



# Gastvortrag

Mittwoch, 23. November 2022

Uhrzeit: 13.00 Uhr

Seminarraum I

Pasquale Ambrosio

University of Naples Federico II

## Regularity results for some classes of strongly singular or degenerate elliptic and parabolic equations

### Abstract:

I present higher integrability results for the gradient of local weak solutions to the strongly degenerate or singular elliptic PDE

$$-\operatorname{div} \left( (|Du| - 1)_+^{q-1} \frac{Du}{|Du|} \right) = f \quad \text{in } \Omega,$$

where  $\Omega$  is a bounded domain in  $\mathbb{R}^n$  for  $n \geq 2$ ,  $1 < q < \infty$ , and  $(\cdot)_+$  stands for the positive part (see [1]). I assume that the datum  $f$  belongs to a suitable Sobolev or Besov space. The main novelty here is that I deal with the case of *subquadratic growth*, i.e.  $1 < q < 2$ , which had so far been neglected. In the latter case, I also establish the higher fractional differentiability of the solution to a variational problem, which is characterized by the above equation.

Moreover, motivated by applications to gas filtration problems, I study the regularity of weak solutions to the parabolic counterpart of the previous PDE

$$w_t - \operatorname{div} \left( (|Dw| - 1)_+^{p-1} \frac{Dw}{|Dw|} \right) = g \quad \text{in } \Omega_T = \Omega \times (0, T),$$

when  $p \geq 2$  (see [2]). In particular, I establish the higher differentiability of a function of the spatial gradient  $Dw$  of the solutions, the higher integrability of the spatial gradient itself and the existence of the weak time derivative  $w_t$ , by initially assuming that  $g \in L^{\frac{p}{p-1}} \left( 0, T; W^{1, \frac{p}{p-1}}(\Omega) \right)$ . Next, I also show how it is possible to retrieve most of the above results by suitably weakening the assumption on the datum  $g$ . These results extend to a widely degenerate setting the known results for parabolic equations.