PCS NEWSLETTER



PCS Workshops and Meetings

PCS, with the Asia Pacific Center for Theoretical Physics, will run and host IBSPCS-APCTP International Workshop Computational Approaches to Magnetic Systems application form on August 17 - August 19, 2022.



PCS IBS Seminars

- "Flat bands and band touching in hyperbolic lattices" by Joseph Maciejko, University of Alberta, Canada (July 5)
- "Circular Rosenzweig-Porter random matrix ensemble" by Wouter Buijsman, Ben-Gurion University of the Negev, Israel (July 7)
- "Equilibrium quantum batteries" by Felipe Barra, Universidad de Chile, Chile (July 21)
- "Nanofluidics: fluid properties at molecular scale and application to water treatment and energy conversion" by Alessandro Siria, École normale supérieure, France (July 26), IBS Physics Colloquium @ Daejeon
- "Carrier-driven ultrafast coherent phonon generation in monolayer MoSe2 explored by ab initio approach" by Soungmin Bae, Tokyo Institute of Technology, Japan (July 28)
- You can find more seminars on *this page*.



New research results

Intermediate statistics in singular quarter-ellipse shaped microwave billiards

Barbara Dietz and Achim Richter J. Phys. A: Math. Theor. **55**, 314001

This publication is a contribution to a special edition of Journal of Physics A dedicated to the memory of Fritz Haake. The authors analyze experimental data obtained 15 years ago for a superconducting microwave billiard simulating a singular billiard with the shape of a quarter ellipse, that is, a quantum billiard containing zero-range perturbations. Such billiards are expected to exhibit intermediate statistics. They validate analytical results derived by Bogomolny, Gerland, Giraud and Schmit for singular billiards with shapes that generate an integrable classical dynamics. They further compare the spectral properties to analytical results obtained by Haake and Lenz in the 1990s based on the Rosenzweig-Porter model, which interpolates between the models applicable for quantum systems with an integrable and chaotic classical dynamics, respectively.





Classification of multiple arbitrary-order non-Hermitian singularities

Jung-Wan Ryu, Jae-Ho Han, and Chang-Hwan Yi Phys. Rev. A 106, 012218 (arXiv:2112.02547)

The authors investigate the classification of Riemann surface topology generated by multiple arbitrary-order exceptional points of quasistationary states based on the permutation group. These reveal all possible product permutations of holonomy matrices that describe a stroboscopic encircling of second-order exceptional points. The permutations turn out to be categorized into a finite number of classes according to the topological structures of the Riemann surfaces. The results are verified by an effective non-Hermitian Hamiltonian founded on generic Jordan forms and then examined in physical systems of desymmetrized optical microcavities.

Fluctuation properties of the eigenfrequencies and scattering matrix of closed and open unidirectional graphs with chaotic wave dynamics

Jiongning Che, Xiaodong Zhang, Weihua Zhang, Barbara Dietz, and Guozhi Chai

Phys. Rev. E 106, 014211

The authors present experimental and numerical results for the fluctuation properties in the eigenfrequency spectra and of the scattering matrix of closed and open unidirectional quantum graphs, respectively. Unidirectional quantum graphs are composed of bonds connected by reflectionless vertices. They were introduced by Akila and Gutkin. The short-range correlations of their eigenvalues were shown to comply with random-matrix theory predictions for typical chaotic systems with completely violated time-reversal invariance (GUE). This work finds clear deviations from these predictions for the long-range correlations and also for the fluctuation properties of the scattering matrix of the corresponding open graph. These are attributed to a loss of complexity of the underlying dynamics, induced by the unidirectionality.





Puzzle of the month

July puzzle answer:

Yes there are, and not only in Daejeon! Assume there are N people. There are 0,1,2,...,N-1 different friend numbers which makes a total of N. However, assume there are m lonely persons which have with zero friends. If m>1 we are done with the proof. If m=1, the rest of the N-1 people can have only N-2 combinations, which means at least two of them must have the same number of friends. If m=0, there are N people but only N-1 combinations, same story.

Congratulations to Ihor Vakulchyk for the correct answer!

Puzzle of the month:

We cut a pizza (shape - ideal circle) with ten straight cuts. Cutting lines can cross each other. We do not move pieces during cutting. What is the largest possible number of pieces we obtain? Note that we do not need them all to be of equal size.

Send your solution to <u>eun@ibs.re.kr</u> The winner will be announced in the next issue.

