

Simulations

(inc. depolarization)

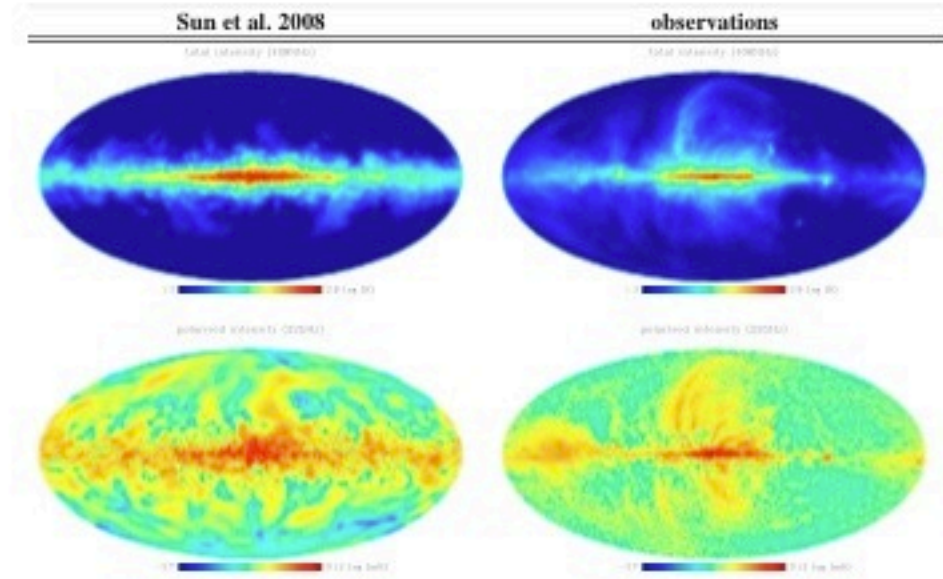
What **questions** need to be answered using simulations?

Overview of different types of simulation & modelling
being done now.

Global models: static

Milky Way

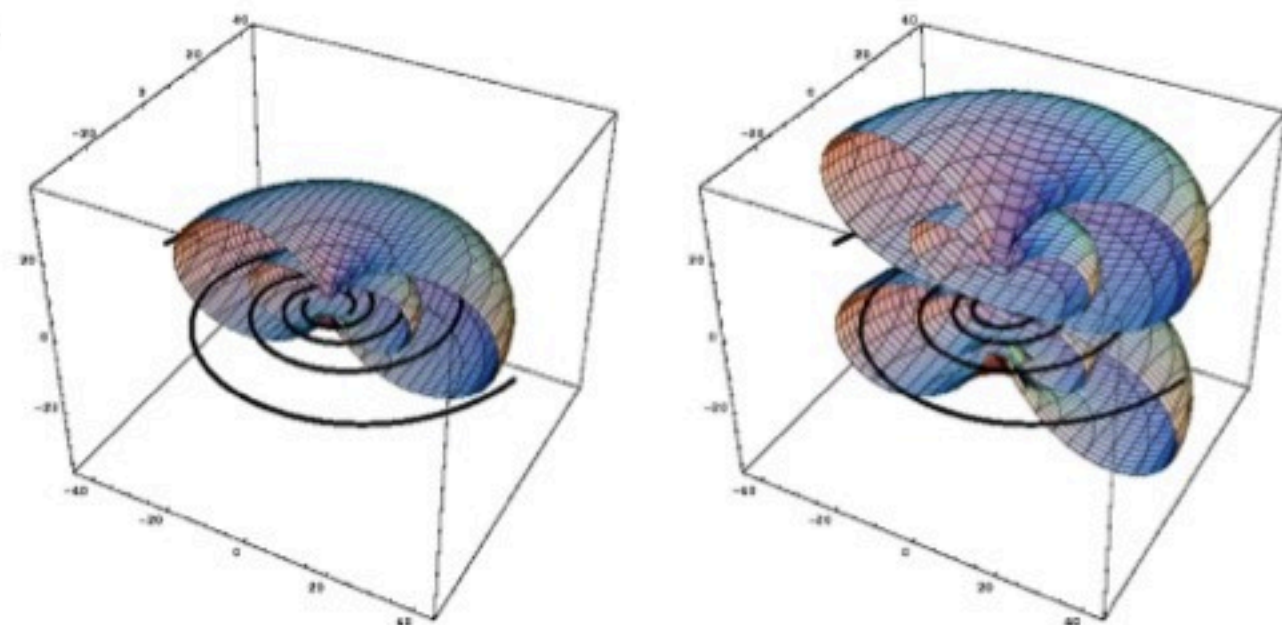
Waelkens et al. (2009), Sun et al. (2007),
Sun & Reich (2010):
define large-scale B , n_e , n_{cr} & small-scale B



