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BOOK OF ABSTRACTS

SS11 - New Trends on Calculus of Variations and Partial Differential Equations

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Organizers:

João Rodrigues dos Santos Junior, Federal University of Pará
Pasquale Candito, University of Palermo

Magnetic Neumann problems with Aharonov-Bohm potentials

Veronica Felli

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We discuss spectral properties of a planar magnetic Schrödinger operator with an Aharonov-Bohm vector potential, under Neumann boundary conditions. Through a gauge transformation, the corresponding eigenvalue problem can be formulated in terms of the Laplacian on a fractured domain, where the fracture lies along the segment connecting the pole to its projection on the boundary. As the pole approaches the boundary, the eigenvalues converge to those of the Neumann Laplacian and the variation exhibits a logarithmic vanishing rate. In the case of multiple eigenvalues, when the pole approaches a fixed point of the boundary, a splitting phenomenon is observed, with the largest branch separating from the others.

References

- [1] V. Felli, P. Roychowdhury, G. Siclari, *Magnetic Neumann problems with Aharonov-Bohm potentials: boundary asymptotics of eigenvalues and splitting phenomena*, Preprint 2026 <https://arxiv.org/abs/2602.14522>.

Quasilinear nonlocal problem via topological, variational and set-valued methods

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We study a class of nonlocal quasilinear problems driven by the p -Laplacian-like operators of a nonvariational type. The nonlocal term depends on the unknown function. The multiplicity of positive solutions as well as nonexistence results are established through a combination of variational methods, truncation techniques, set-valued analysis, and fixed-point arguments.

References

- [1] G. Failla, L. Gasiński, *Nonlocal Carrier's double phase problem*, Proceedings of the Royal Society of Edinburgh Section A: Mathematics, published online, doi: 10.1017/prm.2025.10099.
- [2] P. Candito, L. Gasiński, R. Livrea, J.R.Santos Junior, *Multiplicity of positive solutions for a degenerate nonlocal problem with p -Laplacian*, Advances in Nonlinear Analysis, 11 (2022), 357–368, doi:10.1515/anona-2021-0200.
- [3] P. Candito, L. Gasiński, R. Livrea, *Three solutions for parametric problems with nonhomogeneous $(a, 2)$ -type differential operators and reaction terms sublinear at zero*, Journal of Mathematical Analysis and Applications, 480:1 (2019), 123398, doi:10.1016/j.jmaa.2019.123398.

Advances in solving nonlinear Schrödinger Equations with general potentials

Romildo Lima

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We will present some recent results on the existence of a positive solution to nonlinear Schrödinger equations

$$(P_V) \quad -\Delta u + V(x)u = f(u) \quad \text{in } \mathbb{R}^N,$$

for very general potentials V , with positive or zero limit at infinity (allowing convergence from above, below, or oscillations), but imposing no symmetry or decay rate assumption. Also, the nonlinearities f may satisfy mild hypotheses, including superlinear or asymptotically linear growth at infinity. This is possible due to the application of the classical Monotonicity Trick approach. If time permits, we will also discuss new results for the case where the operator $-\Delta + V(x)$ has negative eigenvalues.

References

- [1] R. Lima, L. Maia, M. Soares, *Advances in solving nonlinear Schrödinger equations with general potentials*, Journal of Differential Equations, 460 (2026), 114066.

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Singular elliptic equations having a gradient term with natural growth

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This talk will present existence results for a class of Dirichlet boundary value problems whose prototype is

$$(1) \quad \begin{cases} -\Delta_p u = h(u)|\nabla u|^p + u^{q-1} + f(x) & \text{in } \Omega, \\ u \geq 0, & \text{in } \Omega \\ u = 0 & \text{on } \partial\Omega, \end{cases}$$

where Ω an open bounded subset of $\mathbb{R}^N$, $0 < q < 1$, $1 < p < N$, h is a continuous function and f belongs to a suitable Lebesgue space. The main features of this problem are the presence of a singular term and a first order term with natural growth in the gradient. A priori estimates and existence results are proved depending on the summability of the datum f . These results are contained in the joint paper [1].

References

- [1] A. Ferone, A. Mercaldo, S. Segura de León, *Singular elliptic equations having a gradient term with natural growth*, Adv. Differential Equations 30 (2025), 635–670.

