

Miniworkshop on Geometric and Variational Analysis

Book of Abstracts

12 October 2026 | 15:00

Room I, Department of Mathematics, University of Bari Aldo Moro

15:00–15:45

Data-driven analysis of elliptic PDE models for population growth

Laura Baldelli — Karlsruhe Institute of Technology

Abstract. We introduce a data-driven approach to the modeling and analysis of an elliptic PDE describing population growth. Instead of relying on a predefined constitutive law, such as the Verhulst model of logistic growth, we adopt a framework based directly on experimental data. Specifically, we seek solutions that match the observations in an optimal way. This yields a novel relaxed solution concept, for which we analyze consistency and convergence properties. This talk is based on joint work with Wolfgang Reichel (KIT) and Paolo Malanchini (Università degli Studi di Milano - Bicocca).

15:45–16:30

Around the Grushin Laplacian: Asymptotics and Beyond

Paolo Luzzini — Università del Piemonte Orientale

Abstract. The Grushin Laplacian is a degenerate elliptic operator whose degeneracy occurs along a submanifold. In this talk, we study weak solutions of a Schrödinger-type equation involving the Grushin Laplacian, under suitable assumptions on the potential. By means of an Almgren-type monotonicity formula, we determine the precise asymptotic profile of solutions near points of the degeneracy set. As a main consequence, we establish a strong unique continuation principle. In the final part of the talk, we discuss several related open problems and directions for future research, including singular perturbations of Grushin eigenvalues in domains with small holes, the explicit construction of Grushin spherical harmonics, and shape optimization problems.

17:00–17:45

Stretching tubes: Asymptotic behaviour of Dirichlet Laplacians of order $s > 0$

Giulio Romani — Università degli Studi di Udine

Abstract. The study of the asymptotic properties of differential equations posed in bounded domains that become unbounded in one or more directions is interesting from both theoretical and applied perspectives. In this talk, I will consider Dirichlet problems driven by Laplacians of real order $s > 0$, hence possibly fractional and/or of higher order, and I will focus on their spectral and variational properties. First, I will discuss the asymptotic behaviour of the eigenvalues, and then deal with the G-convergence and Γ -convergence of the corresponding rescaled quadratic forms. In all cases, dimension reduction phenomena will be observed and, for the eigenvalues, quantitative estimates for the rate of convergence will be obtained. These results are based on a joint work with Roberta Musina (Udine).

Organizers: Silvia Cingolani, Annunziata Loiudice, Gabriele Mancini