DYNAMICS AND EVOLUTION OF DISC GALAXIES

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Evolution of magnetic fields in galaxies and future observational tests

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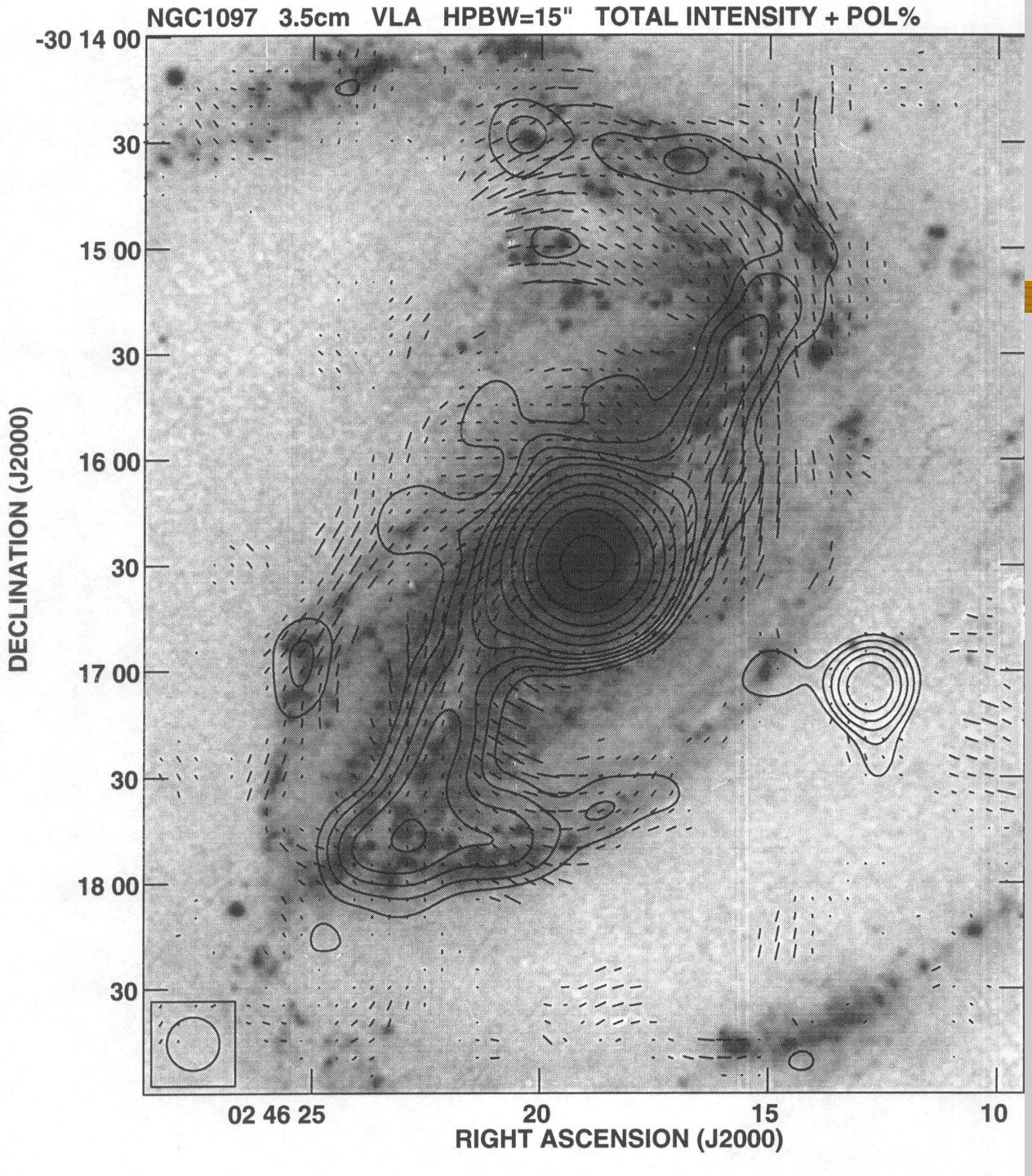
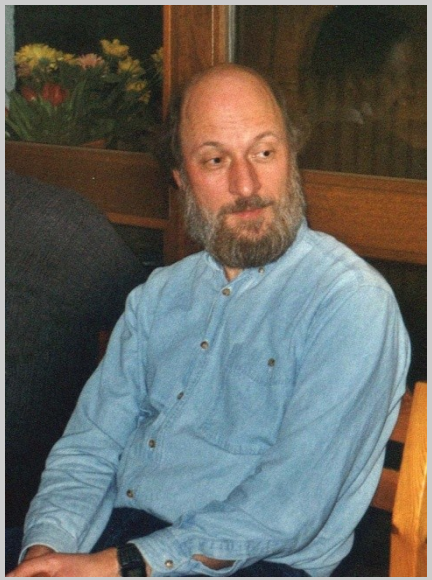
NGC1097 – a bared galaxy





