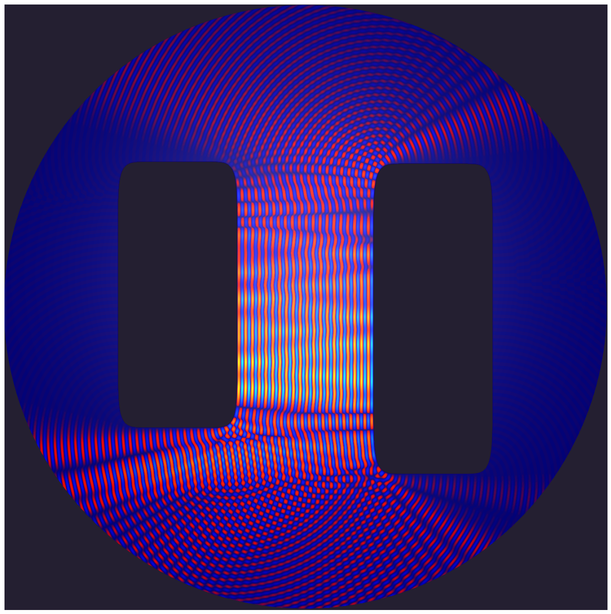
MAMA26: Modern Applications of Microlocal Analysis

A satellite workshop GSTW06 of the Isaac Newton Institute Programme on Geometric spectral theory and applications



16–20 February 2026

Book of abstracts

All talks are in Room C3.09, UCL Institute of Education, 20 Bedford Way, London WC1H 0AL. Coffee breaks will be in room C3.11, except Tuesday when they will be in C3.12.

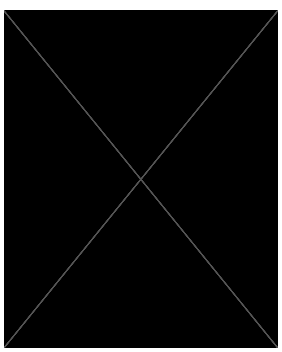
Workshop organisers: Matteo Capoferri (Universitá degli Studi di Milano and Heriot-Watt University), Jeffrey Galkowski (University College London), and Michael Levitin (University of Reading)

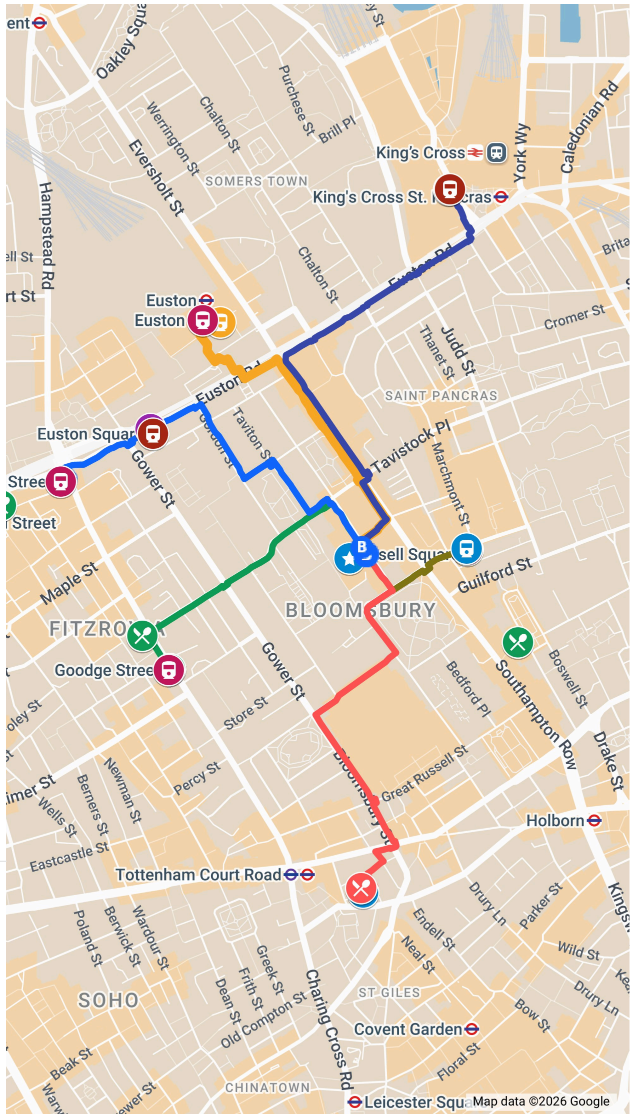
The workshop is supported by JG's EPSRC Fellowship EP/V001760/1: High energy spectral and scattering phenomena via microlocal analysis, and by UCL Department of Mathematics

