Editors' Introduction

The conference "C^*-algebras and elliptic theory, II" was held at the Stefan Banach International Mathematical Center in Będlewo, Poland, in January 2006, one of a series of meetings in Poland and Russia. This volume is a collection of original and refereed research and expository papers related to the meeting. Although centered on the K-theory of operator algebras, a broad range of topics is covered including geometric, L^2- and spectral invariants, such as the analytic torsion, signature and index, of differential and pseudo-differential operators on spaces which are possibly singular, foliated or non-commutative. This material should be of interest to researchers in Mathematical Physics, Differential Topology and Analysis.

The series of conferences including this one originated with an idea of Professor Bogdan Bojarski, namely, to strengthen collaboration between mathematicians from Poland and Russia on the basis of common scientific interests, particularly in the field of Non-commutative Geometry. This led to the first meeting, in 2004, which brought together about 60 mathematicians not only from Russia and Poland, but from other leading centers. It was supported by the European program "Geometric Analysis Research Training Network". Since then there have been annual meetings alternating between Będlewo and Moscow. The second conference was organized in Moscow in 2005 and was dedicated to the memory of Yu.P. Solovyov. The proceedings will appear in the *Journal of K-Theory*. The conference on which this volume is based was the third conference in the overall series with the fourth being held in Moscow in 2007. A further meeting in Będlewo is planned for 2009.

D. Burghelea, R.B. Melrose, A. Mishchenko, E. Troitsky

Contents

Pseudo-differential operators

In two papers *"Dual manifolds and pseudo-differential operators"* and *"Homotopy classification and K-homology"* **V. Nazaykinskiy, A. Savin and B. Sternin** examine index questions and the homotopy classification of pseudo-differential operators on manifolds with corners.

The paper *"Dixmier traceability for general pseudo-differential operators"* by **F. Nicola and L. Rodino** generalizes previous results about the finiteness of the Dixmier trace of pseudo-differential operators.

In *"Boundaries, Eta invariant and the determinant bundle"*, **R. Melrose and F. Rochon** show that the exponentiated η invariant gives a section of the determinant bundle over the boundary for cusp pseudo-differential operators, generalizing a theorem of Dai and Freed in the Dirac setting.

K-theory

The paper *"K-theory of twisted group algebras"* by **S. Echterhoff** presents applications of the Baum-Connes conjecture to the study of the K-theory of twisted group algebras.

A geometric formulation of the description of the dual of a finite group is extended to discrete infinite groups in the paper *"Twisted Burnside theorem for two-step torsion-free nilpotent groups"* by **A. Felshtyn, F. Indukaev and E. Troitsky**.

The paper *"Group bundle duality, invariants for certain C^*-algebras, and twisted equivariant K-theory"* by **E. Vasselli** describes a general duality for Lie group bundles and its the relation with twisted K-theory.

In the paper *"Topological invariants of bifurcation"*, **J. Pejsachowicz** uses the J-functor in K-theory to describe bifurcation for some nonlinear Fredholm operator families.

Torsion and determinants

"Torsion, as a function on the space of representations" is a survey by **D. Burghelea and S. Haller** of their results on three complex-valued invariants of a smooth closed manifold arising from combinatorial topology, from regularized determinants and from the counting instantons and closed trajectories.

The Ihara zeta function for infinite periodic simple graphs, involving a "determinant" in the setting of von Neumann linear algebra, is defined and studied in the paper *"Ihara zeta function for periodic simple graphs"* by **D. Guido, T. Isola and M. Lapidus**.

Operator algebras

Ch. Wahl, in *"A new topology on the space of unbounded selfadjoint operators and the spectral flow"*, revisits the relationship between the space of Fredholm operators and the classical K^1 and K^0 functors.

In the paper *"L^2-invariants and rank metric"*, **A. Thom** gives results about L^2-Betti numbers for tracial algebras.

A positive answer to a conjecture on non-commutative spheres, is provided by **U. Krähmer** in *"On the non-standard Podleś spheres"*.

The paper *"Modified Hochschild and periodic cyclic homology"* by **N. Teleman** proposes a modification in the definition of these two homologies to better relate them to the Alexander-Spanier homology.

Foliated manifolds

Lefschetz theory associated to a "transverse" action of a Lie group on a foliated manifold is examined in the paper *"Lefschetz distribution of Lie foliation"* by **J. Alvarez Lopez and Yu. Kordyukov**.

The paper *"Adiabatic limits and the spectrum of the Laplacian on foliated manifolds"* by **Yu. Kordyukov and A. Yakovlev** presents results on the spectrum of the Laplacian on differential forms as the Riemannian metric is expanded normal to the leaves.

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