An Imprint of Magnetization in the Structure of the Interstellar Medium

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for Galactic and Extragalactic Star Formation GESF2014

Extended maps of the polarized thermal emission of dust at submillimeter wavelengths are now possible with instruments such as Planck, BLASTpol, and ALMA. These polarization maps provide a key tool to study the structure of the magnetic field on scales ranging from tenths of parsecs in local clouds to the entire Galaxy. Both the observed column density and the projected magnetic field morphology contain valuable information about the role of magnetic fields, turbulence, and gravity in the formation of structure in the Interstellar Medium.

I will introduce the Histogram of Relative Orientations (HRO), a novel statistical tool for the study of extended polarization maps. The HRO quantifies the relative orientation between density structures and the magnetic field both in simulation cubes and observations. I will describe the HRO characterization of MHD simulations of molecular clouds in which the initial conditions of the magnetic field and turbulence produce an imprint on the relative orientation of density and magnetic field projected onto the plane of the sky. Finally, I will present the observation of this imprint in the Planck measurements of the polarized dust emission over the whole sky and discuss its relation to the physical conditions modelled in the MHD simulations.