MAMA26 locations map

Useful locations

- Conference Venue: 20 Bedford way
- Russell square tube station
- Euston Square tube station
- Euston tube station
- Warren Street tube station
- Goodge Street station
- King's Cross St. Pancras
- Cabana Restaurant, 7 St Giles St
- Many food options (near Goodge St)
- Master Wei Xi'An (Cosmo place) - excellent noodles
- Food market (near Warren St.)





Monday 16 February

09:00–09:30: Registration

09:30–10:30

Nicolas Burq — **Université Paris-Saclay**

Observation from measurable sets for Schroedinger equations

In this talk I will present some recent results about the observability and controllability of Schroedinger equations from measurable sets. I will present two types of results: on tori where we extend previously known results and provide a criterion to get the most general result (observability from any non trivial space time measurable set); on general domains and manifold where we prove that in (almost) all cases previously known where observability holds, we can replace time intervals by any (non trivial) measurable time set. This is based on joint works with Hui Zhu (NYU Abu Dhabi).

10:30–11:00: Coffee break

11:00–12:00

Andras Vasy — **Stanford University**

Microlocal analysis of the non-relativistic limit of the Klein-Gordon equation

The non-relativistic limit for a Klein-Gordon equation, with electric and magnetic potential terms on a Lorentzian manifold, corresponds to a family of Lorentzian metrics for which, with respect to an appropriate spacelike foliation of the manifold, the speed of light tends to infinity. Concretely, we consider decaying, both in spacetime and as $c \to +\infty$, perturbations of the Minkowski metric, $-c^2dt^2 + dx^2$, with spacetime decaying electric and magnetic potentials on $\mathbb{R}^{1,d}$; this is interesting already if the metric is just the c-dependent Minkowski metric. We give a complete and unified phase space analysis of the solution operators for the inhomogeneous wave equation as $c \to \infty$. In some regimes these tend to the Minkowski Klein-Gordon propagators, but in others (spatially low frequency) two copies of the Schrödinger propagator emerges, with electric and magnetic potentials, but on flat space, as expected from the standard physical treatment. Joint work with Andrew Hassell, Qiuye Jia and Ethan Sussman; the talk will emphasize the microlocal ingredients of the project, as in arXiv:2509.09518, see arXiv:2511.08724 for the applications.

12:00–14:00: Lunch break

14:00–15:00

Alex Sobolev

University College London

Time-frequency analysis: eigenvalue asymptotics

We study discrete spectrum of self-adjoint Weyl pseudodifferential operators with discontinuous symbols of the form $\mathbf{1}_\Omega \phi$ where $\mathbf{1}_\Omega$ is the indicator of a domain in $\Omega \subset \mathbb{R}^2$, and $\phi \in C_0^\infty(\mathbb{R}^2)$ is a real-valued function. It was known that in general, the singular values s_k of such an operator satisfy the bound $s_k = O(k^{-3/4})$, $k = 1, 2, \ldots$. We show that if Ω is a polygon, the singular values decrease as $O(k^{-1} \log k)$. In the case where Ω is a sector, we obtain an asymptotic formula which confirms the sharpness of the above bound. This a joint work with A. Derkach.

15:00–15:30: Coffee break

15:30–16:30

Clotilde Fermanian Kammerer

Université d'Angers

Semiclassical propagators

In this talk, we will describe different phenomena that arise when analyzing systems of coupled semiclassical PDEs. We will discuss approximations of the propagator in the semiclassical limit.

16:30–17:30

Matthieu Léautaud

Université Paris-Saclay

Poincaré series of convex bodies

We consider the set of distances from a point to a lattice in Euclidean space, for a metric related to a convex body. Associated with these lengths, we construct a Poincaré series: a natural holomorphic function defined in a complex half-plane. The aim of the talk is to study this function: its possible extension to the other half-plane, its poles, its singularities, etc. In doing so, we encounter a multiplication operator by a Morse function on the sphere and describe its spectral theory. This is joint work with Nguyen Viet Dang, Yannick Guedes-Bonthonneau, and Gabriel Rivière.