Other Galaxies

Braun, Heald, Beck (2010): define large-scale B , n_e , n_{cr}

Newcastle group: dynamo B + define n_e , n_{cr}



Global models: dynamic

Krakow group velocity field + dynamo + cosmic rays,

$$\frac{\partial \rho}{\partial t} + \nabla(\rho V) = 0, \quad (1)$$

$$\frac{\partial e}{\partial t} + \nabla \cdot (eV) = -p(\nabla \cdot V), \quad (2)$$

$$\frac{\partial V}{\partial t} + (V \cdot \nabla)V = -\frac{1}{\rho} \nabla \left(p + p_{\text{cr}} + \frac{B^2}{8\pi} \right) + \frac{B \cdot \nabla B}{4\pi\rho} - 2\Omega \times V + 2q\Omega^2 x \hat{e}_x + g_z(z) \hat{e}_z, \quad (3)$$

$$\frac{\partial B}{\partial t} = \nabla \times (V \times B) + \eta \Delta B, \quad (4)$$

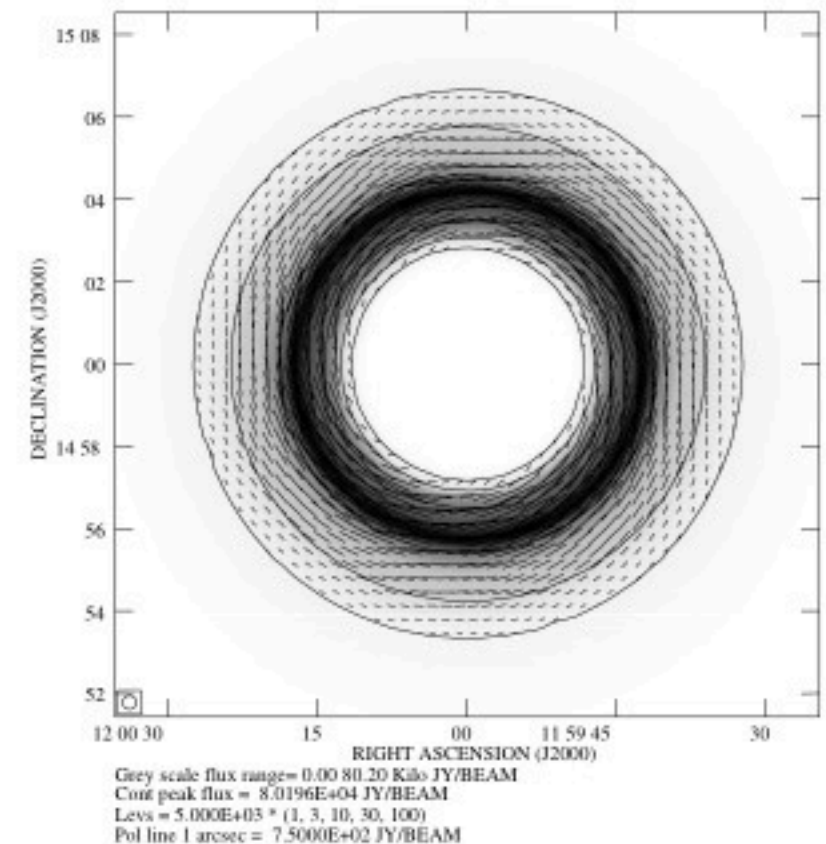


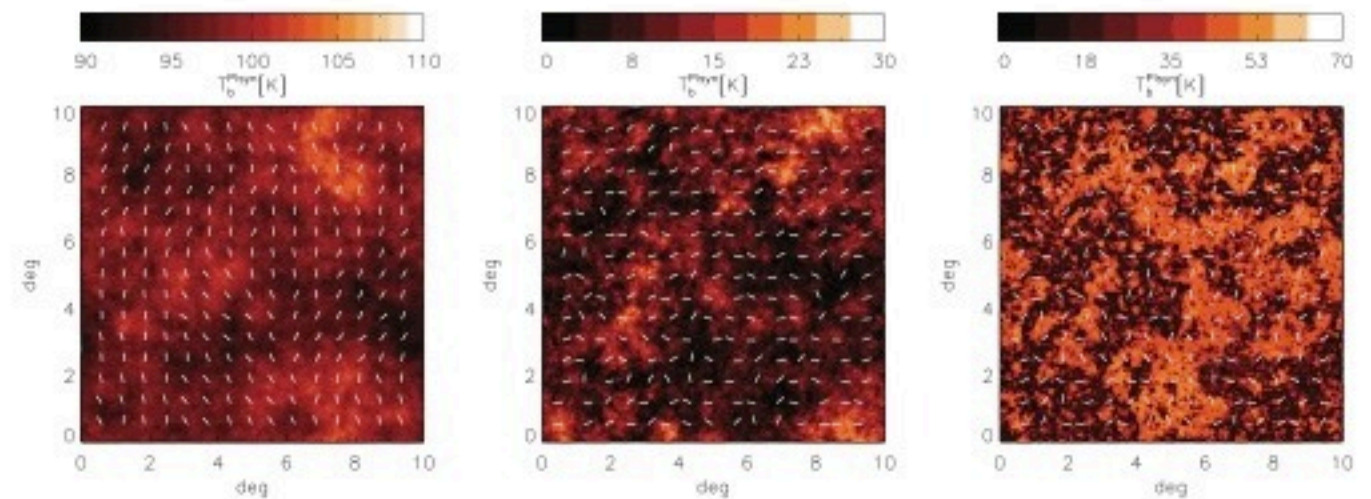
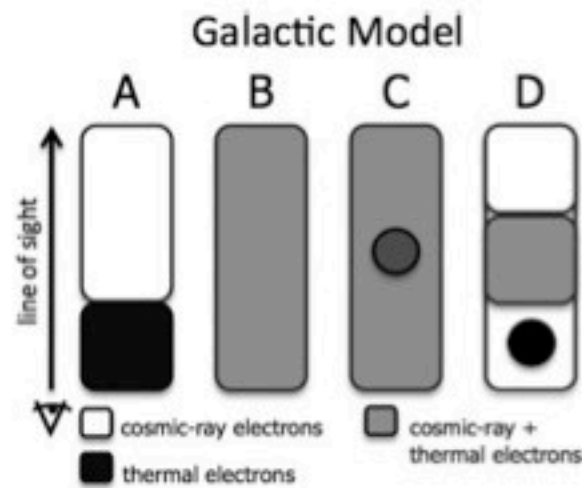
Figure 4. Face-on map of the polarized emission of the modeled galaxy. Contours and gray scale show polarized emission intensity, vectors are of directions of apparent magnetic polarization vector, and length is proportional to the intensity.

CAN THE COSMIC RAY DRIVEN DYNAMO MODEL EXPLAIN THE OBSERVATIONS OF THE POLARIZED EMISSION OF EDGE-ON GALAXIES?

