General Mathematics Seminar
of the
University of Luxembourg
in cooperation with the
Luxembourg Mathematical Society

May, 2012

Tuesday, May 8 , 2012, at 17:00 **Campus Kirchberg, Room B02**

Christophe Ley
(Université Libre de Bruxelles)

Maximum Likelihood Characterization Theorems: a generalization of Gauss' principle

Abstract:

In probability and statistics, a characterization theorem occurs whenever a given law or a given class of laws is the only one which satisfies a certain property. A classical research field, initiated by Gauss and Poincaré, is concerned with Maximum Likelihood characterizations. Indeed, Gauss in 1809 proved the following result, nowadays known as Gauss' principle: the Maximum Likelihood Estimator (MLE) of the location parameter in a location family of probability distributions always (this notion will become clearer in the talk) coincides with the sample arithmetic mean $\frac{1}{n}\sum_{i=1}^{n} X_i$ if and only if the sampled observations $X_1,\ldots,X_n$ are drawn from a normal/Gaussian population. It is through this principle that Gauss discovered the celebrated probability distribution which carries his name. Poincaré in 1912 has similarly characterized members of the vast exponential family. Several extensions of their results have since emerged in the literature. To cite but a few, Teicher (1961) studies an MLE characterization of the normal distribution with respect to the scale (or dispersion) parameter, while Ferguson (1962) characterizes a one-parameter generalized normal distribution via the MLE of its location parameter. Besides these rather "linear" setups, MLE characterizations have also been examined in "non-linear" cases, such as spherical distributions (i.e., distributions taking their values only on the unit hypersphere) in dimensions $k > 1$ (e.g., by von Mises 1918 or Bingham and Mardia 1975). Each such characterization theorem has been obtained by means of ad hoc methods, developed for each case separately. In this talk, we provide a new and unified perspective on this literature by showing that all these results are different instances of a single phenomenon. By doing so, we will on the one hand provide a better understanding of the similarities and differences between existing characterizations and on the other hand show how our point of view allows to easily construct several new MLE characterizations.

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Mai, 2012

Tuesday, Mai 8 , 2012, at 15:00 **Campus Kirchberg, Room B21**

Emil Skoldberg
(University of Galway)

Multiplicative structures on resolutions of ideals

Abstract:

Free resolutions, in particular minimal resolutions, of ideals in polynomial rings is an area that has been intensely studied for the last twenty years. In some instances, such resolutions can be given an additional structure of a differential graded algebra. In this talk, I will discuss classes of ideals for which the minimal resolution is a DGA, applications of multiplicative resolutions, and some recent work of mine on the construction of a multiplication on the minimal resolution of matroidal monomial ideals using algebraic Morse theory.

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May, 2012

Tuesday, May 15 , 2012, at 17:00 **Campus Kirchberg, Room B02**

Ugo Bruzzo
(SISSA, Trieste)

Moduli spaces of framed sheaves

Abstract:

I will give an introduction to moduli spaces of framed sheaves, touching upon at least some of the following topics: their relations with instantons, their construction, their description in terms of ADHM data, and their role in physics.

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May, 2012

Tuesday, May 15 , 2012, at 15:00 **Campus Kirchberg, Room C02**

David Nualart
(University of Kansas)

An introduction to Malliavin Calculus and its applications

Abstract:

The Malliavin calculus is a differential calculus on the Wiener space that was introduced by Paul Malliavin to provide a probabilistic proof of HÂĺormanderâĂŹs hypoellipticity theorem. The main application of Malliavin calculus is the regularity and estimation of densities of Wiener functionals. In this talk we will present an explicit formula for the density, and we will discuss its application to derive the HÂĺolder continuity for the solutions to a class of nonlinear stochastic partial differential equations arising from a system of particles in a random media.

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Tuesday, Mary 22 , 2012, at 17:00 **Campus Kirchberg, Room B02**

Alexander Helemskii
(Moscow State University)

Metric freedom and projectivity for classical and quantum normed modules

Abstract:

The topic of this talk lies in the boundary layer between geometry of normed and operator spaces, normed algebras and category theory.

In functional analysis there are several reasonable approaches to the notion of a projective module. We show that a certain general-categorical framework contains, as particular cases, all known versions. We concentrate on the so-called metric version of projectivity and characterize metrically free 'classical', as well as quantum (= operator) normed modules. Besides, we answer the following concrete question: what can be said about metrically projective modules in the simplest case of normed spaces? We prove that metrically projective normed spaces are exactly $l_1^0(M)$, the subspaces of $l_1(M)$, where M is a set, consisting of finitely supported functions. Thus in this case the projectivity coincides with the freedom.

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May, 2012

Tuesday, May 29 , 2012, at 17:00 **Campus Kirchberg, Room B02**

Bernard Beauzamy
(Société de Calcul Mathématique SA, Paris)

Extreme phenomena: social implications and mathematical approaches

Abstract:

Extreme phenomena (such as earthquakes, flooding, hurricanes, volcanoes, and so on) are constant in human history, but at the same time, constantly forgotten. Mankind seems to be unable to remember (or register) phenomena which occur less than once in a generation. There has been, in Fukushima, a tsunami of same magnitude in the past, and the city of Naples (Italy) is built between two active volcanoes, with eruptions less than 50 years ago.

Mathematically speaking, things are no better. The most commonly used laws, in order to represent such phenomena, are the so-called "Gumbel distributions", which are widely used, for instance in meteorology. They have no theoretical justification at all; their only advantage is that they depend on few parameters, so they are easily tuned with few data. The fact they have any connection at all with real life phenomena is doubtful.

We will present a theoretical work we did recently, in the framework of contracts with the "Caisse Centrale de Réassurance" (Paris). It allows an evaluation of the probability of extreme events (even those which have never been recorded), with only very few observations and no fictitious assumptions. There is considerable room for future work on such subjects, which are of fundamental importance (risk analysis for industrial companies and insurance sector in general).