Tuesday 17 February

09:30–10:30

Cipriana Anghel Stan — **Universität Göttingen**

Dirac spectrum and Selberg Zeta functions on degenerating Riemannian surfaces

We study the behaviour of the spectrum of the Dirac operator on degenerating families of compact Riemannian surfaces, when the length of a simple closed geodesic shrinks to zero, under the hypothesis that the spin structure along the pinched geodesic is non-trivial. The difficulty of the problem stems from the non-compactness of the limit surface, which has finite area and two cusps. The main idea in this investigation is to construct an adapted pseudodifferential calculus, in the spirit of the celebrated b-algebra of Melrose, which includes both the family of Dirac operators on the family of compact surfaces and the Dirac operator on the limit non-compact surface, together with their resolvents. Using the Selberg trace formula, we further study the behaviour of the Selberg Zeta function of the Dirac operator on certain paths in the Teichmüller space.

10:30–11:00: Coffee break

11:00–12:00

Alex Cohen — **Courant Institute**

Ruling out periodicity in quantum chaos

The quantum unique ergodicity conjecture (QUE) predicts that on hyperbolic manifolds, high-frequency Laplace eigenfunctions are always equidistributed. This conjecture fails in a closely related system, quantum cat maps. QUE fails because the cat map analogue of the wave equation is periodic with a small period. In work in progress with Semyon Dyatlov, we develop new harmonic analysis tools to distinguish quantum cat maps from hyperbolic manifolds. In particular, the wave equation on hyperbolic manifolds is not (approximately) periodic with such a small period.

12:00–14:00: Lunch break

14:00–15:00

Alix Deleporte — **Université Paris-Saclay**

Listening to regularity in the 2D Steklov problem

The Steklov problem consists in the eigenvalues of the Dirichlet-to-Neumann map, acting on functions on the boundary of a domain. In 2D, when the boundary of the domain is a smooth closed curve, the problem is completely integrable. The eigenvalues of the Dirichlet-to-Neumann map are then close to the integers (up to a superpolynomial error). To the contrary, for Lipschitz, piecewise smooth boundaries, the angles strongly influence the spectrum. In a work in progress with Jean Lagacé (KCL) and Leonid Parnovski (UCL), we show a two-way relationship between the regularity of the boundary (as measured in the scale of Sobolev spaces) and the closeness of the spectrum to the integers (as measured by weighted summability properties). The more regular the boundary, the closer the eigenvalues lie to the integers, in a way which is generically sharp. Our main tools are the conformal mappings which reduce the problem to the analysis of a weighted operator on the circle, and the study of commutation properties between Fourier multipliers with a singularity at zero (the Hilbert transform, the square root of the Laplacian) and space multipliers by rough functions.

15:00–15:30: Coffee break

15:30–16:30

Zhongkai Tao — **Institut des Hautes Études Scientifiques**

Twisted Ruelle zeta functions at zero on negatively curved surfaces

Since the results of Fried, there have been a lot of studies on the order of vanishing for the Ruelle zeta function at zero for the geodesic flow on a negatively curved manifold. I will talk about my work with Tristan Humbert, in which we obtain some results on negatively curved surfaces, with twist by a flat vector bundle.

16:30–17:30

Jared Wunsch — **Northwestern University**

Gutzwiller trace formula for singular potentials

The Gutzwiller trace formula relates the asymptotic spacing of quantum-mechanical energy levels in the semiclassical limit to the dynamics of periodic classical particle trajectories. We generalize this result to the case of non-smooth potentials, for which there is partial reflection of energy from derivative discontinuities of the potential. It is the periodic trajectories of an associated branching dynamics that contribute to the trace asymptotics in this more general setting; we obtain a precise description of their contribution. This is joint work with Mengxuan Yang and Joey Zou.

Wednesday 18 February

09:30–10:30

Stephane Nonnenmacher — **Université Paris-Saclay**

Spectral gaps for chaotic damped waves

The damped wave equation on a compact Riemannian manifold leads to interesting phenomena. The energy of the wave necessarily decays with time, but the speed of decay depends, at high frequency, on a subtle interplay between the distribution of the damping function, dispersion phenomena induced by wave propagation, and the classical dynamics of the geodesic flow. One way to characterize the decay is to study the spectrum of the generator of the flow dynamics: showing spectral gaps generally allows to prove some form of exponential decay of the energy. I will recall old and more recent results on these spectral questions, in particular in the case of manifolds featuring a chaotic (Anosov) flow, for which they are connected with the question of quantum (unique) ergodicity.

