PCS NEWSLETTER

QR to PCS Webpage

March 2025

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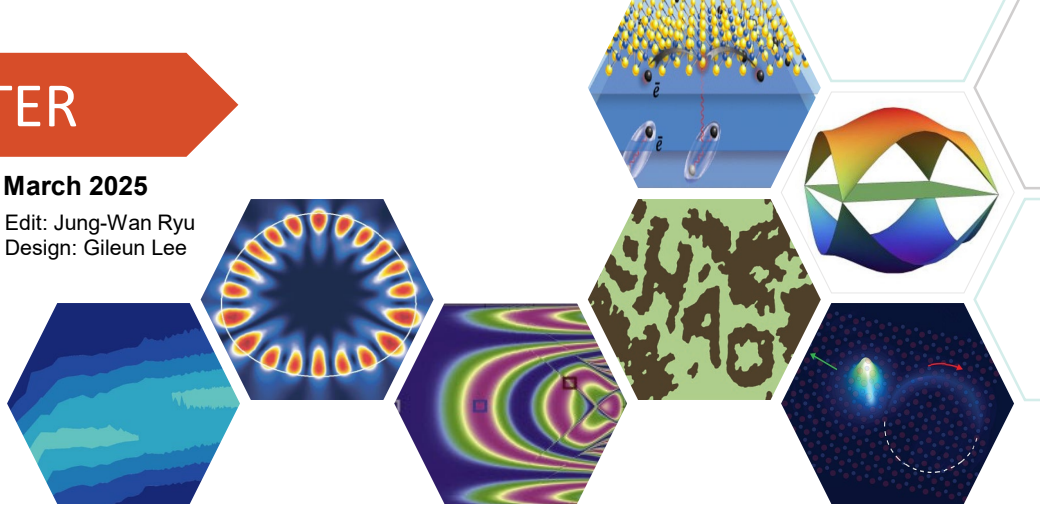


New Members

Dr. Yeongjun Kim has joined PCS as a post-doctoral fellow. He obtained his PhD from the University of Science and Technology (UST) and has a strong background in flat band physics, Anderson localization, and the experimental realization of flat band systems using electric circuits. His current research explores many-particle physics in flat band systems and transport properties in interacting systems.

PCS IBS Seminars

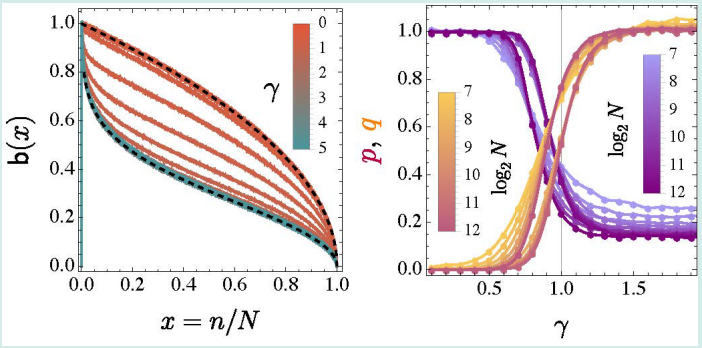
"Classical and Quantum Nonequilibrium Dynamics of Nonlinear Nanomechanical Systems"
by Ron Lifshitz, Tel Aviv University, Israel (February 25)

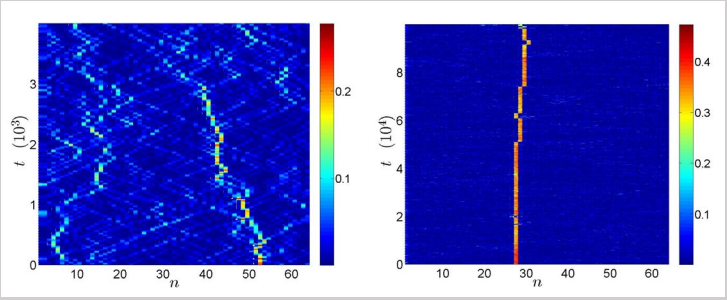
You can find more seminars on this page.

New Research Results

Krylov fractality and complexity in generic random matrix ensembles
Budhaditya Bhattacharjee and Pratik Nandy
Phys. Rev. B Letters 111, L060202 (2025)

The authors study random matrix models that show ergodic to non-ergodic transition through a fractal phase. The transition is captured via probes that explore the tridiagonal form of the random matrix. In particular, they study the distribution of the Lanczos coefficients, the localization properties of the Krylov vectors and the dynamical nature of Krylov complexity across the 3 phases. The authors find that Krylov vector localization is in perfect agreement with eigenvector localization, providing us with a powerful probe to capture localization phenomenon in the tridiagonal basis. They also uncover the sensitivity of Krylov complexity to ergodic, fractal and localized phase and propose an order parameter for such transitions using the maxima of Krylov complexity.





Thermal lifetime of breathers
JFR Archilla, J Bajārs, S Flach
Physica D 473, 134551 (2025)

A parameter called the participation number *P* is proposed to measure localization and its value at thermal equilibrium is deduced as being half the number of particles. Localized excitations at a given site are created with specified energy by changing the momentum of a site in a thermalized system. The thermalization time for the system reaching thermal equilibrium is measured in tens of thousands of simulations and the average is obtained. It is found that on average the thermalization time has an exponential dependence with the energy delivered when this energy is above ten times the thermal energy. Four different systems are studied, three of them with hard and soft on site potentials, harmonic and anharmonic coupling. The fourth, a Josephson junction network has no on-site potential and the localization is in AC frequency.

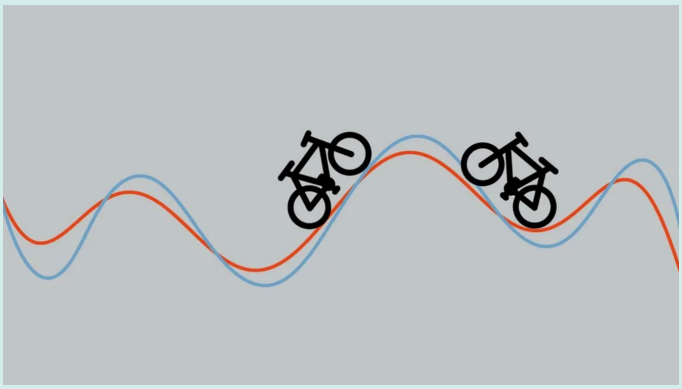
Puzzle of the Month

February puzzle: silence of the lambs, no answers, no solutions. Come on, this is not that hard! We provide some hints in addition, and repeat the puzzle. Physicists are smart enough to figure!

March puzzle:

A bike left the tracks in the snow, artificially colored red and blue in the picture. The bike is long gone. Can you tell which direction it was moving?

Hints: the rear wheel cannot rotate relative to the base, thus the tangent vector of its imprinted wheel path is always directed towards the front wheel.
And therefore the tangent vector of the rear wheel always crosses the front wheel path at exactly the same distance, right?
So then, which way did it go?



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