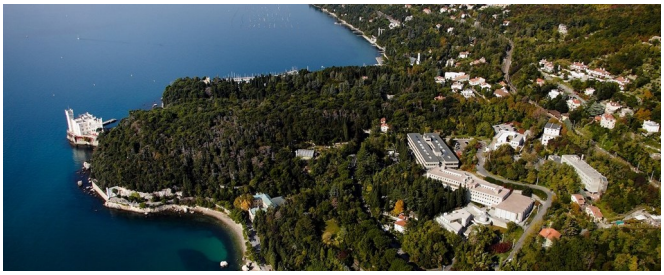

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Minkowski Functionals as a tool to study Non-Gaussianity and anisotropy: new extensions to CMB polarization and beyond

Thursday 31 August 2023 16:15 (25 minutes)

Minkowski Functionals (MFs) are statistical tools that describe the geometry and topology of a field and, therefore, can probe information complementary to the angular power spectrum, such as non—Gaussianity and deviations from statistical isotropy. MFs have been used in many applications such as blind tests of non—Gaussianity in the CMB, improvement of parameter constraints in weak lensing maps, characterization of the morphology of foregrounds, and exploitation of non—linear scales in the Large Scale Structure. In this talk, I will introduce MFs and some of the key aspects of their mathematical foundation. I will show how we have extended the MFs formalism to the CMB polarization (spin) field in two different frameworks that can exploit the full information of polarization, beyond E and B modes (following arXiv:2211.07562 and arXiv:2301.13191). These extensions can further test the Gaussianity and isotropy of polarized emission. I will also mention some new applications of these tools, including the analysis of the polarized dust foreground, the exploitation of the lensing shear non—Gaussianity. Finally, I will introduce Pynkowski [https://github.com/javicarron/pynkowski], a public Python package that we have developed to compute MFs and other higher order statistics on different kinds of data and simulations (including CMB and Large Scale Structure), as well as the theoretical predictions for different kinds of fields. This talk is based on work done in collaboration with Alessandro Carones, Domenico Marinucci, Marina Migliaccio, and Nicola Vittorio.

Presenter: Dr CARRÓN DUQUE, Javier

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