PCS NEWSLETTER

QR to PCS Webpage

May 2025

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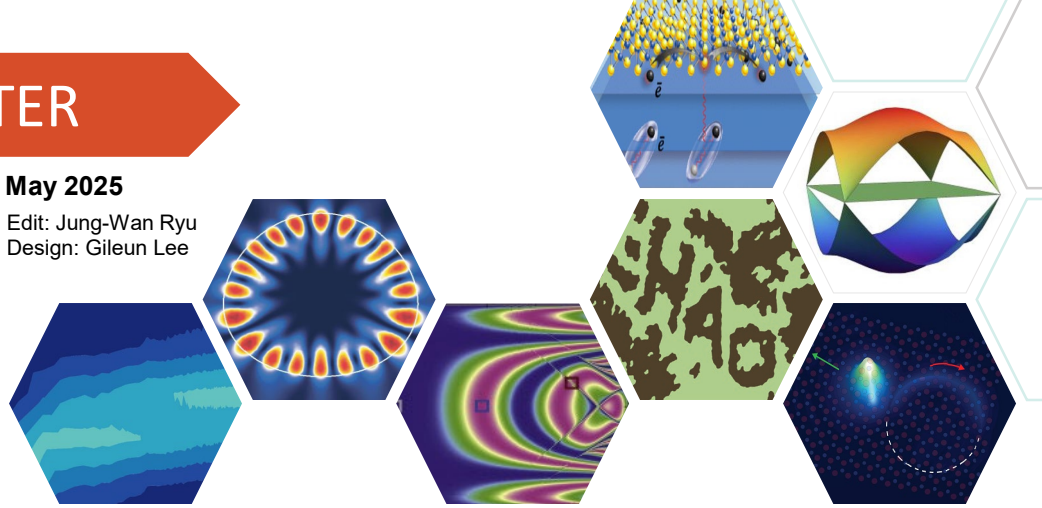


PCS IBS Seminars

"Quantum thermodynamics and spin transport of open one-dimensional single-band Fermi-Hubbard systems"
by Vladimir P. Villegas, Mapúa University, Philippines (April 3)

"p-atic order parameters in the fractional quantum Hall effect from non-relativistic higher-spin fields"
by Patricio Salgado-Rebolledo, APCTP, Korea (April 8)

"Exploring electron correlations in the breathing kagome metal Fe3Sn"
by Shivalika Sharma, Nicolaus Copernicus University, Poland (April 10)

"Fractional conductances: S-matrix vs. Kubo formalism"
by Victor Kagalovsky & Igor Yurkevich, Shamoon College of Engineering, Israel & Aston University, UK (April 22)

"Polariton quantum fluids: from out of equilibrium phase transitions to analogue black holes"
by Alberto Bramati, Laboratoire Kastler Brossel, France (April 29), *IBS Physics Colloquium @ Daejeon*

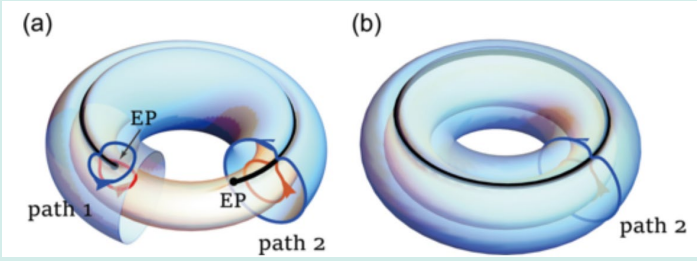
You can find more seminars on this page.

New Research Results

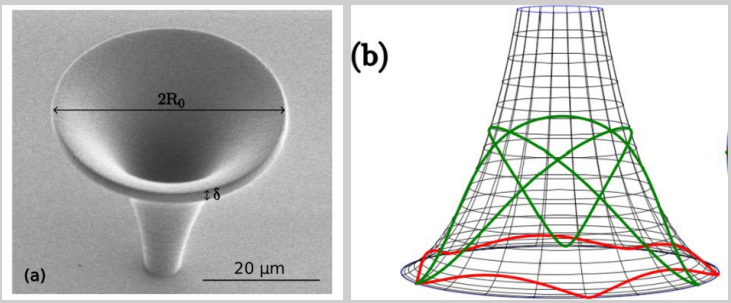
Pseudo-Hermitian topology in multiband non-Hermitian systems

Jung-Wan Ryu, Jae-Ho Han, Chang-Hwan Yi, Hee Chul Park, and Moon Jip Park

Phys. Rev. A 111, 042205 (2025)



The authors unveil the role of pseudo-Hermitian lines in non-Hermitian topology for multiple bands. In particular, the nonseparability of non-Hermitian multibands can be topologically nontrivial without exceptional points in two-dimensional space. As a physical illustration of the role of pseudo-Hermitian lines, the authors examine a multiband structure of a photonic crystal system with lossy materials. Their work builds on the fundamental and comprehensive understanding of non-Hermitian multiband systems and also offers versatile applications and realizations of non-Hermitian systems without the need to consider exceptional points.



