The magnetic field structure in the solar neighborhood with Planck: a case around the south Galactic pole

Andrea Bracco\textsuperscript{1,2}, on behalf of the Planck Collaboration

\textsuperscript{1} Laboratoire AIM, IRFU/Service d’Astrophysique, CEA-Saclay, 91191, Gif-sur-Yvette Cedex, France

\textsuperscript{2}Institut d’Astrophysique Spatiale, CNRS, Univ. Paris-Sud, Bât. 121, Orsay Cedex, France

Magnetic fields are fundamental to investigate the dynamics of the interstellar medium (ISM). The Planck polarization data at sub-millimeter wavelengths offer a new perspective on the Galactic magnetic field (GMF). On behalf of the Planck Collaboration I will present our attempt in characterizing the GMF structure in the solar neighborhood by quantifying its effects on the statistical properties of the dust polarization fraction and angle at high-Galactic latitude in the southern sky [1]. The Stokes Q and U maps at 353 GHz (in Fig. 1) reveal regular patterns at large scale, which we explain with the projection of a uniform direction of the GMF. About these mean patterns, the distributions of polarization angle and fraction show a wide dispersion, which we use to characterize the turbulent component of the GMF. I will present a phenomenological model where the variation of the GMF orientation along the line of sight, caused by turbulence, plays a crucial role in the interpretation of the observations. In our model, this effect is taken into account by summing over a discrete set of Stokes maps (polarization layers) computed from Gaussian realizations of the GMF vector with power-law power spectra. We are able to reproduce the observed distributions of polarization angle and fraction considering 1) only a few independent polarization layers along the line of sight and 2) equipartition between turbulent-kinetic energy and magnetic energy in the diffuse ISM. I will discuss possible physical interpretations of the polarization layers based on the density structure and on the correlation length of the GMF along the line of sight.

Figure 1. Orthographic projections of the south Galactic pole of the Planck Stokes maps.

Références