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TOPOLOGY OF THE NODAL SETS OF EIGENFUNCTIONS OF SCHRÖDINGER OPERATORS

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ABSTRACT

In 2001, Sir Michael Berry conjectured that given any knot there should exist a (complex-valued) eigenfunction of the harmonic oscillator or the hydrogen atom whose nodal set contains a component of such a knot type. This is a particular instance of the following problem: how is the topology of the nodal sets of eigenfunctions of Schrödinger operators? In this talk I will focus on the flexibility aspects of the problem: if we consider operators with a large group of symmetries, one can exploit the large multiplicity of the high eigenvalues to use a novel inverse localization property. In particular, I will show how to use this strategy to tackle the aforementioned Berry's problem.

This is based on different joint works with Alberto Enciso, Alba García-Ruiz, David Hartley and Francisco Torres de Lizaur.

[1] Enciso, A., Hartley, D., Peralta-Salas, D. 2018 A problem of Berry and knotted zeros in the eigenfunctions of the harmonic oscillator. *J. Eur. Math. Soc.* **20**, 301-314.
[2] Enciso, A., Hartley, D., Peralta-Salas, D. 2018 Dislocations of arbitrary topology in Coulomb eigenfunctions. *Rev. Mat. Iberoam.* **34**, 1361-1371.
[3] Enciso, A., Peralta-Salas, D., Torres de Lizaur, F. 2021 High-energy eigenfunctions of the Laplacian on the torus and the sphere with nodal sets of complicated topology. *Springer Proc. Math. & Stat.* **346**, 245-261.
[4] Enciso, A., García-Ruiz, A., Peralta-Salas, D. 2022, Inverse localization and global approximation for some Schrödinger operators on hyperbolic spaces. Preprint (available in ArXiv).