Simulations of polarised dust of the ISM

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Aim:
produce dust linear polarisation that reproduces
the data constraints

Motivations:
- the need for simulations for future CMB experiments
- put constraints on the turbulent Galactic magn. field

STEP 1
choose a Galactic magnetic field model

$$\vec{B}_{\rm gal}(\vec{r}) = \vec{B}_0(\vec{r}) + f_m \vec{B}_{\rm turb}(\vec{r})$$

with

$$\left\langle \vec{B}_{\rm turb}(\vec{r}) \right\rangle = \vec{0}, \quad C_\ell^{\rm turb} \propto \ell^{\alpha}$$

spherical harmonic decomposition

$\vec{B}_0(\vec{r})$ mean magnetic field

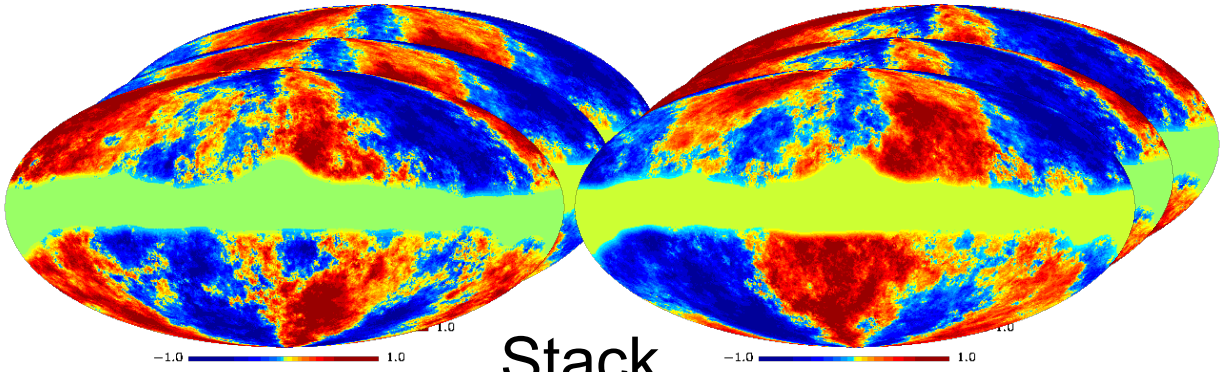
f_m relative strength of the turbulent field

α 3D power index of the turbulent field

STEP 2
compute Stokes parameters

from magnetic field

external intensity map



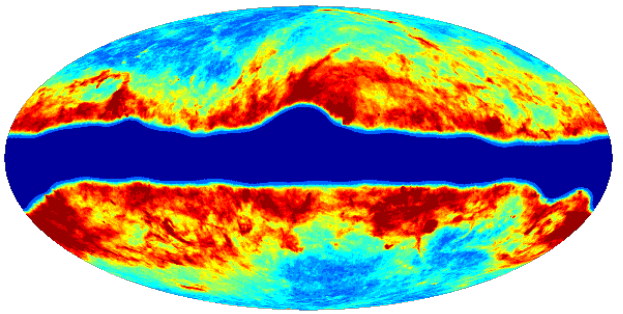
Q/I

Stack

N_{layers}

U/I

+



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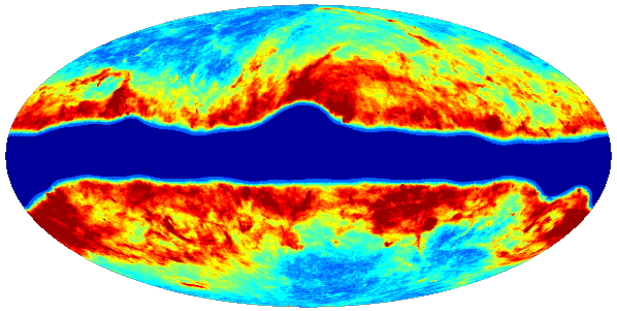

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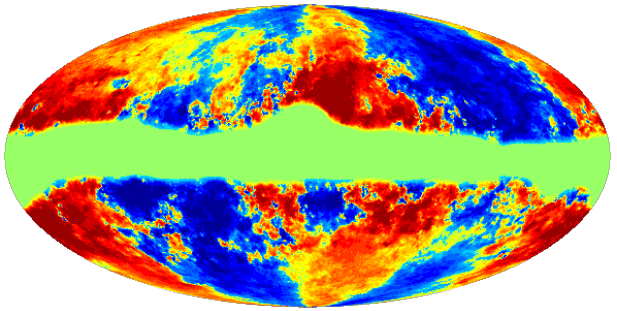

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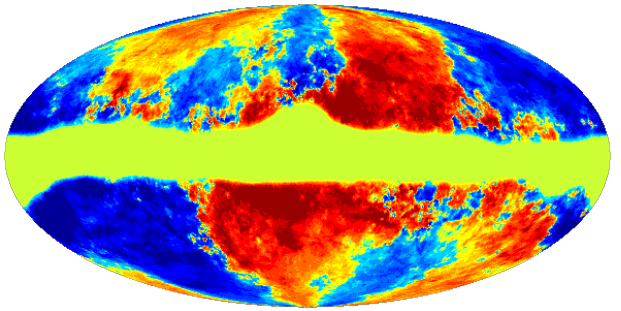
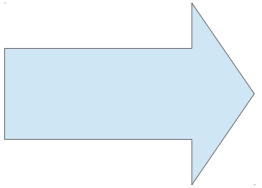


U

STEP 3
post-process to get realistic simulations

dust intensity-polarisation
covariance at multipole (scale) ℓ

$$\begin{pmatrix} A_\ell^{TT} & 0 & 0 \\ 0 & A_\ell^{EE} & 0 \\ 0 & 0 & A_\ell^{BB} \end{pmatrix} \Rightarrow \begin{pmatrix} B_\ell^{TT} & B_\ell^{TE} & 0 \\ B_\ell^{TE} & B_\ell^{EE} & 0 \\ 0 & 0 & B_\ell^{BB} \end{pmatrix}$$



In particular: Include TE correlation and E-B asymmetry

cf. talk by Tuhin Ghosh

Astrophysical results

$\vec{B}_0(\vec{r})$

Mean magnetic field model

Intensity map

$TT/EE, TE/EE, BB/EE$

Data constrained

leads to constraints on

f_m	relative strength of the **turbulent field**
α	power index of the **turbulent field**
$\mathrm{N_{layers}}$	number of realisations of the **turbulent field**