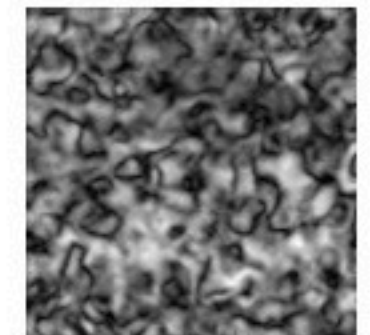
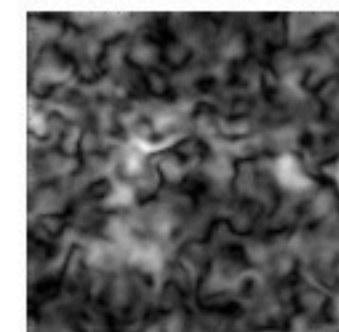
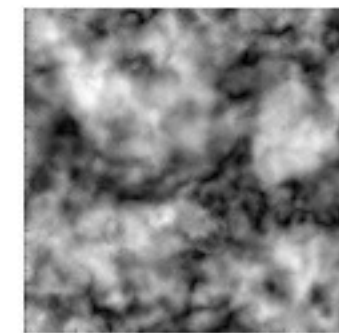
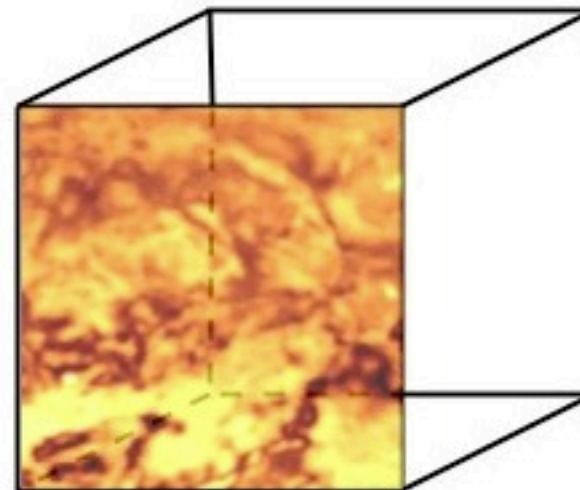
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Local models: static

Jelić et al. (2010)

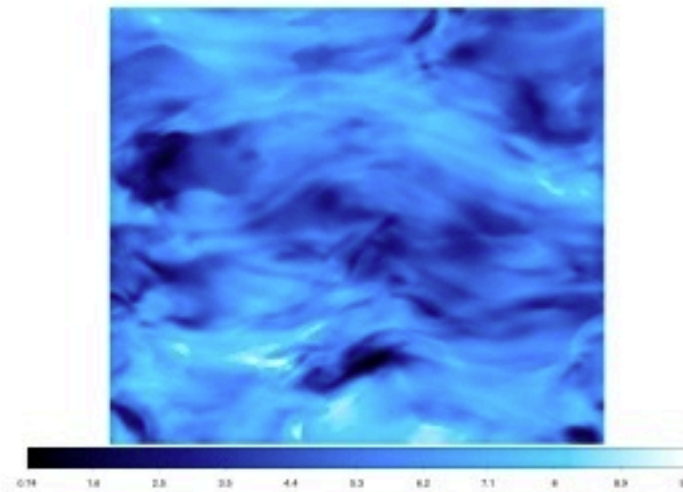


Carl Shneider & Newcastle group:
Gaussian random field models,
controlled (anti)-correlations of
 B , n_e , n_{cr}

