

Hölder Continuity of the Gradient of Solutions to Doubly Non-Linear Parabolic Equations

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Abstract

We study the local behavior of non-negative weak solutions to the doubly non-linear parabolic equation

$$\partial_t u^q - \operatorname{div}(|Du|^{p-2} Du) = 0$$

in a space-time cylinder. Hölder estimates are established for the gradient of its weak solutions in the so-called super-critical fast diffusion regime $0 < p - 1 < q < \frac{N(p-1)}{(N-p)_+}$, where N is the space dimension.

Moreover, decay estimates are obtained for weak solutions and their gradient in the vicinity of possible extinction time. Two main components towards these regularity estimates are a time-insensitive Harnack inequality that is particular about this regime, and Schauder estimates for the parabolic p -Laplace equation.

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