



RTG2491 Autumn School

Spectra of Analysis in Geometry and Physics

October 6–10, 2025

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1 Schedule

- The lectures will take place in the Sitzungszimmer.
- The poster session will be held in the Maximum.
- The conference dinner will be at Le Feu ([Menu](#), [Google maps](#)). The food (buffet) and water for the table are included; drinks are on you. Please bring some cash!

	Monday 6th	Tuesday 7th	Wednesday 8th	Thursday 9th	Friday 10th
9-9:50	Registration				
9:50-10	Welcome				
10-11	Charlambous	Strohmaier	Charlambous	Galkowski	Galkowski
11-11:30	Coffee	Coffee	Coffee	Coffee	Coffee
11:30-12:30	Strohmaier	Rochon	Galkowski	Strohmaier	Rochon
12:30-14:30	Lunch	Lunch	Lunch	Lunch	Lunch
14:30-15:30	Rochon	Charlambous	Strohmaier	Galkowski	Goodbye
15:30-16	Coffee	Coffee	Free afternoon	Coffee	
16-17	Charlambous	Poster session		Rochon	
17-24			Social dinner 18:30	Pub crawl	

2 Lectures

The spectrum of geometric operators on noncompact manifolds

Nelia Charalambous (University of Cyprus)
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In this course we will give an overview of classical results for the spectrum of geometric operators such as the Laplacian on functions and differential forms and the Dirac operator. We will be considering both the spectrum when the operator is acting on a Hilbert space, but also on Banach spaces. We will be seeing how spectral results are also related to heat kernel estimates.

The high energy behavior of Laplace eigenfunctions: applications of geodesic beams

Jeffrey Galkowski (University College London)
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We will discuss the high energy behavior of Laplace eigenfunctions. In particular, we focus on their L^∞ norms and various averages. The course will review some basics of semiclassical analysis and give an introduction to how the method of geodesic beams is used to link the behavior of eigenfunctions to the dynamics of the geodesic flow.

L^2 -cohomology of complete hyperKähler metrics

Frédéric Rochon (Université du Québec à Montréal)
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Using manifolds with corners, the first lecture will introduce the notion of quasi-fibered boundary (QFB) metrics, a class of complete Riemannian metrics of bounded geometry including many examples of hyperKähler metrics, notably quiver varieties and the L^2 -metric on the (universal cover of the reduced) moduli space of $SU(2)$ -monopoles of magnetic charge k on $\mathbb{R}^3$. The second lecture will present the key basic features of L^2 -cohomology for these metrics and give a local description of weighted L^2 -cohomology in terms of a sheaf on an associated stratified space. The third lecture will focus on local computations of weighted L^2 -cohomology using elementary results of the b -calculus of Melrose. Finally, in the last lecture, we will explain how these local computations can be used to compute reduced L^2 -cohomology when the L^2 -harmonic forms are known to decay sufficiently fast at infinity.

Spectral Theory on Spacetimes

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Modern methods developed for spectral theory on Riemannian manifolds can also be applied to the more general case of stationary spacetimes. Here spectral theory is of relevance in classical general relativity and quantum field theory. In comparison to the Riemannian case there are also some important differences. I will focus on trace-formulae and high frequency asymptotics.

3 Poster session

- 1) Abdelmalek Mohammed (Higher school of management of Tlemcen (Algeria)): *Some geometric properties of weighted Newton transformations*
- 2) Akpan Dinmukhammed (Friedrich Schiller University Jena): *Integrable geodesic flows in terms of Nijenhuis operators*
- 3) Benachour Hamza (Abdel-Hamid ibn Badis University): *Weighted flat translation surfaces in Minkowski 3-space with radial density*
- 4) Cosserat Oscar (GAUG): *Butcher series for Hamiltonian Poisson integrators through symplectic groupoids*
- 5) Fotedar Ayush (University of Leicester): *Estimating Hubble's Constant via Gravitational Waves*
- 6) Islam Onirban (Universität Potsdam): *Pauli-Jordan Operator for Dirac Operators with Local Boundary Conditions*
- 7) Kevo Jilly (Universität Bonn): *Trace and Index of Callias Operators on Hyperbolic Space*
- 8) Lemoine Lucas (LAMA, Université Paris-Est Créteil): *Factorisation of the Dirac Operator on a Foliation*
- 9) Majeri Gabriel (University of Bucharest): *Signatures of chaos in classical and quantal spectra*
- 10) McCracken Gabriel (GAUG): *Nonlinear Evolutionary Equations in Exponential Weight Spaces*
- 11) Sabri Khadidja (University of Oran): *Spectral Behavior of the Laplacian on Manifolds with Cylindrical Ends*
- 12) Trébuchon Eric (Albert-Ludwig Universität Freiburg): *Self-adjointness of the Dirac Operator on corner domains*

