Connecting ISM structures to star formation processes

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For too long, the ISM structure has only been loosely connected to star formation. We need to build a global and coherent picture of how cloud structures, accretion flows and magnetic fields have an impact on the formation of dense cores. During this talk, I will present the powerful structural analysis technique, the Multi-scale non-Gaussian Segmentation (Robitaille, Joncas & Miville-Deschenes 2014). The technique merges the PDF analysis, which forms the foundation of many modern theories of star formation, and the power spectrum analysis, which started with the pioneer work of Andrey Kolmogorov and remains our best tool today to analyse and characterise the turbulence. The technique is based on the analysis of complex wavelet transforms of star forming regions maps. The dual property in the spatial and frequency domain of wavelet transforms allow us to separate the true scale-free interstellar medium, possibly related to its turbulent nature, from denser structures possibly associated with star formation processes. Robitaille et al. (2014) showed that this multi-scale segmentation technique lead naturally to the separation of filaments and dense clumps characteristic of star forming regions. We propose to use this technique as a foundation to test the so far postulated analytical theory which links the turbulent fluctuations with the formation of filaments, cores and their relation to the origin of stellar masses (IMF). In addition to the analysis of the ISM density fluctuations, I will also present similar multi-scale analysis techniques recently developed to analyse magnetic field morphology in star forming regions (Robitaille & Scaife 2015; Robitaille et al . 2017). These advanced multi-scale techniques are among the most promising to connect the kinematics and magnetic topology of the interstellar environment to the individual dense cores forming stars.

Filaments