# Comparing interstellar medium observations and simulations beyond gaussian features

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The interstellar medium (ISM) is a complex system where gravity, turbulence, magnetic fields, radiation and chemistry interact in a highly nonlinear way. The structures that emerge are thus highly non-Gaussian, which makes the task of comparing observations and simulations in a quantitative way a true challenge. New statistical tools related to the so-called "scattering transforms" recently obtained attractive results for several ISM studies [1]. These handcrafted statistics share ideas with convolutional neural networks, but do not require to be learned, and allow a direct characterization of interactions between scales in nonlinear processes. In this talk, I will introduce these statistical descriptions, and discuss how they can be used to introduce a notion of distance between different observational and simulated maps of the ISM, provided the specifics of observations and simulations are adequately considered. I will then discuss the first results obtained with observations of the *Herschel* Gould Belt Survey and simulations of both the diffuse ISM and of a collapsing molecular cloud. I will notably show how these new tools perform better than the power spectrum in separating observations from simulations, and discuss the apparent very low dimensional nature of these summary statistics that seems to give various physical insights.

**Références**

[1] E. Allys, F. Levrier, S. Zhang, C. Colling, B. Regaldo-Saint Blancard, F. Boulanger, P. Hennebelle & S. Mallat; "The RWST, a comprehensive statistical description of the non-Gaussian structures in the ISM"; Astronomy & Astrophysics **629**, A115 (2019). 1905.01372