QPhysics
AT QUEENS COLLEGE

Colloquium Notice

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Anisotropic exceptional points of arbitrary order and some experimental demonstrations

In non-Hermitian systems, an exceptional point of order N (EPN) is characterized by the coalescences of N eigenvalues and the corresponding eigenvectors. In the vicinity of an EPN, both eigenvalues and phase rigidity can have a variety of critical behaviors depending on how the singularity is approached. In this talk, I will first discuss a class of non-Hermitian systems with asymmetric hoppings. The EPs in such systems can form continuous loops. They can be in the form of multiple ellipses of EP2s or a circle of EPNs. For any EP on a loop, the critical behavior is anisotropic. It has different critical exponents when the EP is approached from two orthogonal directions in the parameter space. We study the critical exponents of the eigenvalues and phase rigidity of an EP of arbitrary order N. I will then show an experimental realization of anisotropic EP2 in a system of two coupled acoustic cavities with different losses. I will also show an experimental realization of EP3 in a system of three acoustic cavities. The EP3 is found to be an intersection point of multiple EP arcs of order 2 exhibiting a cusp-like singularity. The EP arcs segment the parameter space and give rise to a hybrid topological invariant. Different winding numbers are found when the EP3 is encircled along a loop in different parameter planes.

References:
[1] Y-X Xiao et al., Phys. Rev. B 99, 241403 (R) (2019).
[2] K. Ding et al., Phys. Rev. Lett. 121, 085702 (2018).
[3] W. Tan et al., Science 370, 1071 (2020).

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