FIELDS WITH SPIRAL SHOCKS

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We report here some preliminary results of 3-D numerical simulations of an α-ω dynamo in galaxies with differential rotation, small-scale turbulence, and a shock wave induced by a stellar density wave. We obtain the magnetic field from the standard dynamo equation, but include the spiral shock velocity field from a hydrodynamic simulation of the gas flow in a gravitational field with a spiral perturbation (Johns and Nelson, 1986).

The most interesting point to emerge so far from these calculations is that, irrespective of the magnetic configuration imposed by the dynamo, the presence of the spiral shock wave moulds the **B** field into a spiral field which is congruent with the density spirals. That is to say the **B** field lines both lie along the density spirals, and the magnitude of **B** is greatest along the gas ridge. To illustrate this we show the results of two runs with and without the shock in the velocity field (Figures 1 and 2, respectively). These two models have exactly the same rotation curve and dynamo parameters, but in the case without the shock there is no obvious spiral structure in the generated field, while with the shock the spirality is quite distinct.

Reference

Johns, T.C. and Nelson, A.H. (1986) 'Global Simulations of Gas Flow in Disc Galaxies', M.N.R.A.S. **220**, 165.

R. Beck et al. (eds.), Galactic and Intergalactic Magnetic Fields, 133–134.

fig. 1

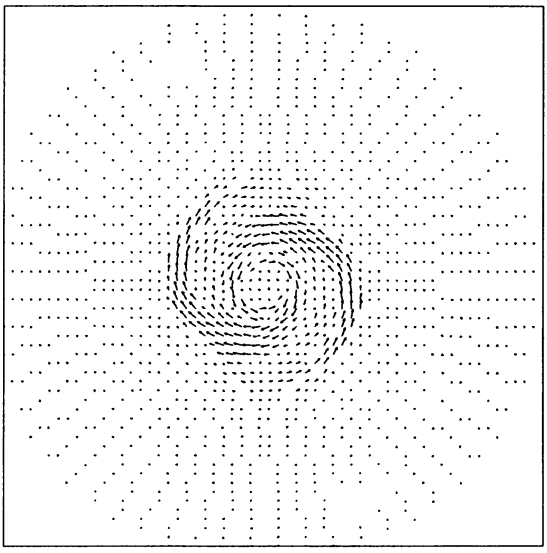
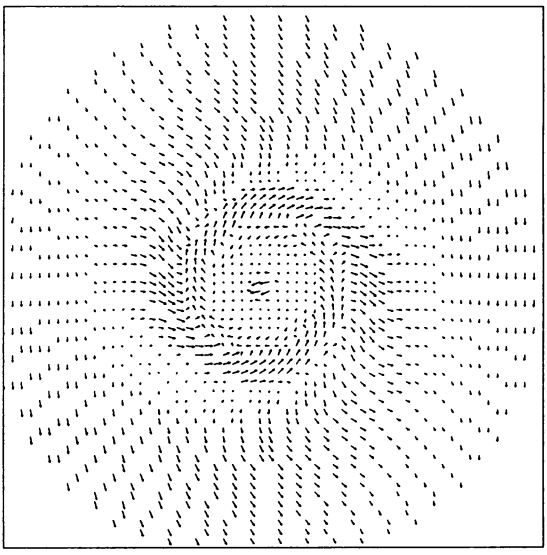


fig. 2



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