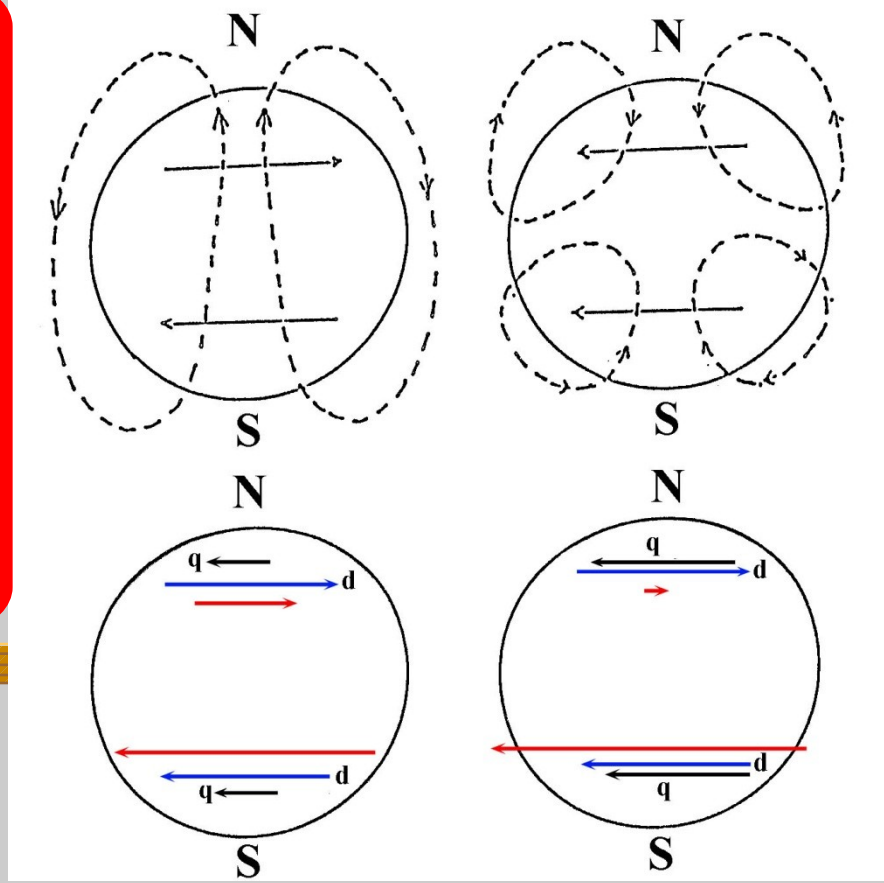
PARKER DYNAMO

$$B_P \xrightarrow{\Omega} B_T$$

Differential rotation

$$B_T \xrightarrow{\alpha} B_P$$

Helicity



We understand more or less how to fit magnetic fields in contemporary spiral galaxis by conventional dynamo models

It requires a detailed knowledge of
galactic HD, dynamo governing parameters etc.
A detailed analysis of observations for a particular galaxy. A typical example here is M31.

Future observations by SKA

Large redshifts z, remote galaxies. Very little is known concerning HD, evolution etc.

