

Seminário de Análise

Geometric estimates for nonlinear models and applications

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Abstract. In this Lecture we study geometric estimates and the limiting behavior as $p \rightarrow \infty$ of nonnegative solutions for elliptic equations of p Laplacian type ($1 < p < \infty$) with a strong absorption:

$$-\Delta_p u(x) + \lambda_0(x) u_{\{u>0\}}^q(x) = 0 \quad \text{in } \Omega \subset \mathbb{R}^N,$$

where $\lambda_0 > 0$ is a bounded function, Ω is a bounded domain and $0 < q < p - 1$. When p is fixed, such a model is mathematically interesting since it permits the formation of *dead core zones*, this is, *a priori* unknown regions where non-negative solutions vanish identically (cf. [4]). First, we turn our attention to establishing sharp C_{loc}^τ regularity estimates along free boundary points, where $\tau = \frac{p}{p-1-q} - 1$ (cf. [3]). Afterwards, assuming that $A := \lim_{p \rightarrow \infty} \frac{q(p)}{p} \in [0, 1)$ exists, we establish existence for limit solutions as $p \rightarrow \infty$, as well as we characterize the corresponding limit operator governing the limit problem. We also establish sharp C_{loc}^γ regularity estimates for limit solutions along free boundary points, where the sharp regularity exponent is given explicitly by $\gamma = \frac{1}{1-A}$ (cf. [2]). We also comment about the parabolic counterpart of such estimates, see [1].

References

- [1] da Silva, J.V., Ochoa, P. and Silva, A. - *Regularity for degenerate evolution equations with strong absorption*. J. Differential Equations 264 (2018), no. 12, 7270-7293.
- [2] da Silva, J.V. Rossi, J. and Salort, A. - *Regularity properties for p -dead core problems and their asymptotic limit as $p \rightarrow \infty$* . London Math. Soc. (2) 00 (2018) 1-28 DOI:10.1112/jlms.12161.
- [3] da Silva, J.V. and Salort, A. - *Sharp regularity estimates for quasi-linear elliptic dead core problems and applications*. Calc. Var. Partial Differential Equations 57 (2018), no. 3, 57: 83.
- [4] Díaz, J.I. - *Nonlinear Partial Differential Equations and Free Boundaries Vol. I. Elliptic equations*. Research Notes in Mathematics, 106. Pitman (Advanced Publishing Program), Boston, MA, 1985. vii+323 pp. ISBN: 0-273-08572-7.