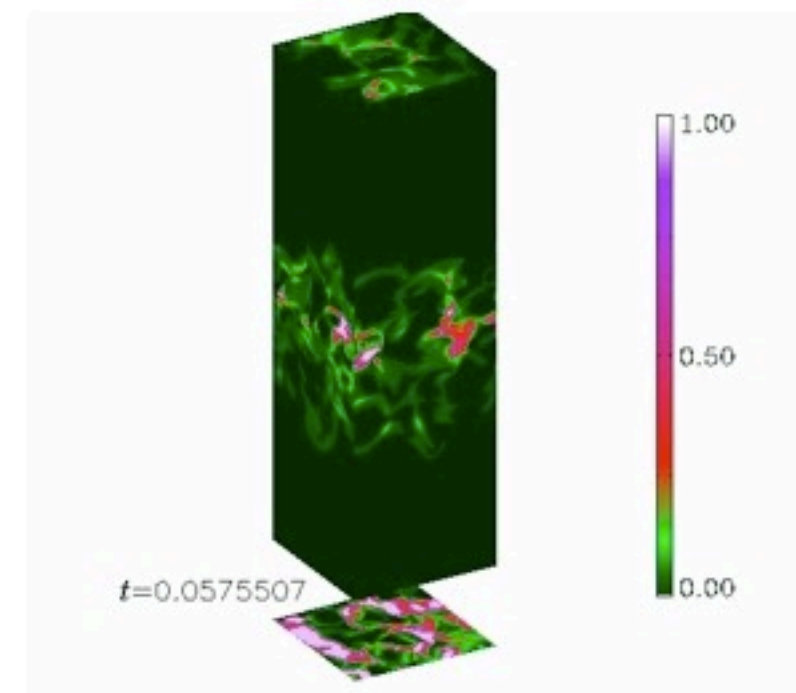
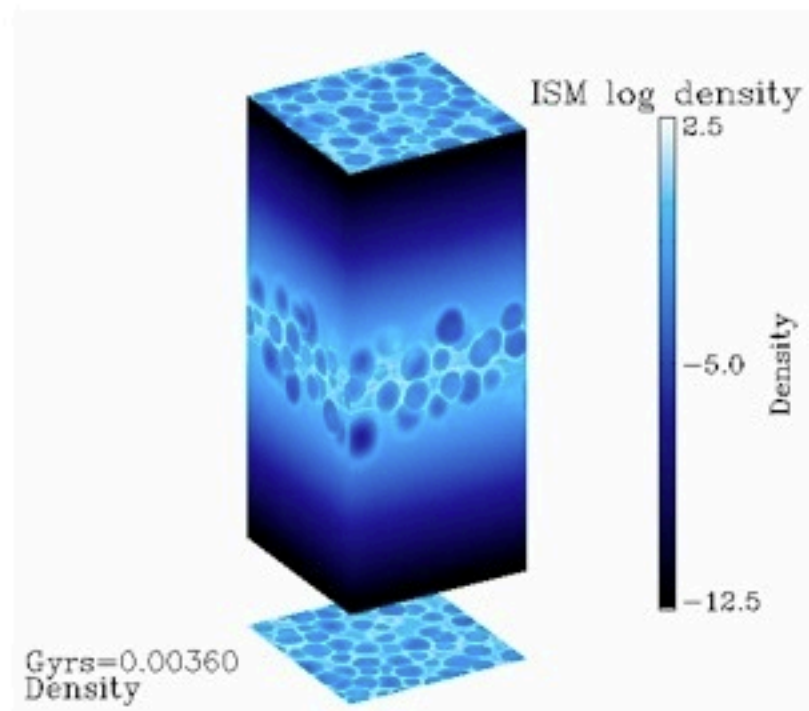