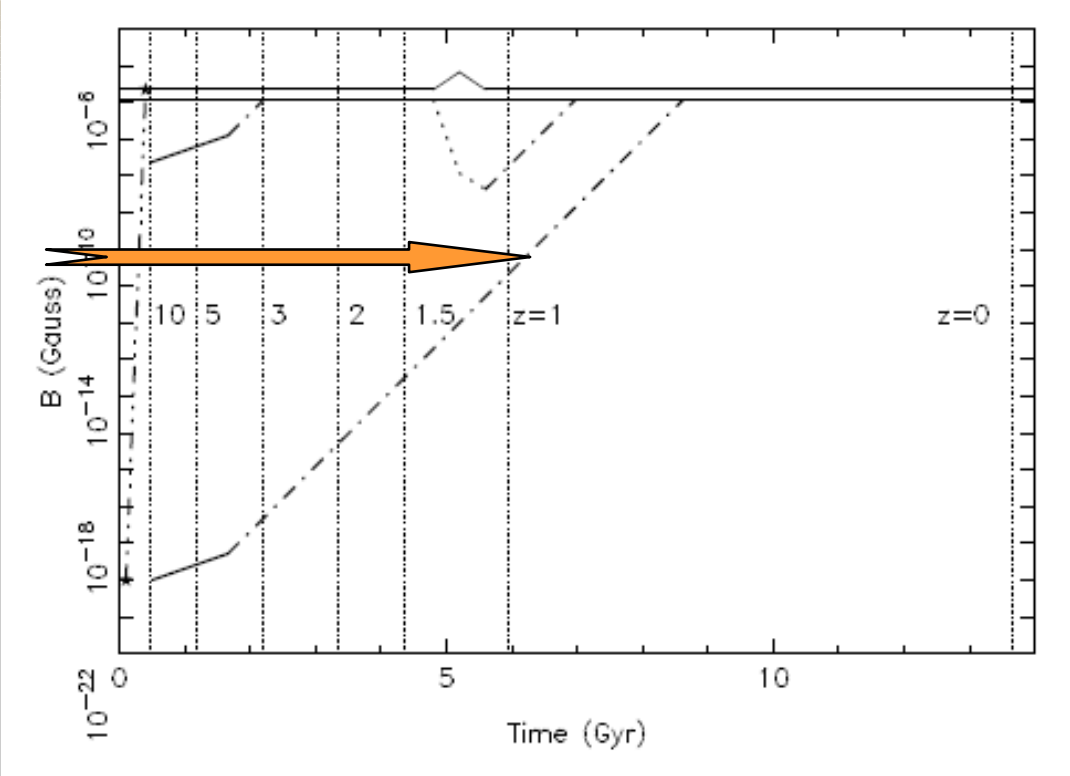
A reasonable decision would be to postpone with any prediction....

