Leibniz Universität Hannover
Institut für Analysis

24. März 2025

SEMINAR ANNOUNCEMENT

for the Summer Semester 2025

Topic: The Calderón Problem
Organizer: Elmar Schrohe
Prerequisites: Basic Knowledge in Functional Analysis and Partial Differential Equations

Overview: In 1980, Alberto Calderón published a short paper entitled "On an inverse boundary value problem". The problem he considered was whether one can determine the electrical conductivity of a medium by making voltage and current measurements at the boundary. This inverse method is known as Electric Impedance Tomography (EIT).
While Calderón was interested in geophysical prospection, possible applications also concern medical imaging given that human organs and tissues have quite different conductivities.
From a mathematical perspective, one considers a bounded domain $\Omega \subset \mathbb{R}^n$, together with a positive function $0 < \gamma \in C^\infty(\Omega)$ (less regularity is sufficient). For a given function f (a voltage potential) on $\partial\Omega$ one solves the conductivity problem for the potential u in Ω:

$$\operatorname{div}(\gamma \nabla u) = 0 \text{ in } \Omega; \quad u|_{\partial\Omega} = f.$$

The Calderón problem is to determine γ from the boundary data f and $\partial_\nu u|_{\partial\Omega}$. In the seminar, we will look at the mathematical background and consider modern developments, following mostly lecture notes by Mikko Salo and Gunther Uhlmann.

References:

1. G. Paternain, M. Salo, and G. Uhlmann. Geometric inverse problems. `https://users.jyu.fi/~salomi/lecturenotes/GIP2D_driver.pdf`
2. M. Salo. Calderón Problem. Lecture notes. `https://users.jyu.fi/~salomi/lecturenotes/calderon_lectures.pdf`
3. M. Salo. The Calderón problem on Riemannian manifolds. `https://users.jyu.fi/~salomi/pub/Salo_InsideOut.pdf`
4. M. Salo. Applications of Microlocal Analysis in Inverse Problems Mathematics 2020, 8(7), 1184; `https://doi.org/10.3390/math8071184`
5. J. Sylvester, G. Uhlmann. A global uniqueness theorem for an inverse boundary value problem. Ann. of Math. (2) 125 (1987), no. 1, 153–169.
6. G. Uhlmann. 30 Years of Calderón's Problem. Seminar Laurent Schwartz. EDP et Applications (2012/13), Talk no. 13, 25 pp. `https://www.numdam.org/item/SLSEDP_2012-2013____A13_0/`

Interested? More information and a list of topic for talks will be available on Stud.IP.
Questions? Send me an email: `schrohe@math.uni-hannover.de`