PCS NEWSLETTER

QR to PCS Webpage

September 2024
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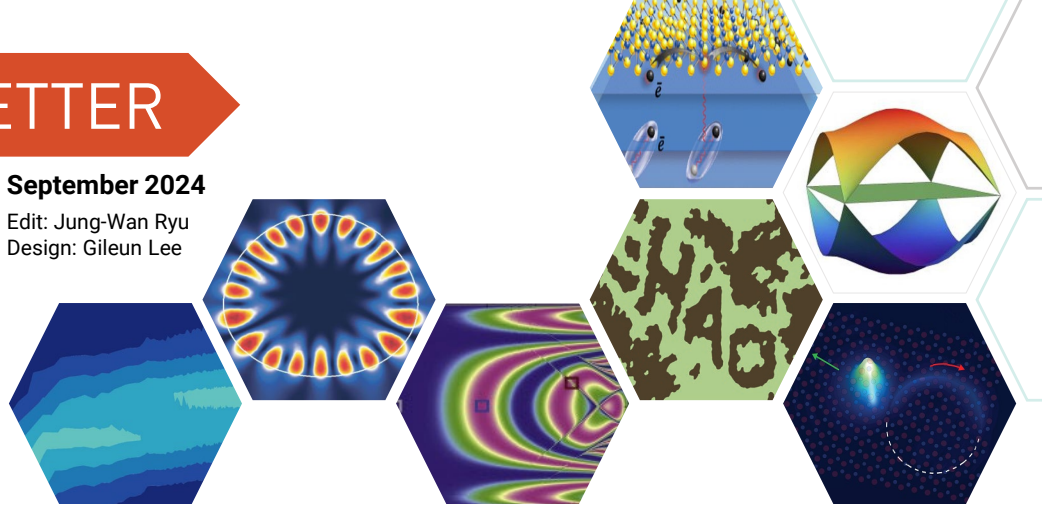


PCS IBS Seminars

"Engineering on-demand band structures and non-Hermitian state of light in photonic crystal"
by Hai Son Nguyen, Lyon Institute of Nanotechnology, France (August 13)

"Emergence of flat bands and ferromagnetic fluctuations via orbital-selective electron correlations in Mn-based kagome metal"
by Heung-Sik Kim, Kangwon National University, Korea (August 21)

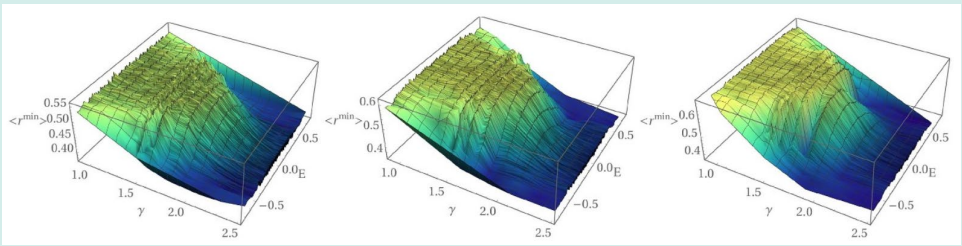
"Exact projected entangled pair ground states with topological Euler invariant"
by Thorsten Wahl, University of Cambridge, UK (August 22)

"Generalized loop braiding statistics in 3+1d topological phases: the case of twisted lattice gauge theory"
by Joe Charles Huxford, Toronto University, Canada (August 29)

You can find more seminars on this page.

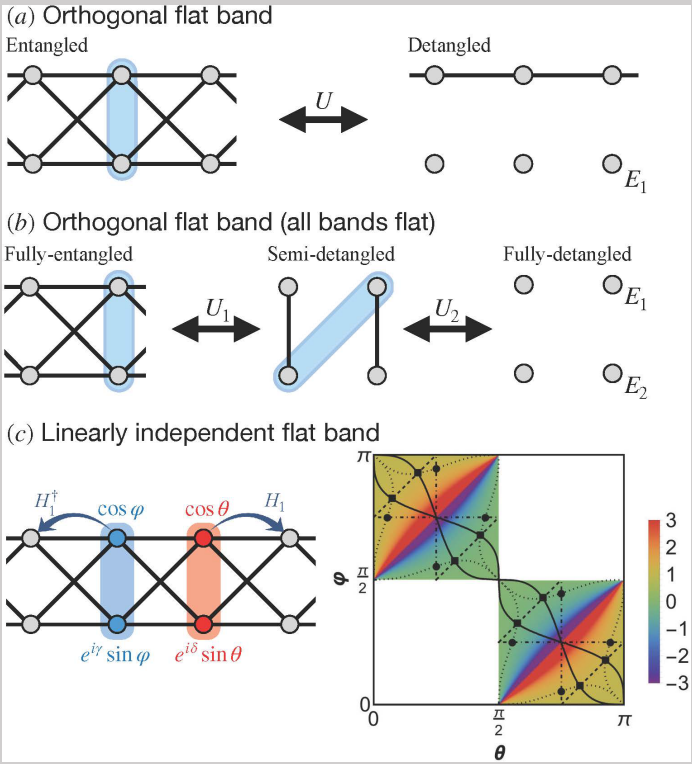
New Research Results

The Rosenzweig–Porter model revisited for the three Wigner–Dyson symmetry classes
Tilen Cadez, Dillip Kumar Nandy, Dario Rosa, Alexei Andreanov and Barbara Dietz
New J. Phys. 26, 083018 (2024)