4 Where to go for lunch?

The mathematical institute is at the southern border of the city center, which means that there are a lot of restaurants to choose from. Here is a list of restaurants which we can recommend:

- **Zentralmensa** (Platz d. Göttinger Sieben 4). This is the main mensa on the central campus, it is an about 20 minutes' walk from the institute. As an alternative to walking, one can take the bus lines 91 and 92 from Bürgerstraße to Auditorium, which takes around 14 minutes;
- **Bäckerei Küster** (Windausweg 8a or Weender Str. 106), for a quick lunch;
- **Göttinger Holzofenbäckerei** (Böttingerstraße 21) for a quick lunch;
- **Sen Viet Cuisine Bistro** (Vietnamese cuisine, good choice of vegetarian/vegan dishes, Rote Str. 18);
- **Goa India** (Indian cuisine, good choice of vegetarian/vegan dishes, Kurze-Geismar-Straße 43)
- **Palmyra** (Syrian cuisine, good choice of vegetarian/vegan dishes, Düstere Str. 10)
- **Asian Fusion Gamie** (Sushi restaurant, Weender Str. 29);
- **Bullerjahn** (European cuisine, Markt 9);
- **Empanadas Sabrosita** (South American cuisine, Karspüle 9).

5 Where to go for dinner?

- **Kartoffelhaus** (German cuisine, Goetheallee 8);
- **Zum Szültenbürger** (German cuisine, Prinzenstraße 7);
- **Tante Giulia** (Italian cuisine, Theaterstraße 25);
- **Ristorante Fellini** (Italian cuisine, Groner-Tor-Straße 28);
- **Nudelhaus** (Italian cuisine, Rote Str. 13);
- **India Haus** (Indian cuisine, good choice of vegetarian/vegan dishes, Kurze-Geismar-Straße 41);
- **Abessina** (Ethiopian restaurant, Ritterplan 2);
- **Nam Anh** (Asian cuisine, Groner Str. 12).

6 Vegan options

Some of the restaurants named above have some vegetarian and vegan options. There are however some more specialized options:

- **Gaia Garden** (Nikolaistraße 18);
- **Chay Vegan Kitchen** (Goethe-Allee 4A).

7 The University and the city of Göttingen

- The University has a lot of collections which you can browse. In Mathematics, we have in particular a beautiful **library** and a **collection of models**, calculating machines, integrators, etc. These can in part be viewed in the foyer in front of the room where the school takes place.
- **Forum Wissen**: the new museum of knowledge in Göttingen.
- **Gänseliesel**: on the main market place in front of the old city hall. PhD students traditionally bring her, following a successful defence, flowers and give her a kiss.
- **Städtisches Museum Göttingen**
- **Gauß' grave**
- **Gauß Observatory**
- **City Cemetery** with graves of David Hilbert, Max Born, Otto Hahn, Max Planck and many more.
- **Göttingen Forest**, including some easy and beautiful hikes (such as the Bismarckturm, Göttinger Biergarten am Kehr, and the nearby *Tiergarten*).



8 RTG2491 Fourier Analysis and Spectral Theory

The Research Training Group (RTG) Fourier Analysis and Spectral Theory is a joint research and graduate education programme funded by the German Science Foundation (DFG). It is based at the Mathematical Institute, University of Göttingen, with participating researchers from the University of Hannover. The initiative started at October 1, 2019 with the opening of 11 PhD and one postdoctoral position.

The RTG Fourier Analysis and Spectral Theory is taking an interdisciplinary and innovative approach to the classical and powerful machinery modern harmonic and Fourier analysis and spectral theory. We focus on its development in the context of mathematical physics, topology and analytic number theory.

A core theme of the RTG is analysis and spectral geometry on Riemannian manifolds, in particular, locally symmetric spaces or more generally spaces acted on by groups. Besides a topological structure, in many interesting cases they also have some arithmetic or combinatorial structure, and one of the key questions involves the fascinating interplay between the spectral properties of certain associated operators on the one hand, and geometric, topological or arithmetic properties on the other. Some prototypical examples of this interaction featured in this RTG are the spectral theory of Cayley graphs of groups; analytic L^2 -invariants, which link harmonic analysis to topology; and the resolvent and scattering theory of geometric differential operators on singular manifolds. A cornerstone at the interface of modern analytic number theory and harmonic analysis is the theory of automorphic forms, viewed as eigenfunctions of a family of operators on a locally symmetric space. Fourier and harmonic analysis also appear prominently in many applications of classical analytic number theory, in the representation theory of Lie groups and groupoids, and in the construction of quantum field theories with microlocal methods.

On the methodological side we draw from a variety of analytic techniques, such as microlocal analysis, symbolic calculus, trace formulas and Plancherel theory, Fourier analysis in numerous variations, spectral and scattering theory of operators, but also classical analysis such as a careful analysis of oscillatory integrals.