18-22 February, 2008

Noncommutative Geometry and Physics 2008 —K-theory and D-Brane—

Title and Abstract

Name	Title	Abstract
David Berman (London)	Noncommutative geometry in M-theory	The lectures will cover how novel versions of noncommutative geometry appear in M-theory.
Alan Carey (Canberra)	Odd K-theory and index theory	I will explain how various problems in gauge theory and string theory lead to questions in spectral theory that are relevant to K-theory and index theory. An odd K-theory class on a manifold determines de Rham cohomology classes in odd degree. The first degree term is related to spectral flow for which there is a very well developed analytic theory. The degree three term is related to gerbes. Gerbes are also relevant to D-branes and this connection raises problems in index theory that have been solved on the topological side but only partially on the analytic side. If time permits I will explain some recent applications of analytic spectral flow theory.
Do Ngoc Diep (Hanoi)	The category of Noncommutative CW complexes	In this talk we introduce the problems reducing to the category of noncommutative CW complexes. We use also some notions of noncommutative cylinder and cone to show the properties of cellular approximation and homotopy exact sequence.
Hiroaki Kanno(Nagoya)	Duality, branes and the geometric Langrands program (after Kapustin and Witten)	This talk is a survey of the work by Kapustin and Witten (arXiv:hep-th/0604151). In the first talk, after introducing “six main ideas” in the paper, including a new twist of N=4 super Yang-Mills theory, branes on Hitchin moduli space and the action of line operators on branes, I will explain how the electromagnetic duality is related to the geometric Langrands program. The second talk is devoted to more specific topics. The role of non-commutativity and the coisotropic A-branes will be discussed.
Catherine Oikonomides (Yokohama)	Introduction to K-theory	This talk serves as an introduction to algebraic K-theory, K-theory for C*-algebras and twisted K-theory. First, we will give the fundamental definitions of the algebraic K-theory for a ring. We will then proceed to give a brief survey of K-theory for C*-algebras and its main properties, in particular Bott periodicity. Finally, we will give a brief introduction into Rosenberg’s theory of twisted K-theory.
Jae-Suk Park (Seoul)	Minimal Model of Quantum Field Theory	This talk is about an effort to understand the mathematical nature of quantization of classical field theory. For a given classical field theory the Batalin-Vilkovisky (BV) quantization scheme associate a BV quantum algebra, which is both a cochain complex and a graded commutative algebra with certain compatibility including the crucial ″hbar″ condition. Then there is an art, mastered by physicists, of doing Feynman path integrals involving a quantum master action functiona, a choice of gauge fixing, on which the result of path integral is supposed to be independent, and etc. etc. Instead we are going to attach a minimal model with suitable quasi-isomorphism to the BV quantum algebra, such that would be ″path integrals″ and their homotopy generalizations are derivable from it. Then we are going to argue that the whole construction is an algebra map up to homotopy from a certain graded commutative algebra to a certain free graded non-commutative algebra.
Walter van Suijlekom (Nijmegen)	On the geometry of noncommutative gauge fields	In this talk we discuss the geometry of gauge fields on a noncommutative sphere. We study a special class of solutions to the Yang-Mills equations given by connections with selfdual curvature, also known as instantons. This example serves as a guidance in the search for a proper algebraic setting for gauge theories on noncommutative manifolds.

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Richard Szabo (Edinburgh)	D-branes and Bivariant K-theory	We describe a new approach to the topological classification of D-branes which naturally captures aspects of duality and moreover provides a categorical description. T-duality in this framework is interpreted as an example of a correspondence. The formalism is particularly well-suited to treat D-branes on noncommutative spaces. Several explicit examples are worked out, including D-branes in background H-flux and wrapping noncommutative Riemann surfaces. A noncommutative version of the D-brane charge formula is derived. This requires the mathematical development of noncommutative versions of Poincare duality, Todd characteristic classes, and the Grothendieck-Riemann-Roch theorem.
Dai Tamaki (Matsumoto)	A Homotopical Introduction to Twisted K-theory	The aim of this talk is to discuss the meanings of “twisting in cohomology theory” from the point of view of homotopy theory. We first recall the original construction of twisted K-theory by Atiyah and Segal, and basic properties of generalized cohomology theories and spectra. And then we will consider how to twist generalized cohomology theories.
Qin Wang (Shanghai)	The Roe Algebras and Operator Norm Localization on Discrete Groups	The Roe algebras are Cˆ*-algebras associated to metric spaces. These algebras have important applications to geometry, topology and analysis, due to the fact that their K-theory groups are receptacles of higher indices of elliptic differential operators on non-compact spaces. In this talk, I will discuss certain operator norm localization on residually finite groups, and its application to the K-theory of the Roe algebras of expanding graphs
Shuyun Wei (Xian)	A Construction of Chern Character of K-homology for Locally Compact Metric space	In this lecture we will give a construction of Chern character from K-homology to for locally compact simplicial complex.
Shengzhi Xu (Shanghai)	From Classes to Standard Sets	Since some hard problems in K-theory are related to set theory, this talk is dedicated to the study of set theory in a way that some axioms of ZFs are used to to define standard sets and others are theorems in this setting. A set is then a class which is the image of some standard set.
Josip Trampetic (Zagreb)	Renormalizability as a condition to determine noncommutative deformation parameter for ¥theta-expanded NCGFT	In this article we consider theta-expanded noncommutative gauge field theory, constructed at the first order in noncommutative parameter theta, as an effective, anomaly free theory, with one-loop renormalizable gauge sector. We also consider the 4psi divergences in noncommutative chiral models for fermions; specifically we discuss the U(1) and the SU(2) cases. Related phenomenology with emphasis on the standard model forbidden decays, within a gauge, hadron and neutrino sectors are discussed. Experimental possibilities of Z・・・,gg;(Quarqonia・・・; K・・・); decays, neutrino dipole moments, etc. are analyzed and a firm bound to the scale of the noncommutativity parameter is set around few TeV's.
Masashi Hamanaka (Nagoya)	Noncommutative Solitons and Quasideterminants	I would like to discuss extension of soliton theory and integrable systems to non-commutative (NC) spaces, focusing on integrable aspects of NC Anti-Self-Dual Yang-Mills equations. I would give exact soliton solutions (with both finite- and infinite-action solutions) by means of Backlund transformations. In the construction of NC soliton solutions, one kind of NC determinants, quasideterminants, play crucial roles. This is partially based on collaboration with C.R.Gilson and J.J.C.Nimmo (Glasgow) [arXiv:0709.2069].