

MAPPING SURGERY TO ANALYSIS

CENTRE FOR SYMMETRY AND DEFORMATION
UNIVERSITY OF COPENHAGEN

MONDAY FEBRUARY 22

- 11:00-12:00. Aud 5. **Jerome Kaminker** *Homotopy invariance of the higher signatures*
15:00-16:00. Aud 5. **Ib Madsen** *Introduction to Surgery theory*

TUESDAY FEBRUARY 23

- 09:30-10:30. St. Up1. **John Roe** *Mapping Surgery to Analysis I*
11:00-12:00. St. Up1. **John Roe** *Mapping Surgery to Analysis I*
15:00-16:00. Aud 6. **Thomas Schick** *Mapping geometry to analysis — enlargeability and the index of the Dirac operator*

Enlargeability is a geometric property of closed manifolds, introduced by Gromov and Lawson to obtain obstructions to positive scalar curvature. In joint work with Hanke, Kotschick and Roe, we show that enlargeability implies that the index of the Dirac operator (twisted with the reduced C^* -algebra of the fundamental group) does not vanish. This is a tiny part of the assertion of the strong Novikov conjecture.

The proof uses methods from coarse geometry, in particular the Roe algebra of finite propagation operators, and a back and forth between the analytic and the geometric/topological world.

WEDNESDAY FEBRUARY 24

- 09:30-10:30. Aud 5. **Nigel Higson** *Mapping Surgery to Analysis II*
11:00-12:00. Aud 5. **Nigel Higson** *Mapping Surgery to Analysis II*
15:00-16:00. Aud 4. **Paolo Piazza** *Eta cocycles and higher index theory*

Concentrating on a pivotal example, that of the Godbillon-Vey cyclic cocycle on foliated bundles, I will explain a new approach to higher index theory on geometric structures with boundary. This new approach is achieved by defining, first of all, relative and absolute Dirac index classes, and proving that they correspond under excision. Next, for each cyclic k -cocycle τ_k defining a higher index in the closed case we define:

- a eta cyclic cocycle σ_{k+1} , depending solely on boundary data; σ_{k+1} is obtained by a sort of suspension procedure involving τ_k and a specific 1-cocycle σ_1 (Roe's 1-cocycle);

- a relative cyclic k -cocycle (τ_k^r, σ_{k+1}) , with τ_k^r a cyclic cochain defined from τ_k through a regularization due to Melrose. The index theorem is obtained by deforming the absolute pairing, which is by definition the higher index, to the relative pairing, which gives the right hand side of the desired index formula. The eta-correction term, in the spirit of the Atiyah-Patodi-Singer index theorem, is obtained through the eta cocycle σ_{k+1} . This is joint work with Hitoshi Moriyoshi.

THURSDAY FEBRUARY 25

09:30-10:30. Aud 1. **Paolo Piazza** *Rho-invariants, bordism and Atiyah-Patodi-Singer index theory*

In this lecture I will explain how it is possible to use higher Atiyah-Patodi-Singer index theory and bordism techniques in order to show that the Atiyah-Patodi-Singer rho invariant and the Gromov-Cheeger rho invariant are homotopy invariants if the fundamental group is torsion free and satisfies the Baum-Connes conjecture.

This was joint work with Thomas Schick (Jour. NCG, 2007). The final result, originally due to Keswani, can now also be proved using the Higson-Roe surgery exact sequence.

11:00-12:00. Aud 1. **Nigel Higson** *Mapping Surgery to Analysis III*

15:00-16:00. Aud 6. **Hervé Oyono-Oyono** *K-theory for C^* -algebras of 3-manifold fundamental groups*

In this joint work with W. Pitsch and M. Matthey, we apply the stability results of Baum-Connes conjecture to fundamental groups of compact 3-manifolds (with boundary).

We give using hyperbolisation results of Perelman a proof of the Baum-Connes conjecture for these groups. We deduce for irreducible manifolds explicit description of the K-theory group of degree zero.

FRIDAY FEBRUARY 26

09:30-10:30. Aud 6.

Thomas Schick *Mapping surgery to analysis and further to homology: variations of the theme of Higson and Roe*

We try to describe an ongoing (and by far not yet finished) program (joint with Paolo Piazza) for a slightly different approach to map the surgery exact sequence (and the positive scalar curvature sequence) to K-theory. It uses directly the index of boundary value problems and suitable (secondary) ρ -invariants.

We will present a partitioned manifold index theorem for these secondary indices.

Finally, we try to indicate how one might map further to non-commutative homology.

11:00-12:00. Aud 6. **John Roe** *Mapping Surgery to Analysis III*

15:00-16:00. Aud 6. **Jerome Kaminker** *Secondary classes and K-theory*

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We will describe some secondary invariants and apply them to studying the algebraic K -theory of the complex numbers. This is joint with Xiang Tang.

SATURDAY FEBRUARY 27

10:30-12:00. Aud 10. *Wrap up & Open problems*