STOCHASTIC STAR FORMATION AND MAGNETIC FIELDS

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The model of selfpropagating star formation uses local processes (200 pc cell size) in the interstellar medium to simulate the large scale cooperative behaviour of spiral structure in galaxies. The dynamic of the model galaxies is taken into account via the mass distribution and the resulting rotation curve; flat rotation curves are used. The interstellar medium is treated as a multiphase medium with appropriate cooling times and density history. The phases are: molecular gas, cool HI gas, warm intercloud and HII gas and hot coronal fountain gas. A detailed gas reshuffeling between the star forming cells in the plane and outside the galactic plane controls the cell content. Two processes working stochastically are incooperated: the building and the decay of molecular clouds and the star forming events in the molecular clouds.

Isotropic and anisotropic percolation

The percolating processes are working isotropically. All neighbouring cells around each star forming site have an equal probability of being stimulated by shockwaves to form new stars or molecular clouds at the next time step. The model presented now uses anisotropic propagating star formation caused by the anisotropic magnetic field pressure in the interstellar medium. The magnetic fields are usually orientated in an azimuthal direction parallel to spiral arms or ringlike. Such an orientation should effect cloud and also shockwave motion, because the gas and the wave tends to move parallel to the field. This implies that propagating star formation is more likely to occur in a direction parallel to the field than perpendicular to it.
Since molecular clouds are preformed in short filaments and assuming that the molecular clouds are carrying the magnetic

R. Beck et al. (eds.), Galactic and Intergalactic Magnetic Fields, 257–258.

field lines, there ist a natural explanation for such assumptions.

Two anisotropic percolation models are run. Gas reshuffeling and shockwaves are working mainly in the cells of the same galactic radius; ringlike configurations. Or the anisotropic percolation follows a spiralarm pattern. In Fig. 1 we present a model calculation for a ringlike magnetic field, in Fig. 2 the result for a spiral magnetic field is given. Magnetic fields seem to enhance the morphological appearance of spiral structure. The spiral pattern is better defined. The spiral arm filaments tend to be longer and a greater coherence appears.

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Eds.: R. Beck, R. Gräve. p. 171. Springer Verlag, Berlin

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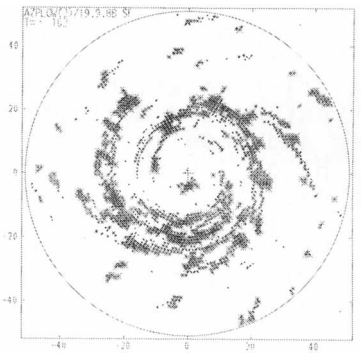

Figure 1. Spiralstructure with underlying ringlike magnetic field

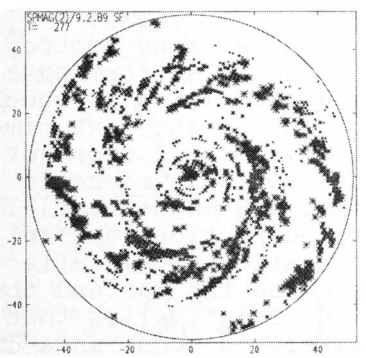

Figure 2. Spiralstructure with underlying spiral magnetic field

https://doi.org/10.1017/S0074180900190175 Published online by Cambridge University Press