Exploring non-Euclidean photonics: Pseudosphere microlaser

H. Girin, S. Bittner, X. Checoury, D. Decanini, B. Dietz, A. Grigis, C. Lafargue, J. Zyss, C. Xu, P. Sebbah, and M. Lebental

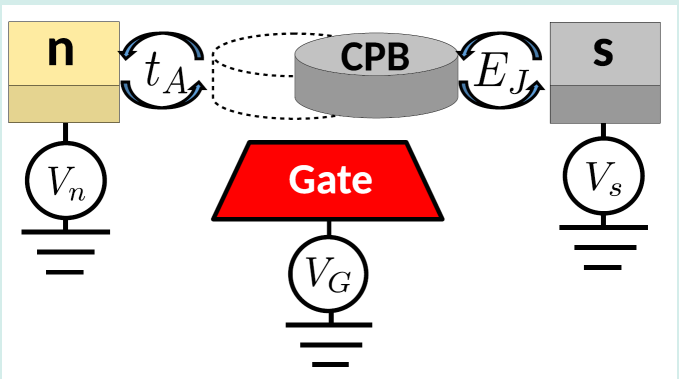
Phys. Rev. A 111, 043512 (2025)

The authors investigate classical and wave properties of surface-like organic microlasers with the shape of a truncated pseudosphere both experimentally and numerically. The Gaussian curvature of the pseudosphere is constant and negative. The microcavities were fabricated with high optical quality by direct laser writing. It is shown that they behave, in many ways, similar to two-dimensional flat disks, regardless of their differing Gaussian curvatures. The authors derive the monodromy matrices for geodesics on the pseudosphere and demonstrate that the periodic geodesics are marginally stable. Actually, due to the rotational symmetry, the pseudosphere is an integrable system.

Andreev probing of a Cooper-pair flying qubit

S. Park, L. Y. Gorelik, S. I. Kulinich, H. C. Park, C. Kim, and R. I. Shekhter

Phys. Rev. B 111, 165403 (2025)

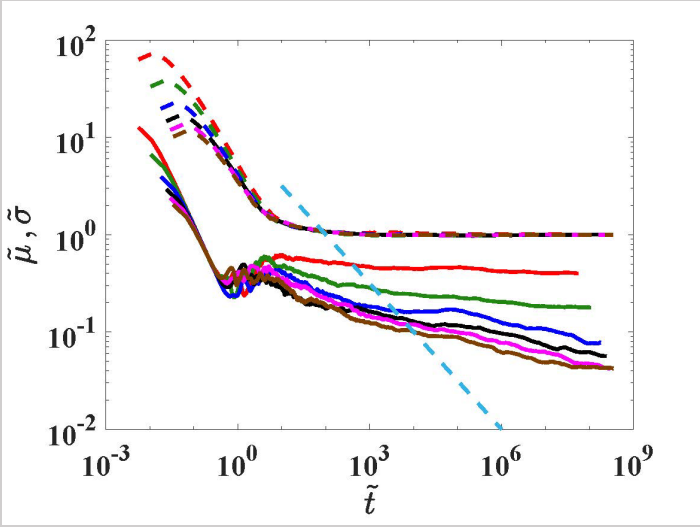


The authors propose a nanomechanical device in which a movable Cooper-pair box qubit can be transported, actuated, and probed. The qubit, formed on a superconducting island denoted by CPB in the figure, oscillates coherently by means of nanoelectromechanics between a superconducting electrode (s) and a normal electrode (n), where the coupling with the superconducting electrode acts as a unitary operation on the qubit, while that with the normal electrode probes the qubit state via Andreev reflection. It aligns with efforts to develop a nanomechanical processor for transferring quantum information.

New Research Results

Observation of prethermalization in weakly nonintegrable unitary maps
Xiaodong Zhang, Gabriel M. Lando, Barbara Dietz, and Sergej Flach
Fizyka Nyzkykh Temperatur/Low Temperature Physics 51(6), 870-880 (2025)

The authors study prethermalization by examining the time-dependent largest Lyapunov exponent for unitary-circuit maps near integrability. They compute the mean and standard deviation of for different initial conditions. Thermalization corresponds to with converging to a finite value. The authors observe prethermalization plateaus where both and stabilize at finite values, indicating distinct saturated Lyapunov exponents for different trajectories. The lifetime of these plateaus provides a new timescale for thermalization dynamics near integrability.



Puzzle of the Month

April puzzle solution: "x+y" = (y^2,x+y,x^2) thus "3+3" = 969

the correct solution was communicated in chronological order by Jiseon Shin, Mohamad Mirzakhani, Jayendra Bandyopadhyay and Oleg Utesov. Congratulations!

Puzzle of the month: find A,B,C,D,E,F if

$$\begin{aligned}
ABCDEF \cdot 1 &= ABCDEF \\
ABCDEF \cdot 3 &= BCDEFA \\
ABCDEF \cdot 2 &= CDEFAB \\
ABCDEF \cdot 6 &= DEFABC \\
ABCDEF \cdot 4 &= EFABCD \\
ABCDEF \cdot 5 &= FABCDE
\end{aligned}$$

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