Department of Mathematics and Statistics
Mississippi State University

Colloquium

On Striking Differences Between the Spectra of Linear and Quasilinear Diffusion Operators (the linear Laplacian versus the p-Laplacian)

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Allen 14

Abstract. We begin with a short introduction about the origin(s) of the (linear) Laplace operator $\Delta := \operatorname{div}(\nabla u)$ and its natural quasilinear generalization $\Delta_p u := \operatorname{div}(|\nabla u|^{p-2}\nabla u)$ for $1 < p < \infty$, the so-called p-Laplace operator. Then we formulate the corresponding reaction-diffusion equations for these two types of operators, linear and quasilinear, respectively, and briefly describe a few applications to problems in hydrodynamics, phase transitions, and climate modeling. Then we focus on the main part of the lecture, the *spectral properties* of the p-Laplace operator Δ_p, $1 < p < \infty$. The main open question that we will try to answer is *whether it is possible* to fully describe the spectrum of the p-Laplacian Δ_p for $p \neq 2$ by a method similar to the commonly used variational method of Courant and Fischer for the (linear) Laplace operator Δ. We will present an example of a domain (a circle) and a potential where the commonly used Ljusternik-Schnirelmann analogue of the Courant-Fischer method does *not* yield all variational eigenvalues of Δ_p for any $p > 2$.

There will be a reception for Dr. Takáč in Allen 467 at 3:00.

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