

ADA LOVELACE DAY IN URBINO 2026

October 15, 2026

Collegio Raffaello
Piazza della Repubblica, 13, Urbino

Ada Lovelace Day is an international celebration of the achievements of women in science, technology, engineering and maths (STEM). It aims to increase the profile of women in STEM and, in doing so, create new role models who will encourage more girls into STEM careers and support women already working in STEM. Founded in 2009 by the British journalist and writer Suw Charman-Anderson, since 2010 it is held every year on the second Tuesday of October.

This conference aims to celebrate Ada Lovelace Day at the University of Urbino Carlo Bo, featuring contributions from early-career female researchers alongside more experienced mathematicians from various Italian and international universities, all recognized globally for their significant scientific contributions to the mathematics community. The invited speakers work in the field of nonlinear analysis and its applications, areas that fit within a broad body of scientific literature and hold great interest for both the national and international mathematical communities, not least due to their numerous applications in other fields of knowledge.

ABSTRACTS

Non-existence of isolated Catenoidal singularities in Analytic three-manifolds

Luigi Appolloni

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Given a sequence of minimal hypersurfaces under suitable assumptions, one can always extract a subsequence converging to a weak limit. However, the limit object may differ significantly from the original sequence due to the formation of singularities. A classical example is a shrinking catenoid converging to a plane with multiplicity two. In recent years, blow-up techniques around singular points have led to significant progress in understanding this phenomenon. In this talk, I will present a new approach inspired by a reduction method of Leon Simon to study the formation of singularities. In particular, we will investigate conditions under which certain types of singularities can or cannot occur. More precisely, we will see that analytic metrics prevent the formation of catenoidal singularities.

This is a joint work with Andrea Malchiodi and Ben Sharp.

Regularity and representation for elliptic equations in double divergence form with Morrey data

Giuseppe Di Fazio

Università degli Studi di Catania, Italy

We discuss the regularity and representation theory for second-order elliptic equations in *double divergence form*,

$$\operatorname{div}^2(Au) := D_{ij}(a_{ij}u) = f \quad \text{in } \Omega \subset \mathbb{R}^n, \ n \geq 3,$$

which arise as the formal adjoints of non-divergence operators $Lu = a_{ij}D_{ij}u$ and occur naturally in stationary Kolmogorov equations, invariant measures of diffusion processes, and in the Fokker–Planck–Kolmogorov component of Mean Field Games systems.

Unlike their divergence-form counterparts, double divergence equations do not regularise: the regularity of a solution u is intrinsically tied to that of the coefficient matrix A , a rigidity already visible in the one-dimensional equation $(au)'' = 0$. We present two recent results, obtained in collaboration, that extend the regularity and summability theory for the adjoint problem into the low-integrability, Morrey-space regime for the datum f .

When A is Hölder continuous and f belongs to the Morrey space $L^{1,\lambda}(\Omega)$ with $\lambda > n - 1 + \alpha$, we prove existence and uniqueness of the adjoint solution via a duality argument, together with its local Hölder continuity, obtained through a Campanato-type coefficient-freezing and iteration scheme. When A merely has Dini Mean Oscillation, we establish instead a Green function representation formula for adjoint solutions with $f \in L^1(\Omega)$, and derive extra summability and boundedness properties when $f \in L^{1,\lambda}(\Omega)$, via sharp pointwise Green estimates combined with Hardy–Littlewood maximal function techniques.

Together, these results provide a fairly complete regularity and summability picture for the adjoint problem across the entire range of low-integrability Morrey data, and suggest a natural conjectural bridge – continuity of adjoint solutions under Dini Mean Oscillation coefficients and Morrey data – that is currently under investigation.

References.

- [1] G. Di Fazio, D. Sberna, *Hölder regularity for double divergence form elliptic equations with Morrey data*, Z. Anal. Anwend., in press (2026).
- [2] G. Di Fazio, D. Sberna, *Green function representation and summability properties for elliptic equations in double divergence form with Morrey data*, J. Math. Anal. Appl. 564 (2026), art. 130912.

Quaternion-based modeling of local rotational transitions: a geometric framework with applications to spinal alignment

Carlo Famoso

Università San Raffaele Roma, Italy

The geometric description of a chain of rigid bodies requires attention to both their orientations and the relative rotations between adjacent elements. This talk presents a quaternion-based framework for studying local rotational transitions, motivated by the proximal junction between an instrumented spinal segment and the adjacent mobile vertebrae. Vertebral orientations are represented by unit quaternions, and relative rotations are computed through the Hamilton product. The formulation accounts for quaternion sign equivalence and is invariant under a common global rotation of the chain. Scalar descriptors derived from relative rotation magnitudes summarize local angular differences, boundary jumps, cumulative magnitude and the discrete total variation of the magnitude profile. Particular attention is given to the information retained by these descriptors and to the directional information lost when full rotations are reduced to scalar quantities. Controlled

synthetic configurations illustrate how the descriptors respond to changes in rotational magnitude and spatial distribution, including configurations with equal cumulative magnitude but different local profiles. The framework provides a methodological basis for interpretable geometric analysis. Its potential contribution to clinical risk modeling remains a question for future validation on patient-derived data.