An expected development: no observations in future

A demand: give a hint what do you expect for magnetic fields of first galaxies

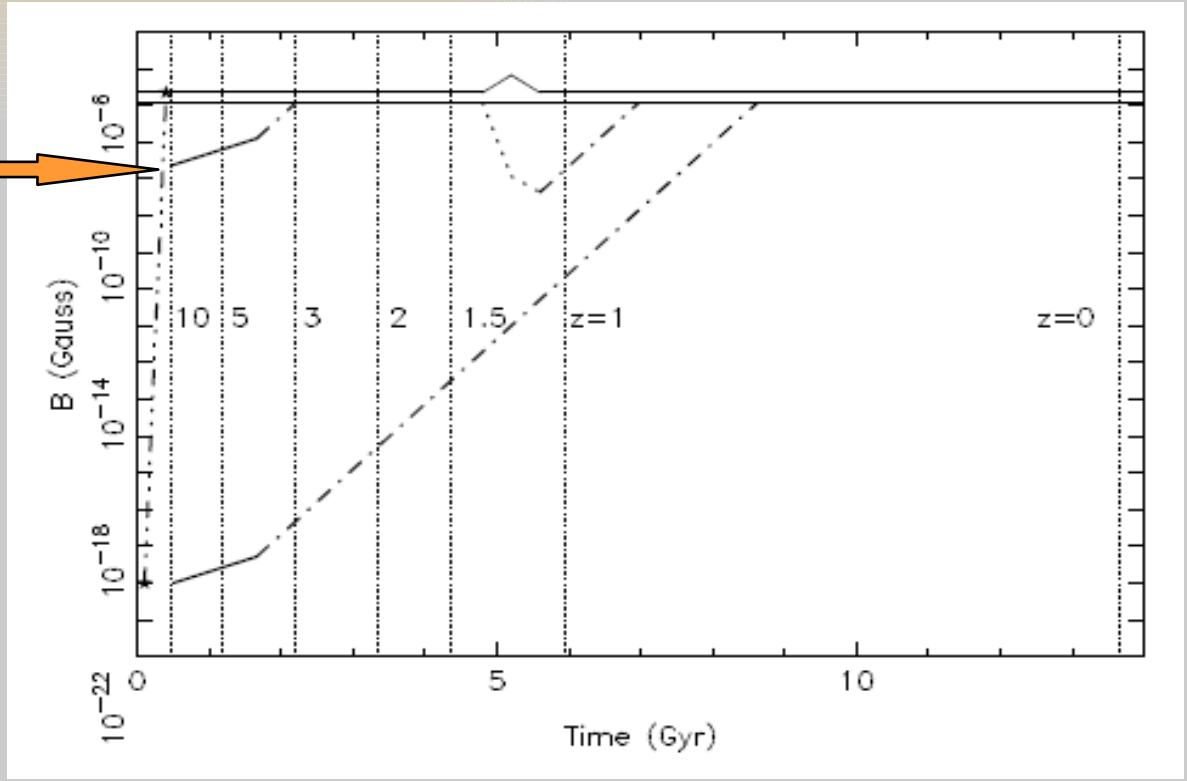
Seeds in protogalaxies + conventional mean-field dynamo

A most straightforward set of parameters -----> time is too short



Seed in protogalaxies + small-scale dynamo + mean-field dynamo

It works!!!! A stage of spotty structure. In principle one can observe it.