Interest in the Rosenzweig-Porter model, a parameter-dependent random-matrix model that interpolates between Poisson and Wigner-Dyson (WD) statistics, has come up again in recent years in the field of many-body quantum chaos. The reason is that it exhibits parameter ranges in which the eigenvectors are Anderson-localized, non-ergodic (fractal) and ergodic extended. The authors present for all symmetry classes of Dyson's threefold way numerical results for the fluctuation properties in the eigenvalue spectra, for the properties of the eigenvectors in terms of the adiabatic gauge potential and Kullback-Leibler (KL) divergences, and a validation of existing analytical results. A finite size scaling analysis of the KL divergences at the ergodic and Anderson transitions yields the same critical exponents for all three WD classes, thus indicating superuniversality of these transitions.

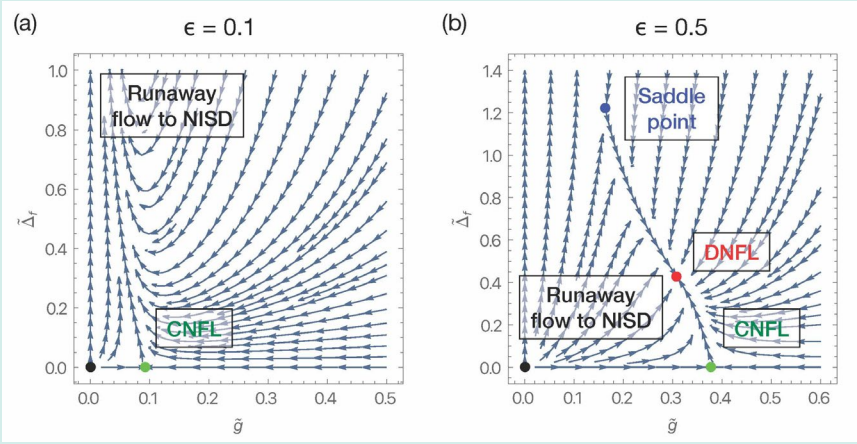
New Research Results



Flat band fine-tuning and its photonic applications
Carlo Danieli, Alexei Andreanov, Daniel Leykam and Sergej Flach
Nanophotonics (2024)

Flat bands – single-particle energy bands – in tight-binding lattices, aka networks, have attracted attention due to the presence of macroscopic degeneracies and their sensitivity to perturbations. They support compact localized eigenstates protected by destructive interference. This makes them natural candidates for emerging exotic phases and unconventional orders. In this review the authors consider the recently proposed systematic methods to construct flat band networks based on symmetries or fine-tuning and how these methods can be further extended, adapted or exploited in presence of perturbations, both single-particle and many-body, leading to the discovery of non-perturbative metal-insulator transitions, fractal phases, nonlinear and quantum caging and many-body nonergodic quantum models. The authors discuss what implications these results may have for the design of fine-tuned nanophotonic systems including photonic crystals, nanocavities, and metasurfaces.

Disordered non-Fermi liquid fixed point for two-dimensional metals at Ising-nematic quantum critical points
Kyoung-Min Kim and Ki-Seok Kim
SciPost Phys. 17, 059 (2024)



In this study, the authors identify a stable fixed point governing the quantum critical behavior of two-dimensional non-Fermi liquid metals in the presence of a random potential disorder. By performing renormalization group analysis on a dimensional-regularized field theory for Ising-nematic quantum critical points, they systematically investigate the interplay between random potential disorder for electrons and Yukawa-type interactions between electrons and bosonic order-parameter fluctuations in a perturbative epsilon expansion. Their investigation reveals that two-loop vertex corrections induced by Yukawa couplings are pivotal in the emergence of the disordered non-Fermi liquid fixed point, primarily through screening disorder scattering. Additionally, the disordered non-Fermi liquid fixed point is distinguished by a substantial anomalous scaling dimension of fermion fields, resulting in pseudogap-like behavior in the electron's density of states. These findings shed light on the quantum critical behavior of disordered non-Fermi liquid metals, emphasizing the indispensable role of higher-order loop corrections in such comprehension.

Puzzle of the Month

August puzzle solution:

6999,7000.
The correct solution was sent in by Merab Malishava, followed by Victor Kagalovsky, Sergei Koniakhin, Alireza Akbari and Oleg Utesov (in time order).
Congratulations!

Puzzle of the month:

Replace all '?' by any of the numbers 0,1,2,3,4,5,6,7,8,9 (multiple times allowed) such that the sentence becomes true:

'This sentence contains
? times the number 0,
? times the number 1,
? times the number 2,
? times the number 3,
? times the number 4,
? times the number 5,
? times the number 6,
? times the number 7,
? times the number 8,
? times the number 9.'

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