Local models: dynamic

Jongsoo Kim: driven MHD turbulence simulations



Newcastle group: supernova driven magnetic ISM

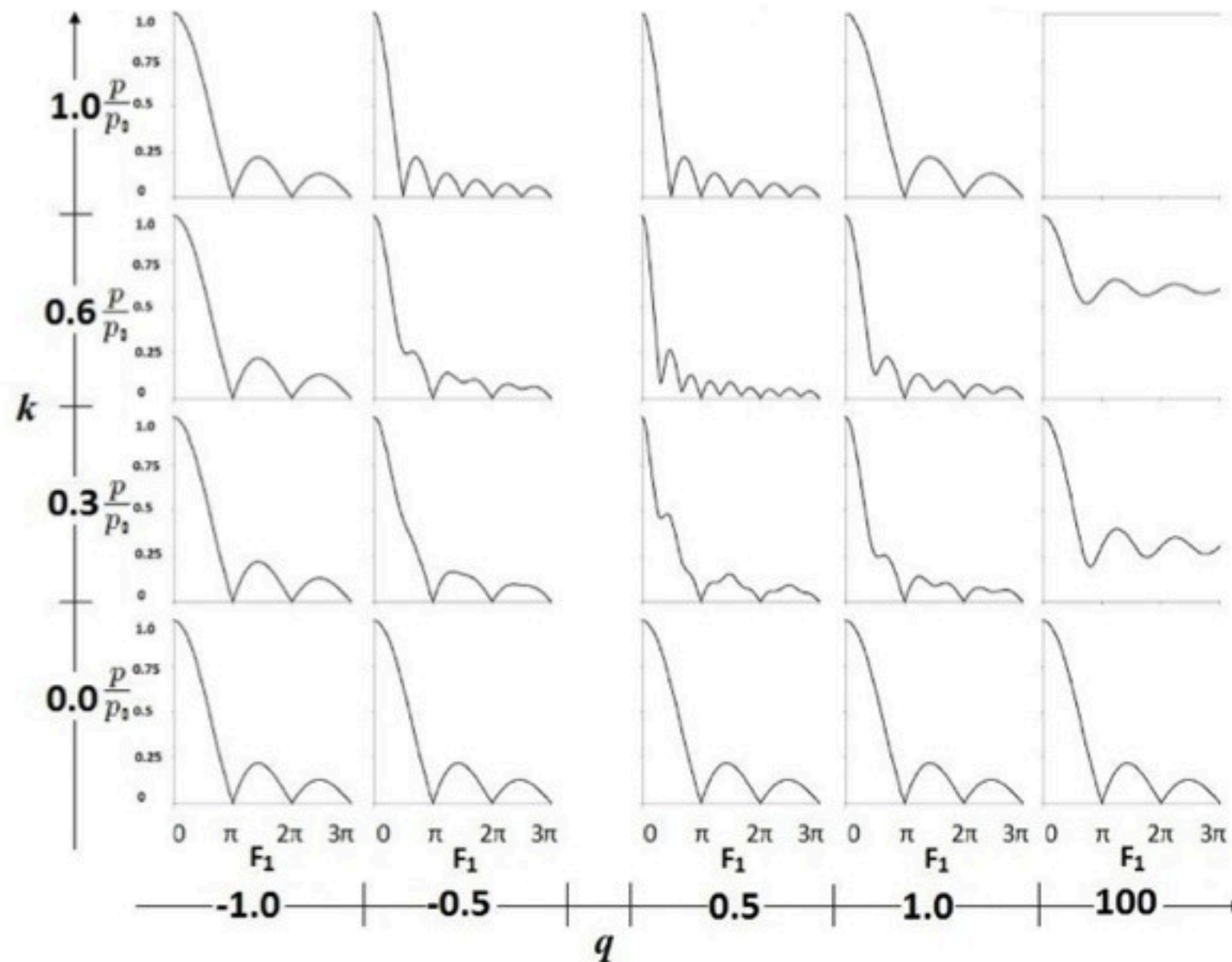


1D and Analytic

Newcastle group depolarization due to random fields,
weak emissivity $\rightarrow$ Faraday screen,

