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המכון למצב מוצק

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סמינר

Applications of Exceptional Points in Photonics and AMO

Dr. Adi Pick

Department of Chemistry,
Technion

Abstract

Exceptional points (EPs) are exotic degeneracies that can occur in open systems, which are described by non-Hermitian operators. Due to their counterintuitive properties and recent realizations, EPs have been the focus of immense attention. In this talk, I will present three new applications of EPs: (I) Enhancing spontaneous emission with special optical cavities [1-3], (II) Controlling photoionization in laser-driven atoms and molecules [4], and (III) Creating topological mode switches with NV centers in diamonds [5]. I will begin by presenting our new formulation for computing the emission spectrum near EPs, where traditional theories produce erroneous divergent results. Our formulation predicts that EPs can enhance the emission by more than two orders of magnitude. In the second part, I will present a method for optically inducing EPs in atomic and molecular systems, and show that slight changes in the laser parameters may lead to dramatic enhancement or to complete inhibition of the photoionization. Finally, I will discuss topological mode switches, which convert a system from an initial state to a final state in a robust manner. I will present a protocol for realizing this idea in NV centers, which are one of the leading platforms for quantum information applications. Our theory enables exploring new phenomena (e.g., high-order EPs in low-dimensional systems) and presents a crucial step towards incorporating topological mode switches in quantum technologies.

[1] A Pick, B Zhen, OD Miller, CW Hsu, AW Rodriguez, M Soljacic, and SG Johnson, "General theory of spontaneous emission near exceptional points," *Opt. Express*. **25**, 12325 (2017)

[2] Z Lin, A Pick, M Loncar, and AW Rodriguez, Inverse design of third-order Dirac exceptional points in photonic crystals. *Phys. Rev. Lett.* **117**, 107402 (2017)

[3] A Pick, Z Lin, and, AW Rodriguez, "Enhanced nonlinear frequency conversion and Purcell enhancement at exceptional points," *Phys. Rev. B* **96**, 224303 (2017)

[4] A Pick, PR Kapralova-Zdanska, and N Moiseyev, "Ab-initio theory of photoionization via resonance," *JPC*, **150**, 204111 (2019)

[5] A Pick, S Silberstein, N Moiseyev, N Bar-Gill, *arXiv*: 1905.00759 (2019)

ההרצאה תתקיים ביום רביעי, ה-12.6.19 בשעה 12:30

באודיטוריום המכון למצב מוצק, קומת כניסה

The lecture will take place on Wednesday, 12.6.19 at 12:30
at the Solid State Institute auditorium, entrance floor

Host: Prof. Nimrod Moiseyev