TEMPLE UNIVERSITY

Department of Mathematics

Analysis Seminar

Room 617 Wachman Hall

Monday, November 27th, 2023, 2:30 p.m.

Elliptic equations with singular drifts on Lipschitz domains

by Hyunwoo Kwon

Brown University

Abstract: We consider the Dirichlet problems for second-order linear elliptic equations

$$-\Delta u + \operatorname{div}(u\mathbf{b}) = f \quad \text{and} \quad -\Delta v - \mathbf{b}\cdot\nabla v = g$$

in a bounded Lipschitz domain Ω in $\mathbb{R}^n$, $n \geq 2$, where $\mathbf{b} : \Omega \to \mathbb{R}^n$ is a given vector field. Under the assumption that $\mathbf{b} \in L^n(\Omega)^n$, we establish the existence and uniqueness of solutions in $L^p_\alpha(\Omega)$ for the Dirichlet problem. Here $L^p_\alpha(\Omega)$ denotes the Sobolev space with the pair (α, p) satisfying certain conditions. This result extends the classical work of Jerison-Kenig (1995) for the Poisson equation. We also prove the existence and uniqueness of solutions of the Dirichlet problem with boundary data in $L^2(\partial\Omega)$. We also discuss relevant problems for Neumann problems and different regularities on the drift coefficient as well. Part of this presentation is based on the joint work with Prof. Hyunseok Kim (Sogang University, South Korea).