# Mathematics Colloquium

## of the University of Luxembourg

in cooperation with the
Luxembourg Mathematical Society

**Tuesday 23 February 2016, at 4 pm**          **Campus Kirchberg, Room B02**

## Prof. Dr. Domenico Marinucci

### University of Rome "Tor Vergata", Italy

*Prof. Domenico Marinucci is a member of the Department of Mathematics of the University of Rome Tor Vergata, of which he has been director during the period 2007-2015. He is also a Core Team Member of the European Space Agency (ESA) Mission Planck, as well as a component of the ESA Consortium Euclid. He is the current Editor in Chief of the Electronic Journal of Statistics, and the holder of the ERC Grant PASCAL. Domenico Marinucci has made a large number of seminal contributions to probability theory and mathematical statistics, in particular to the analysis of long memory time series, to the geometric and spectral analysis of isotropic fields on homogeneous spaces, to the theory of spin random fields, as well as to the use of needlet/wavelet techniques for the analysis of cosmological data.*

### *The geometry of random spherical eigenfunctions*

In this talk, we review some recent developments on the geometry of random fields on the sphere; we will discuss also the importance of these fields for applications, in particular in a Cosmological framework. More precisely, we focus on the area, the boundary length and the Euler-Poincaré characteristic for the excursion sets of random spherical eigenfunctions - i.e., the three Lipschitz-Killing curvatures, or Minkowski functionals. Their expected value can be fully characterized by means of the so-called Gaussian Kinematic Formula (Adler and Taylor 2007); we discuss here some very recent results on computation of their variances and derivation of quantitative central limit theorems. We consider also the case where the eigenfunctions are averaged over energy windows, as it happens in the implementation of spherical wavelets. Finally, we illustrate some applications of these tools for the analysis of Cosmic Microwave Background radiation data. The results we discuss are the outcome of joint works with Valentina Cammarota, Giovanni Peccati, Maurizia Rossi and Igor Wigman.

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