A new Minimax Theorem for C^1 -Functionals with Nehari Set Homeomorphic to Submanifolds of the Sphere and Applications to Elliptic PDEs.

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We establish a new abstract minimax theorem for obtaining ground-state critical points of a class of C^1 -functionals. The central feature of this class is that the associated Nehari set is not necessarily a differentiable manifold, but is homeomorphic to a (possibly non-complete) submanifold of the unit sphere. This occurs for functionals whose fibering maps $t \mapsto I(tu)$ possess a unique global maximum point only when u belongs to an open cone in the underlying Banach space. A detailed topological analysis of the Nehari set is conducted to overcome the lack of a standard variational framework thereon. As a consequence, we provide a general minimax characterization of the ground-state energy level. The applicability and robustness of our abstract results are demonstrated by considering a range of relevant elliptic partial differential equations, leading to improvements and complements of existing results in the literature.

References

- [1] G.M. Figueiredo, H.R. Quorin and K. Silva, ground-states of elliptic problems over cones, *Calc. Var. PDE* **60**, (2021), 189.
- [2] J.R.S. Nascimento, M.T.O. Pimenta and J.R. Santos Júnior, A Nehari approach for asymptotically linear elliptic problems, *Bull. Braz. Math. Soc. (N.S.)*, 56, Art. 32 (2025).
- [3] A. Szulkin and T. Weth, The method of Nehari set, *Handbook of Nonconvex Analysis and Applications*. D.Y. Gao and D. Montreanu eds., International Press, Boston, (2010), 597-632.

Prescribed energy solutions to some scaled problems via a scaled Nehari manifold

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We prove the existence, multiplicity, and bifurcation of solutions with prescribed energy for a broad class of scaled problems by introducing a suitable notion of scaling based Nehari manifold. Applications are given to Schrödinger–Poisson–Slater type equations.

References

- [1] K. Perera, K. Silva, *Prescribed energy solutions to some scaled problems via a scaled Nehari manifold*, Journal of Functional Analysis, 290-1, (2026), 111213.

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On the asymptotically linear problem for an elliptic equation with an indefinite nonlinearity

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We study the semilinear elliptic problem

$$-\Delta u = Q_\Omega |u|^{p-2} u \quad \text{in } \mathbb{R}^N,$$

where $Q_\Omega = \chi_\Omega - \chi_{\mathbb{R}^N \setminus \Omega}$ for a bounded smooth domain $\Omega \subset \mathbb{R}^N$, $N \geq 3$, and $1 < p < 2^*$. This equation arises in the study of optical waveguides and exhibits indefinite nonlinearity due to the sign-changing weight Q_Ω . We prove that, for $p > 2$ sufficiently close to 2, positive solutions are nondegenerate and the problem admits a unique least energy solution. Our approach combines a detailed analysis of an associated eigenvalue problem involving Q_Ω with variational methods and blow-up techniques in the asymptotically linear regime. We also provide a comprehensive study of the spectral properties of the corresponding linear problem, including the existence and qualitative behavior of eigenfunctions, sharp decay estimates, and symmetry results. In particular, we establish analogues of the Faber–Krahn and Hong–Krahn–Szegő inequalities in this non-standard setting.

References

- [1] Walter Allegretto and Huang Yin Xi. A Picone’s identity for the p-Laplacian and applications. *Nonlinear Analysis: Theory, Methods & Applications*, 32(7):819–830, 1998.
- [2] Mónica Clapp, Jorge Faya, and Alberto Saldaña. Critical equations with a sharp change of sign in the nonlinearity. *arXiv preprint arXiv:2502.19563*, 2025.
- [3] Mónica Clapp, Víctor Hernández-Santamaría, and Alberto Saldaña. Positive and nodal limiting profiles for a semilinear elliptic equation with a shrinking region of attraction. *Nonlinear Analysis*, 251:113680, 2025.
- [4] Mónica Clapp, Alberto Saldaña, and Andrzej Szulkin. On a Schrödinger system with shrinking regions of attraction. *Zeitschrift für angewandte Mathematik und Physik*, 76(1):37, 2025.
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- [8] Tobias Weth. Symmetry of solutions to variational problems for nonlinear elliptic equations via reflection methods. *Jahresbericht der Deutschen Mathematiker-Vereinigung*, 112:119–158, 2010.

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