Colloquium

SFB 956

Conditions and Impact of Star Formation

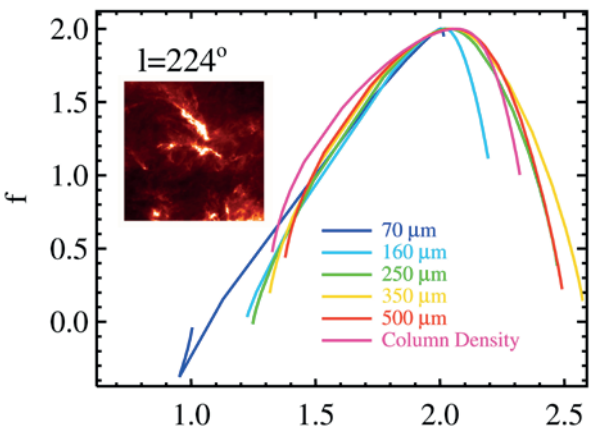
22 October 2018

Monday 3:00 pm

Physikalische Institute Köln

Lecture Hall III

Zülpicher Straße 77 | 50937 Köln



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Multifractal Analysis of Herschel/Hi-GAL Observations: First Results

The images of the interstellar clouds, obtained observing molecular lines or dust continuum emission, exhibit a certain degree of self-similarity, generally ascribed to internal turbulence. The fractal geometry is therefore invoked to provide a quantitative description of the cloud morphology. As a further development, the multifractal approach is based on a continuous spectrum of exponents rather than on a single descriptor (the fractal dimension). It is more suitable to describe sets of intertwined fractals, showing a deviation from a strict self-similarity, which is typical of natural (stochastic) fractals, including clouds. However, the multifractal geometry remained an underexploited approach to describe and quantify the large-scale structure of interstellar clouds. I'll describe how multifractal analysis was applied to Herschel far-infrared (70-500 µm) dust continuum maps, representing an ideal case of study. In particular, I computed the so-called multifractal spectrum and generalized fractal dimension of six Hi-GAL regions in the third Galactic quadrant, measuring systematic variations of the spectrum at increasing wavelength, which generally correspond to an increasing complexity of the image. Furthermore, I found a peculiar behaviour for each investigated field, strictly related to the presence of high-emission regions, which in turn are connected to star formation activity. The same analysis was also applied to synthetic column density maps, generated from numerical turbulent molecular cloud models and from fractal Brownian motion, allowing for the confrontation of the observations with models with well controlled physical parameters. I will discuss the results for both these classes of images. Finally, the link between mono-fractal parameters and multifractal indicators was investigated: I will describe common trends, but also differences highlighting the fact that multifractal analysis can offer a more extended and complete characterization of the cloud structure.

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