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## Varopoulos extensions of $BMO$ and $L^p$ functions in domains with Ahlfors-regular boundaries and applications to Boundary Value problems for elliptic PDEs with $L^\infty$ coefficients.

Wednesday, 18 June 2025 09:00 (1h 30m)

This course presents a unified approach to extending boundary data from rough domains into the interior, with a focus on applications to boundary value problems for elliptic operators. We study recent advances in constructing *smooth harmonic-type extensions* of  $BMO$  and  $(L^p)$  functions from the boundary  $(\partial \Omega)$  of a domain  $(\Omega \subset \mathbb{R}^{n+1})$ , where the geometry of  $(\Omega)$  may be highly irregular.

The domains under consideration include:

- Corkscrew domains* when  $(\partial \Omega)$  is  $(n)$ -dimensional and Ahlfors regular,
- and *complements of  $(s)$ -Ahlfors regular sets* when  $(s < n)$ .

The core objectives of the course include:

- Constructing *smooth interior extensions* of boundary functions with optimal control in terms of *Carleson measures* and *non-tangential maximal functions*,
- Establishing *pointwise convergence* of these extensions back to the boundary data in a non-tangential sense,
- Showing how *Lipschitz boundary data* yields Lipschitz continuous extensions up to the closure of the domain.

A significant portion of the course will be dedicated to *applications in elliptic boundary value problems*, particularly for *divergence-form elliptic systems with rough (e.g., merely bounded, complex-valued) coefficients*. We will explore:

- The role of these extensions in solving *Dirichlet problems with  $(L^p)$  and  $BMO$  boundary data*,
- Connections between *interior regularity in Carleson or tent spaces* and the *solvability of Poisson problems*,
- How these tools fit into the modern framework of harmonic analysis on non-smooth domains.

The course is aimed at graduate students and researchers interested in *elliptic PDEs, harmonic analysis, and geometric measure theory*. It will balance theoretical development with motivation from concrete problems in analysis and PDE.

**Presenter:** Prof. MOURGOGLOU, Mihalís (Universidad del País Vasco/Euskal Herriko Unibertsitatea)