Mathematical Relativity and Geometric Analysis
Relativité mathématique et analyse géométrique
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Global counterexamples to uniqueness for a Calderón problem with C^k conductivities

Let Ω be a bounded subset of $\mathbb{R}^n$ with C^∞ boundary, where $n \geq 3$, and let $\gamma = (\gamma^{ij})$ be a bounded measurable function on $\overline{\Omega}$ taking values in the set $\mathcal{S}_n$ of positive definite $n \times n$ symmetric matrices. The Calderón inverse problem consists in recovering the map γ from the from the knowledge of the Dirichlet-to-Neumann map at fixed frequency for the operator $L_\gamma = -\partial_i(\gamma^{ij}\partial_j)$, up to some gauge equivalences induced by the invariance properties of the Dirichlet-to-Neumann map. We obtain counterexamples to uniqueness for the Calderón problem by showing that for any smooth map γ and any frequency that does not belong to the Dirichlet spectrum of L_γ, there exists, for any $k \geq 1$ and any $\epsilon > 0$, a pair of non gauge-equivalent maps γ_1, γ_2 of class C^k which are ϵ-close to γ in the $C^k(\overline{\Omega}, \mathcal{S}_n)$ topology, such that their Dirichlet-to-Neumann maps are equal. This is joint work with Thierry Daudé (Besançon), Bernard Helffer (Nantes) and François Nicoleau (Nantes).

MARIEM MAGDY, Perimeter Institute

ARGAM OHANYAN, University of Toronto
On the geometry of continuously differentiable spacetime metrics

Nonsmooth metrics appear naturally in mathematical relativity and spacetime geometry, whether as solutions of Einstein's equations or during the course of physically relevant operations such as spacetime matching. It is important to study their geometry also to give further physical credence to the singularity theorems of Hawking and Penrose. In this talk, we will discuss the class of continuously differentiable spacetime metrics, for which many important theorems have been established recently. After introducing the main approximation tools and methods of study, we will discuss important applications such as the Hawking and Penrose singularity theorems, the Hawking-Penrose singularity theorem, and the splitting theorem.

This talk is partly based on joint collaborations with Kunzinger, Schinnerl, Steinbauer and with Braun, Gigli, McCann, Sämann.

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