Spatial configurations

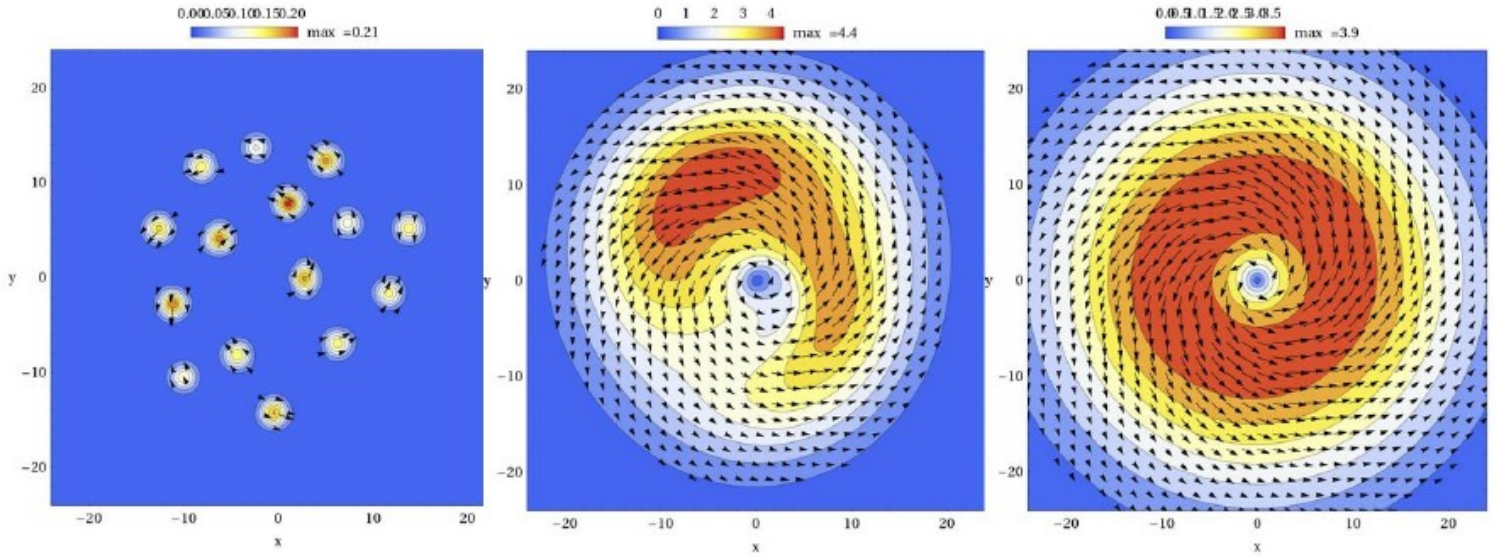
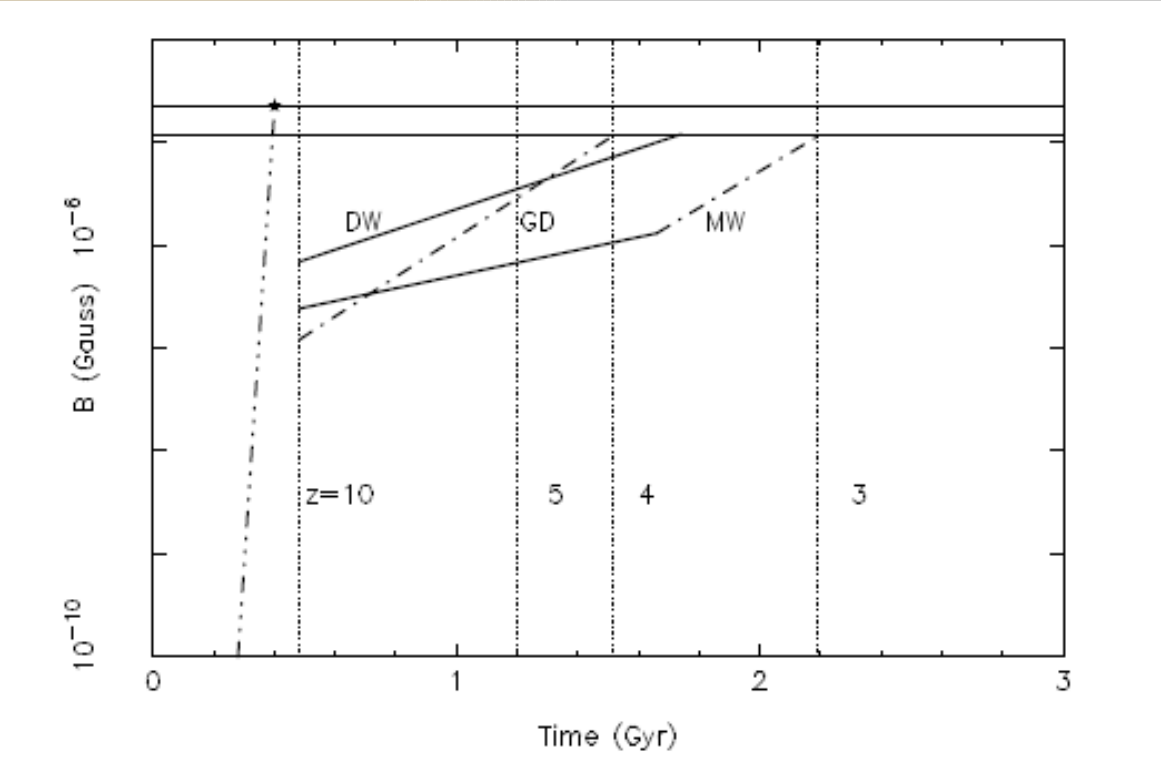
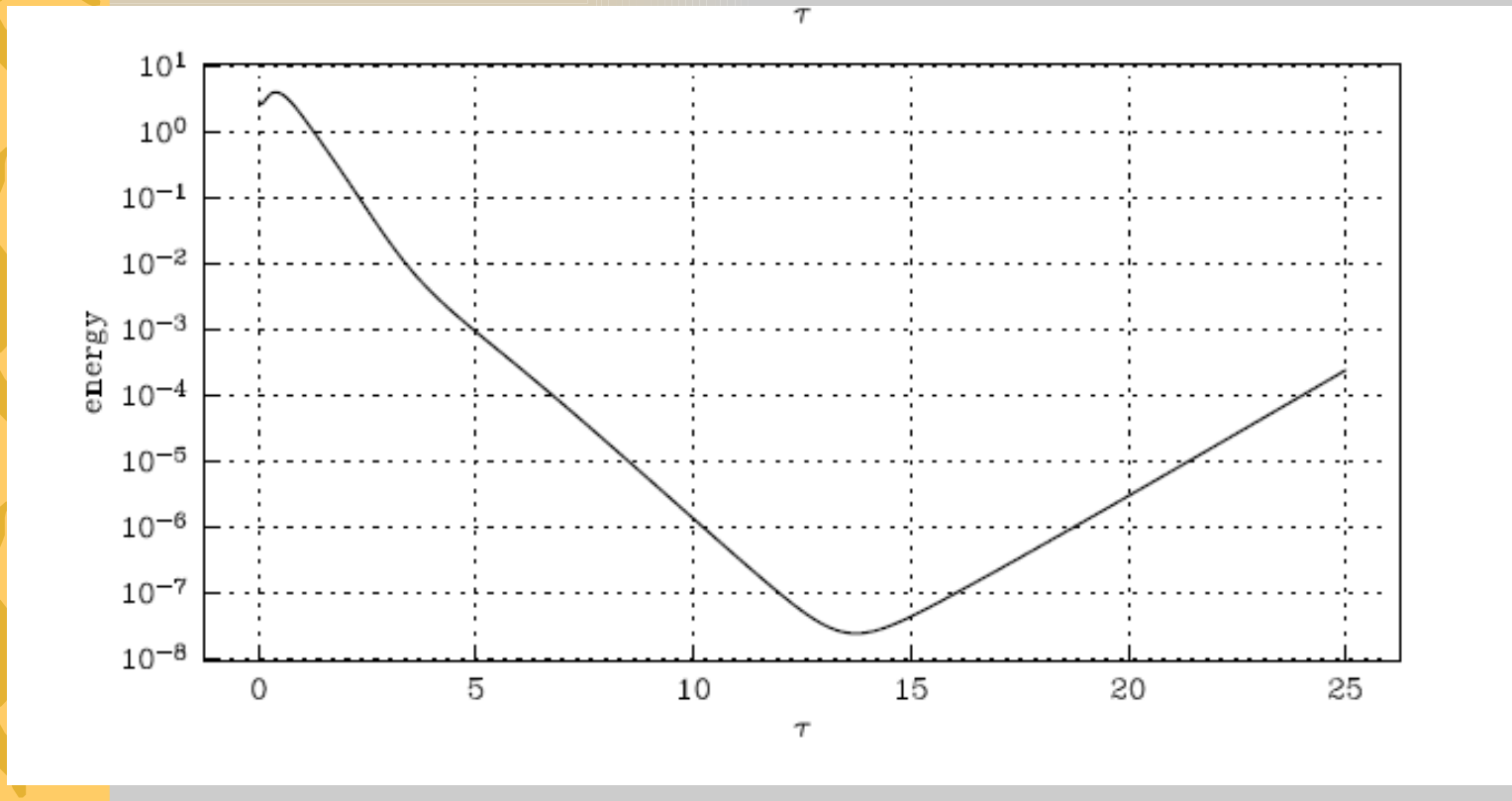


Figure 3: Simulations of the evolution of regular magnetic fields in the disk of a galaxy. The amplitude and ordering scale of the regular fields at the epoch of disk formation (3×10^{-7} G and 1 kpc; left panel), after 5 Gyr ($\sim 2 \times 10^{-5}$ G and 6 kpc; middle panel), and after 10 Gyr ($\sim 2 \times 10^{-5}$ G and 12 kpc; right panel).

We can play with parameters. Dwarf galaxies.



Homogeneous relic field+ dynamo: it works unexpectedly bad (recent simulations of D.Moss)



Rotation expels homogeneous field on the remote part of the galaxy (recent simulations of D.Moss)