60th birthday of Martin Olbrich

14–15 décembre 2023, Université du Luxembourg

Programme

Jeudi 14 décembre 2023 (Salle MSA 4.510, Campus Belval)

09:00-09.30 Inscription

09:30–09:35 **Salah Mehdi & Guenda Palmirotta**
opening words

09:40–10:30 **Ulrich Bunke**
On the K-theory of crossed products

10:40–11:30 Pause café

11:30–12:20 **Andreas Juhl**
Curved analogs of symmetry breaking differential operators and a singular Yamabe problem

12:30-13:30 Déjeuner

13:30–14:20 **Jean-Philippe Anker**
Spectral projections on hyperbolic surfaces

14:30–15:20 **Ines Kath**
The cubic Dirac operator on compact quotients of the oscillator group

15:30–16:00 Pause café

16:00–16:50 **Jean-Marc Schlenker**
The renormalized volume of hyperbolic 3-manifold

17:00–17:50 **Werner Müller**
Spectral theory on locally symmetric spaces and automorphic L-functions

18:00–18:30 Chat & coffee

19:00 Dîner de conférence au restaurant Postkutsch
8 rue Xavier Brasseur, L-4040 Esch-sur-Alzette

Vendredi 15 décembre 2023 (Salle MSA 3.190, Campus Belval)

09:30–10:20 **Sofiane Souafi**
Geometric side of a local relative trace formula

10:30–11:00 Pause café

11:00–11:50 **Colin Guillarmou**
Resonances on spaces with symmetry

12:00–12:50 **Joachim Hilgert**
Vector-valued Poisson Transforms in Quantum-Classical Correspondences

13:00–13:05 **Martin Olbrich**
closing words

13:10 Déjeuner

- **Jean-Philippe Anker** (Université d'Orléans):

Spectral projections on hyperbolic surfaces

In an ongoing collaboration with Pierre Germain (Imperial College) and Tristan Léger (Princeton University), we study L^2 to L^p estimates $(p > 2)$ for spectral projections in a small window on (locally) symmetric spaces. For hyperbolic surfaces of infinite area and with no cusps, we have recently obtained almost optimal results [arXiv:2306.12827]. In this talk, I will give a brief survey of the problem, which goes back to the restriction theorem of Stein-Tomas in the Euclidean setting, comment on our result for hyperbolic surfaces and present the main steps of its proof.

- **Ulrich Bunke** (Universität Regensburg):

On the K-theory of crossed products

Given a C^*-algebra A with a finite group action one can form the crossed product. In this talk I will discuss to which extend one can calculate the K-theory of this crossed product in terms of the K-theory spectrum of the algebra with its induced group action. Viewing the crossed product as a kind of homotopy orbits of the algebra this is an instance of the descent problem asking when the caninical map $K(A)_{hG} \to K(A_{hG})$ is an equivalence.

- **Colin Guillarmou** (Université Paris-Saclay):

Resonances on spaces with symmetry

I will review several situations where a notion of quantum or classical resonances can be defined and provide a notion of discrete spectrum, fitting in a general scattering setting. This includes for example certain locally symmetric spaces: in rank 1 the Laplacian on convex co-compact manifolds, the geodesic flow in similar settings, the Weyl chamber flow in higher rank, or even geodesic and pseudo-Riemannian Laplacian on Lorentzian quasi-Fuchsian manifolds. In all these cases, there is a quantum-classical correspondence between the eigenstates. If time permits, I'll mention also some infinite dimensional setting in conformal field theory where the underlying Lie algebra is infinite dimensional (Virasoro) and related questions appear and can be solved.

- **Joachim Hilgert** (Universität Paderborn):

Vector-valued Poisson Transforms in Quantum-Classical Correspondences

Poisson transforms for symmetric spaces, respectively trees, play a decisive role in the quantum-classical correspondences (QCC) relating spectral data of Laplacians with spectral data of geodesic flows for compact quotients. For generic spectral parameters the scalar Poisson transforms are bijective and constitute the bridge to pass from one set of spectral data to the other. There is a known set of exceptional spectral parameters for which the scalar Poisson transforms are neither injective nor bijective. It turns out that for these spectral parameters one can still build QCCs using specific vector-valued Poisson transforms of the type discussed in Martin Olbrich's PhD-thesis. In the case of compact rank 1 locally symmetric spaces the vector parts come from the minimal K-types of the socles of the (reducible) spherical principal series representations associated with the exceptional spectral parameter. In the case of finite graphs one can use the edge Poisson transform. The goal of this talk is to explain these exceptional QCCs and discuss topological interpretations of the exceptional spectral data.