10:30–11:00: Coffee break

11:00–12:00

Colin Guillarmou — **Université Paris-Saclay**

Spectral properties of Coulomb Gaz and imaginary Liouville

we consider models of conformal field theory related to statistical mechanics models. These have been studied in physics via the Coulomb Gaz integral approach. We take a spectral theoretic point of view on these models, which are non self-adjoint with discrete spectrum, to uncover the factorisation properties (bootstrap) of certain Coulomb Gaz integrals. Supported by numerics, we also discuss a “non-compact version” of the model, which goes back to Witten, Zamolodchikov.

12:00–13:00

Katya Krupchyk — **University of California, Irvine**

Fractional anisotropic Calderón problem

The anisotropic Calderón problem asks whether a Riemannian metric, or more generally a compact Riemannian manifold with boundary, can be recovered from the Dirichlet-to-Neumann map for the Laplace–Beltrami operator, given on the boundary of the manifold, and it remains open in general for smooth metrics in dimensions three and higher. In this talk, we discuss a nonlocal analogue, the fractional anisotropic Calderón problem, and present uniqueness results in two settings. First, on a smooth closed Riemannian manifold, we show that the source-to-solution map for the fractional Laplace–Beltrami operator, known on an arbitrary nonempty open subset, determines the manifold up to isometry. Second, in Euclidean space, we demonstrate that the partial exterior Dirichlet-to-Neumann map for the fractional Laplace–Beltrami operator, known on an arbitrary nonempty open subset of the exterior of the domain, determines the smooth Riemannian metric up to a diffeomorphism fixing the exterior, for metrics that agree with the Euclidean metric outside a compact set. The talk is based on joint works with Ali Feizmohammadi, Tuhin Ghosh, Angkana Rüland, Johannes Sjöstrand, and Gunther Uhlmann.

Thursday 19 February
Dmitri Vassiliev's 70th birthday celebrations

09:30–10:30

Matteo Capoferri — Universitá degli Studi di Milano and Heriot-Watt University

Pseudodifferential projections and spectral theory

In my talk I will report on a series of recent joint works with Dmitri Vassiliev (UCL) featuring the use of pseudodifferential projections as a key tool to obtain spectral-theoretic results for operators on closed manifolds. As an important example, I will discuss the analysis of spectral asymmetry for the operator curl.

10:30–11:00: Coffee break

11:00–12:00

Marco Marletta — Cardiff University

Essential spectra, essential numerical ranges and spectral pollution, with applications to non-selfadjoint Maxwell systems and other non-sectorial operators

If we wish to approximate the spectrum of an operator A in a Hilbert space H, we may generate a sequence of approximating operators A_n (often operators in finite-dimensional spaces H_n) that converge to A in some sense and whose spectra we are able to find more easily. Dima Vassiliev coined the term 'spectral pollution' to describe the situation in which there is a convergent sequence $(\lambda_n)_{n\in\mathbb{N}}$ with limit λ in the resolvent set of A, but each λ_n in the spectrum of A_n. Early work on spectral pollution dealt with the selfadjoint case, where the concept of extended essential spectrum turns out to be important. In this talk we will discuss spectral pollution for non-selfadjoint operators. In these cases it often turns out that the concept of essential numerical range is optimal for capturing spectral pollution. However we shall show that for certain non-sectorial operators such as Maxwell systems with conductivity, spectral pollution can be captured in a remarkably smaller set. The technology for proving this is closely related to techniques we have developed in the last four years for Maxwell essential spectra. If time permits I shall also review results for non-selfadjoint Stark operators.

12:00–14:00: Lunch break

14:00–15:00

Grigori Rozenblum — **Chalmers University of Technology**

Microlocal analysis in some nonsmooth problems

It is a general knowledge that microlocal analysis fits not quite well with problems with nonsmooth data. Nevertheless, sometimes it plays decisive role in such problems. In examples I discuss, the starting step and the concluding step require involvement of microlocal analysis. The topics concern the not that recent proof of the Weyl asymptotics for the Poincare-Steklov operator in a domain with Lipschitz boundary and a more recent study of spectral asymptotics for the difference of resolvents of operators with Neumann and with Robin boundary conditions for a domain with $C^{1,1}$ boundary.