The best constants in the strong convexity of $|\xi|^p$ and in the strong monotonicity of $|\xi|^{p-2}\xi$

Antonio Gaudiello

Università degli Studi della Campania Luigi Vanvitelli, Italy

I will be presenting a joint paper with Francois Murat and Olivier Guibé where we prove that the function $\xi \in \mathbb{R}^N \rightarrow |\xi|^p$ is strongly convex for every p , $p \in]1, +\infty[$, and we give a characterization, through the resolution of an algebraic equation, of the best constant which appears in the strong convexity inequality. The same proof allows us to prove that the function $\xi \in \mathbb{R}^N \rightarrow |\xi|^{p-2}\xi$ is strongly monotone and to identify the explicit value of the best constant.

Existence of nontrivial solutions for a critical magnetic Schrödinger equation in $\mathbb{R}^N$

Karen Sabrina Gomes Viana

Universidade de Brasília, Brazil

In this talk, we discuss the existence of nontrivial solutions for a critical magnetic Schrödinger equation in $\mathbb{R}^N$. This equation involves the diamagnetic operator $(-i\nabla + A(x))^2$ and a critical nonlinearity of Sobolev type. Hence, under suitable assumptions on the magnetic potential A and the electric potential V , we establish the existence of a nontrivial weak solution, using variational methods together with a global compactness argument that overcomes the lack of compactness caused simultaneously by the critical Sobolev exponent and the unboundedness of the domain.

This result complements and is inspired by a pioneering paper by Benci and Cerami [1] that constitutes a landmark contribution to the study of nonlinear elliptic equations involving critical Sobolev growth. In their work, a refined variational framework is developed and, inspired by the concentration–compactness principle of Lions [2] and by Struwe’s global compactness analysis [3], a precise description of Palais–Smale sequences associated with the corresponding energy functional is established.

References.

- [1] V. Benci and G. Cerami, *Existence of positive solutions of the equation $-\Delta u + a(x)u = u^{\frac{N+2}{N-2}}$ in $\mathbb{R}^N$* , J. Funct. Anal. **88** (1990), no. 1, 90–117.
- [2] P.-L. Lions, *The concentration-compactness principle in the calculus of variations. The limit case, part 1*, Rev. Mat. Iberoamericana **1** (1985), no. 1, 145–201.
- [3] M. Struwe, *A global compactness result for elliptic boundary value problems involving limiting nonlinearities*, Math. Z. **187** (1984), no. 4, 511–517.

*From Coulomb-Sobolev spaces to multiplicity results for nonlinear
Schrödinger-Poisson-Slater equations*

Carlo Mercuri

Università degli Studi di Modena e Reggio Emilia, Italy

Recent advances in the understanding of Coulomb-Sobolev spaces have opened new avenues for the variational analysis of nonlinear and nonlocal PDEs. In this talk, I will discuss how the scaling symmetries of the principal operator give rise to a nonlinear eigenvalue problem, providing a framework for studying resonance and establishing existence and multiplicity results. The main focus will be joint work with A. Marinho and K. Perera (Florida Institute of Technology) on nonlinear Schrödinger-Poisson-Slater equations.

References.

- [1] A. J. Marinho, C. Mercuri and K. Perera, *New solutions to Schrödinger-Poisson-Slater equations in Coulomb-Sobolev spaces* <https://arxiv.org/abs/2602.12784arXiv:2602.12784>.

Existence results of solutions for problems involving quasilinear Schrödinger equations

Vitoria Henrylla Pinheiro Souza

Universidade de Brasília, Brazil

This work presents results concerning the existence and multiplicity of solutions for different problems involving quasilinear elliptic equations, which arise from a class of quasilinear Schrödinger equations. Furthermore, we will see the importance of using a change of variables and the application of variational and non-variational methods to obtain these results.

Multiplicity of positive solutions for a class of nonlocal elliptic equations involving the fractional Laplacian

Suellen Cristina Queiroz Arruda

Federal University of Pará, Brazil

This talk is devoted to the study of positive solutions for a class of nonlocal elliptic problems driven by the fractional Laplacian operator. A first positive weak solution is obtained, under general conditions, by combining the sub-supersolution method with a minimization argument. Additionally, by considering an Ambrosetti-Rabinowitz type condition and applying the Mountain Pass Theorem to a suitably truncated energy functional, we establish the existence of a second positive solution. The results obtained complement and extend classical results from local to nonlocal elliptic operators, allowing the construction of an ordered pair of sub and supersolutions without the need to rely on the first eigenvalue of the operator.

Infinitely many solutions for fractional equations with nearly resonant terms

Luca Vilasi

Università degli Studi di Messina, Italy

We consider a nonlinear elliptic problem governed by the spectral fractional Laplacian on a bounded domain with mixed Dirichlet-Neumann boundary data. The nonlinearity is considered both in the subcritical and in the critical regime. By using linking and variational theorems of mixed type (one of the so-called ∇ -theorems), we prove the existence of multiple solutions when the perturbation parameter is close to each eigenvalue of the operator.