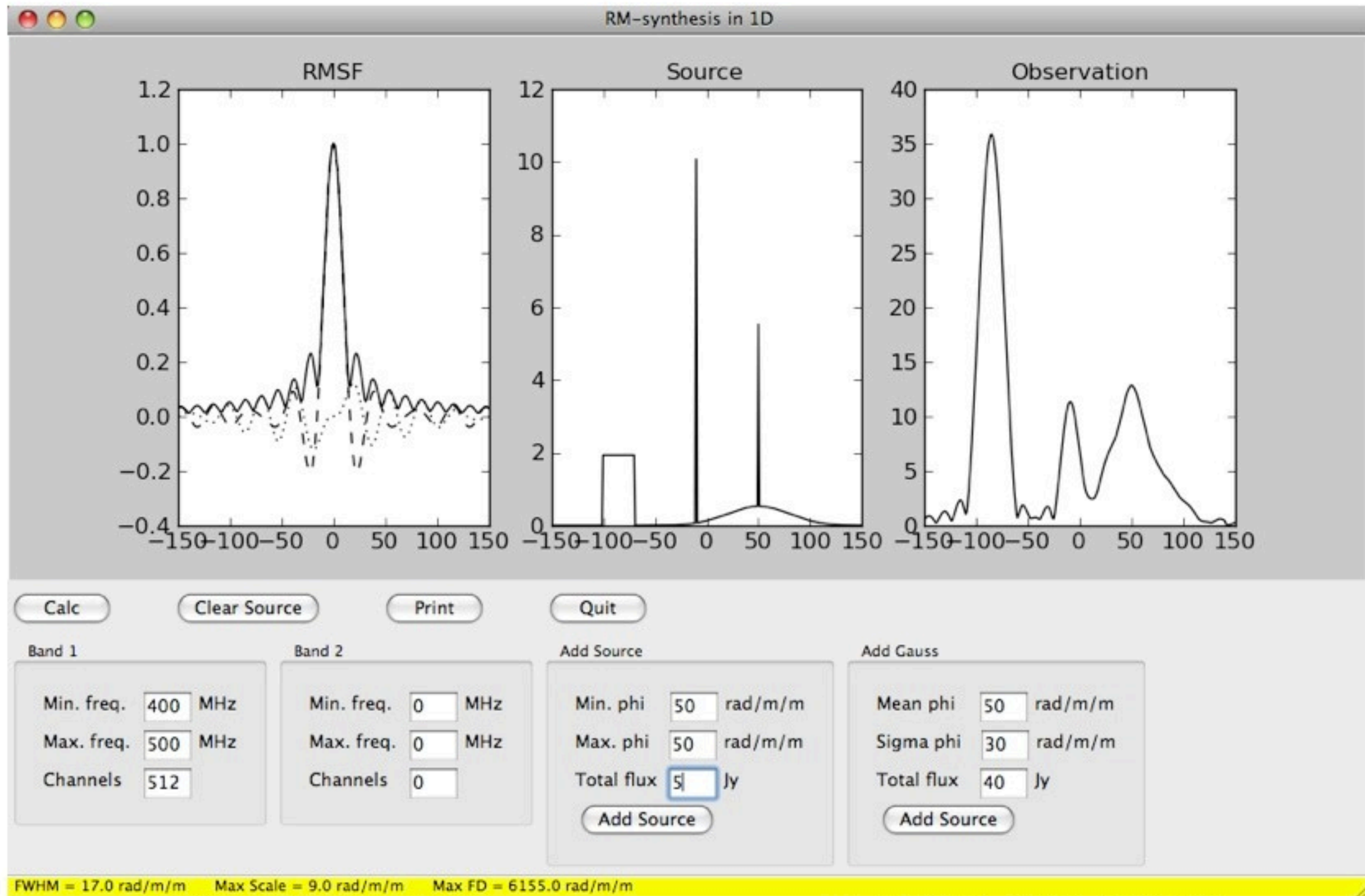
$$\langle \mathcal{P} \rangle = \langle \mathcal{P}_0 \rangle \frac{1 - \exp(-S)}{S},$$

where $S = 2\lambda^4 \sigma_{\text{RM}}^2 - 2i\lambda^2 \mathcal{R}$



1D and Analytic

Application to apply RM-synthesis to specified source distribution: will distribute on request.



Simulations

(inc. depolarization)

What questions need to be answered using simulations?

(Not “What does X look like at low frequency?”)

1. Separating Milky Way and extra galactic signal?
2. Faraday dispersion and RM-cubes?
3. Do different turbulent B models give similar results?
4. Your question here ...