15:00–15:30: Coffee break

15:30–16:30

Nikolai Saveliev — **University of Miami**

Seiberg–Witten equations on Berger 3-spheres

The Seiberg–Witten equations are a system of nonlinear partial differential equations that play a central role in low-dimensional topology and differential geometry. This talk will focus on the three-dimensional theory for closed, oriented manifolds. We begin with an accessible introduction to the Seiberg–Witten equations and conclude with an explicit formula for counting their solutions on Berger 3-spheres in terms of the spectrum of the Dirac operator.

16:30–17:10 (online)

Ari Laptev — **Imperial College London**

Wave equation for the harmonic oscillator in an Aharonov–Bohm magnetic field

17:10-17:30

Michael Levitin — **University of Reading**

The man behind the λs

A few words about Dima Vassiliev on occasion of his 70th birthday,

From 18:30: Conference/Dmitri Vassiliev's celebratory dinner
Cabana, 7 St Giles High St, London WC2H 8AB
by invitation or ticket only

Friday 20 February

09:30–10:30

Euan Spence — **University of Bath**

Designing new finite-element meshes using semiclassical resolvent estimates

The finite-element method is a very popular method used across science and engineering to solve, in particular, wave problems modelled by the Helmholtz equation. Standard finite-element methods seek the solution as piecewise polynomial (of fixed degree) on a triangulation (aka mesh) of the domain. For the Helmholtz equation, the meshwidth must then depend on the norm of the solution operator (aka the resolvent) to maintain accuracy as the frequency increases. In two papers in 2012, Datchev and Vasy (following earlier work by Burq, Cardoso, and Vodev) showed how, for problems with trapping, the resolvent behaves better at high frequency if either the data or the measurement location are (microlocally) away from trapping. This talk, based on the paper [Averseng, Galkowski, Spence, arXiv 2506.15630], will describe how this knowledge can be combined with state-of-the-art finite-element analysis to produce new finite-element meshes for high-frequency Helmholtz trapping problems. (No prior knowledge of the finite-element method will be required to understand this talk!)

10:30–11:00: Coffee break

11:00–12:00

Tanya Christiansen — **University of Missouri, Columbia**

Low frequency scattering and wave decay

This talk focuses on low-energy resolvent expansions for a wide class of scattering settings. We concentrate on operators defined on $\mathbb{R}^2$, with particular attention to the Dirichlet or Neumann Laplacian on the exterior of an obstacle and to Aharonov-Bohm operators. We give applications to long-time behavior of the solutions of the wave equation and low-energy behavior of the scattering phase. This is based on joint work with Kiril Datchev. A portion is work with Mengxuan Yang and Pedro Morales.

12:00–14:00: Lunch break

14:00–15:00

Rupert Frank — **Ludwig-Maximilians-Universität München**

Localization of orthonormal functions in spectral clusters

We generalize the L^p spectral cluster bounds of Sogge for the Laplace-Beltrami operator on compact Riemannian manifolds to systems of orthonormal functions. We show that these bounds are optimal on any manifold in a very strong sense. These spectral cluster bounds follow from Schatten-type bounds on oscillatory integral operators and their optimality follows by semi-classical analysis. The talk is based on joint work with Julien Sabin.

15:00–16:00

Maciej Zworski **University of California, Berkeley**

WKB structure in a scalar model of flat bands

The scalar model of flat bands is a simplification of models in condensed matter physics. It allows the study of relevant spectral problems using a 2nd order scalar equation, akin to the Schroedinger equation with the square of dbar on a torus replacing the Laplacian. It displays many features of original models such as the "quantisation" of the reciprocals of magic angles at which flat bands appear. The space of solutions can be described using a rank 2 holomorphic vector bundle over the torus and its properties as alpha varies are related to the structure of bands leading to a trichotomy: tangential touching (most of alphas), Dirac points (discrete set of alphas) and flat bands (discrete set). (Mengxuan Yang and Bryan Li observed that the same argument works in a more physically realistic setting of twisted two-layered wafers of graphene.) In my talk I will describe the basic properties of the scalar model and of the general class of scalar equations to which it belongs. I will also present a discussion of WKB-like structure of solutions. This is joint work with S Dyatlov and H Zeng, with earlier contributions by S Becker, M Embree, J Galkowski, M Hitrik, T Humbert, Z Tao, J Wittsten and M Yang.