Doubly Nonlinear Parabolic Equations with Measure Data

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Doubly nonlinear parabolic equations have a large number of applications in fluid mechanics, population dynamics, or groundwater infiltration. For $m > 0$ and $p > 1$, the model equation is given by

$$\partial_t u - \operatorname{div}[|u|^{m-1}|Du|^{p-2}Du] = \mu$$

in a space-time cylinder $\Omega_T = \Omega \times (0, T)$ of height $T > 0$ over a bounded open set $\Omega \subset \mathbb{R}^n$. Here, the unknown function $u\colon \Omega_T \to \mathbb{R}$ represents the distribution of the density of a gas, for instance. The p-Laplace equation and the porous medium equation are covered as special cases for $m = 1$ and $p = 2$, respectively. The particular interest in Radon measures μ as forcing terms is motivated by several phenomena such as explosions or the heat release from point sources. In this talk, some basic features of doubly nonlinear parabolic equations and an overview of the results of the doctoral thesis are presented. The statements to be discussed include existence and regularity results for the measure-valued equation as well as for obstacle problems.

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