**Titolo del corso:** Degenerate or Singular Elliptic and Parabolic Equations

**Docente:** Pasquale Ambrosio

**Membro del collegio proponente:** Giovanni Cupini

**Ore frontali di lezione:** tra 16 e 20 ore

**Periodo di lezione:** marzo - giugno 2026

**Settore/i disciplinare del corso:** MATH-03/A, Analisi Matematica

**Tipologia di corso:** base/avanzato

**Modalità di verifica dell'apprendimento:** seminario su un argomento del corso

**Abstract del corso:**
This doctoral course introduces participants to the regularity theory for elliptic and parabolic PDEs with (strongly) singular or degenerate structure. The equations under consideration satisfy standard $p$-growth and $p$-ellipticity conditions, typical of $p$-Laplacian type operators, sometimes only away from the origin. This gives rise to a rich variety of analytical difficulties and phenomena. We first discuss the elliptic setting, focusing on higher differentiability results for weak solutions, in both the subquadratic ($1 < p < 2$) and superquadratic ($p \geq 2$) regimes. We then explore analogous results in the parabolic framework, addressing the higher spatial and temporal differentiability of the weak solutions under suitable assumptions on the data.
Throughout the course, emphasis will be placed on the main ideas, techniques and tools underlying the proofs. The lectures aim to provide participants with both a conceptual understanding and a solid technical foundation for further research in nonlinear PDEs.

**Programma del corso:**


- Review of some classical regularity results for the stationary and evolutionary $p$-Laplacian.

- Higher differentiability results for weak solutions to strongly singular/degenerate *elliptic* PDEs of $p$-Laplacian type away from the origin.

- Higher differentiability results for weak solutions to strongly degenerate *parabolic* PDEs of $p$-Laplacian type away from the origin.

- A brief overview on the Lipschitz regularity of weak solutions to widely degenerate *elliptic* and *parabolic* PDEs.