- **Andreas Juhl** (Humboldt-Universität Berlin):

Curved analogs of symmetry breaking differential operators and a singular Yamabe problem

A special case of symmetry breaking differential operators (SBDO) are intertwining operators for spherical principal series representations which map smooth functions on a sphere to smooth functions on an equatorial subsphere. Here the symmetry is broken since equivariance holds true only with respect to the subgroup of the conformal group of the big sphere which leaves the small sphere invariant. These operators interpolate between conformal powers of the Laplacian on both spheres. There are farreaching analogs of construction SBDO in the context of Riemannian manifolds X with boundary M. We describe recent progress on such constructions in conformal differential geometry. The constructions rest on the solution of a singular version of the Yamabe problem. Among other things, this leads to the notions of extrinsic conformal Laplacians and extrinsic Q-curvatures (generalizing Branson's Q-curvatures). The extrinsic conformal Laplacians are conformally covariant generalizations of so-called GJMS-operators (higher-order analogs of Yamabe and Paneitz operators). The extrinsic Q-curvatures are linked to conformal invariants of hypersurfaces. We also describe low-order cases of the extrinsic conformal powers of the Laplacian and make explicit the related conformal invariants of hypersurfaces. The presentation partially rests on joint work with Bent Orsted developing an alternative perspective towards works of Gover and Waldron.

- **Ines Kath** (Universität Greifswald):

The cubic Dirac operator on compact quotients of the oscillator group

The subject of the talk is a contribution to the analysis of Dirac operators on compact locally symmetric Lorentzian manifolds. We will consider Kostant's cubic Dirac operator $D^{1/3}$ on four-dimensional compact homogeneous spaces $X = G/\Gamma$, where G is a solvable Lie group endowed with a bi-invariant Lorentzian metric and Γ is a (cocompact) lattice in G. More exactly, G is the four-dimensional oscillator group, which is a semi-direct product of the three-dimensional Heisenberg group and the real line. We use the canonical indefinite inner product on smooth sections of the spinor bundle $\Sigma(X)$ to define a Krein space $L^2(\Sigma(X))$. Then the cubic Dirac operator is defined on $L^2(\Sigma(X))$ and $iD^{1/3} : L^2(\Sigma(X)) \to L^2(\Sigma(X))$ is essentially self-adjoint (as an operator on a Krein space). We determine the spectrum of $D^{1/3}$ on X for each basic lattice $\Gamma \subset G$ by using an explicit decomposition of the regular representation of G on $L^2(\Sigma(X))$ into irreducible subrepresentations.
This is joint work with Margarita Kraus.

- **Werner Müller** (Universität Bonn):

Spectral theory on locally symmetric spaces and automorphic L-functions

Spectral theory on locally symmetric spaces is closely related to the theory of automorphic forms and has deep connections with number theory. Spectra of canonical differential operators on quotients of symmetric spaces by discrete groups, which are defined arithmetically, are expected to carry fundamental arithmetic information. In this talk I will give an introduction to the subject. Then I will discuss some aspects of spectral theory on locally symmetric spaces, especially the Weyl law, the limit multiplicity problem and approximation of L^2-invariants. The continuous spectrum of canonical differential operators is governed by Eisenstein series. Through the constant terms of Eisenstein series,

automorphic L-functions come into play. The analytic properties of automorphic L-functions have a significant impact on the structure of the spectrum. This is another issue which I will discuss in some detail.

- **Jean-Marc Schlenker** (Université du Luxembourg):

The renormalized volume of hyperbolic 3-manifold

Convex co-compact hyperbolic manifolds have infinite volume. However, they have a well-defined "renormalized" volume, which has a number of interesting properties. We will outline the definition of this renormalized volume, and some of its key properties, including its relations to the volume of the convex core. We will then survey some recent results on the global behavior of the renormalized volume, considered as a function over the deformation space of convex co-compact hyperbolic metrics on a given manifold. If time allows, we will describe some open questions concerning the renormalized volume of convex co-compact hyperbolic manifolds having a given Riemann surface as asymptotic boundary.

- **Sofiane Souafi** (Université de Strasbourg):

Geometric side of a local relative trace formula

In general, the trace formula is a way to express the trace of some operator into two different ways, one in terms of geometric objects, the other one in terms of spectral objects. In a joint work with P. Delorme and P. Harinck, we give an asymptotic description of the geometric side of a local trace formula for a reductive p-adic group G relative to some symmetric subgroup H. As a consequence of this result, we can express spherical characters of an H-distinguished supercuspidal representation of G using weighted orbital integrals.