PCS NEWSLETTER

May 2022

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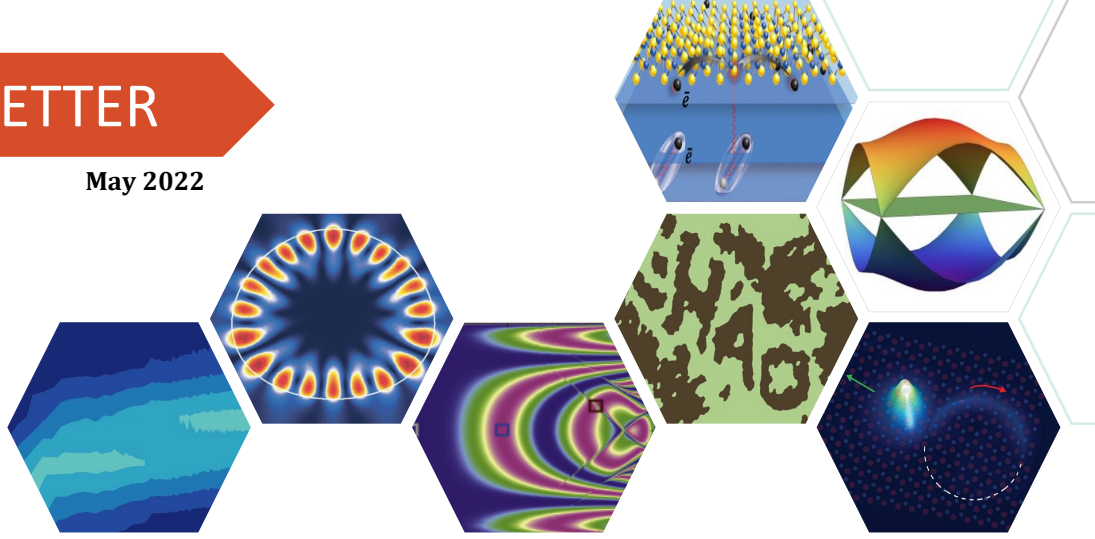


PCS IBS Seminars

"Topological phases and flat bands of quantized light"
by Dawei Wang, Zhejiang University, China (Apr. 5)

"Two-Dimensional Quantum Fluids in GaAs-Based Semiconductors"
by Hyoungsoon Choi, KAIST, Korea (Apr. 14)

"Robust D-Wave Superconductivity of Doped Mott Insulators"
by Donna Sheng,California State University, USA (Apr. 19)

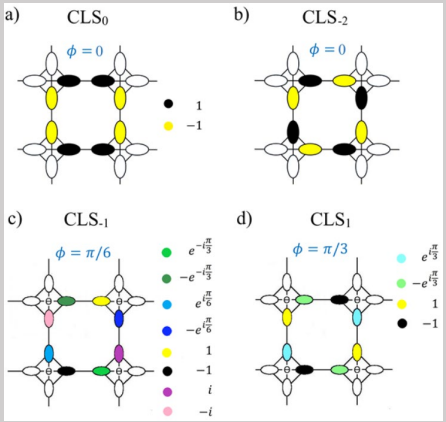
"Scalable approach to many-body localization via quantum data"
by Alexander Gresch, Heinrich-Heine-Universität Düsseldorf, Germany (Apr. 26)

"Optically trapped exciton-polariton condensates"
by Anton Nalitov, University of Wolverhampton, UK (Apr. 28)

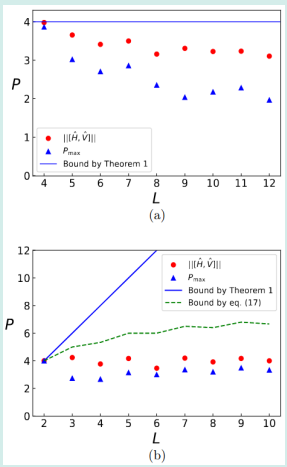
You can find more seminars on ***this page***.

New research results

Nonlinear compact localized modes in flux-dressed octagonal-diamond lattice
M G Stojanović, S Gündoğdu, D Leykam, D G Angelakis, M Stojanović Krasić, M Stepić and A Maluckov
Phys. Scr. 97, 030006 (arXiv:2111.13387)
The authors study the emergence of singular and non-singular flatbands in the two-dimensional octogonal-diamond lattice threaded by an artificial magnetic flux. They show that the nonlinearity strength or the applied flux can be used to control the dynamical properties and stability of nonlinear compact localized modes. The model can be realized using either ring resonator lattices or nonlinear waveguide arrays.

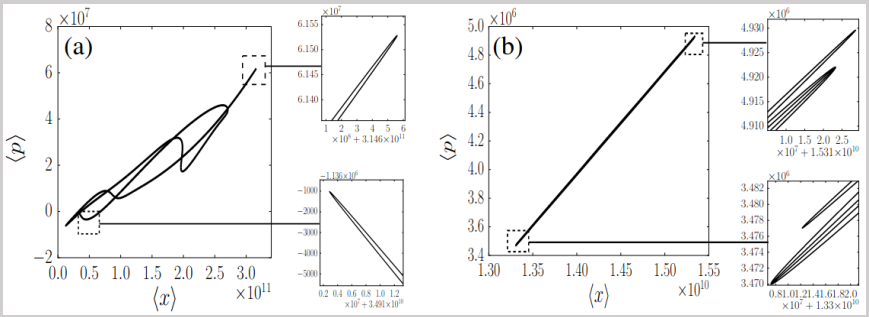


New research results

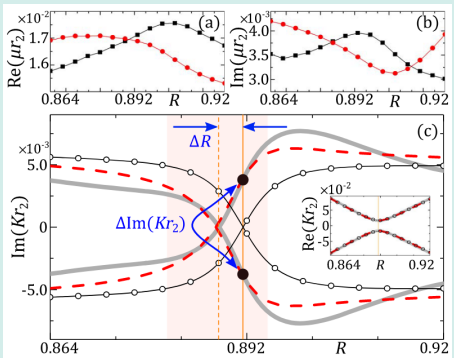


Quantum Charging Advantage Cannot Be Extensive without Global Operations
Ju-Yeon Gyhm, Dominik Šafránek, and Dario Rosa
Phys. Rev. Lett. 128, 140501 (arXiv:2108.02491)
Quantum batteries are devices made from quantum states, used as energy storage devices. The authors offer a significant charging speed up when compared to classical batteries, due to the possibility of using entangling charging operations. They show that the maximal speed up that can be achieved is extensive in the number of cells. To reach such a scaling, a global charging protocol, charging all the cells collectively via entangling operations, needs to be employed. This concludes the quest on the limits of charging power of quantum batteries which was standing for few years.

Nonlinear dynamics of superposition of wavepackets
S. Kannan, M. Rohith, C. Sudheesh
Eur. Phys. J. Plus 137, 471
(arXiv:2008.02771)
The authors study nonlinear dynamics of superposition of quantum wave packets in various systems such as Kerr medium, Morse oscillator and bosonic Josephson junction.



The prime reason behind this study is to find out how the superposition of states influence the dynamics of quantum systems. Considering states that are candidates for quantum computing and communication, a vast changes are observed for superpositions of wave packets in various kinds of dynamics such as periodic, quasi-periodic, ergodic, and chaotic dynamics.



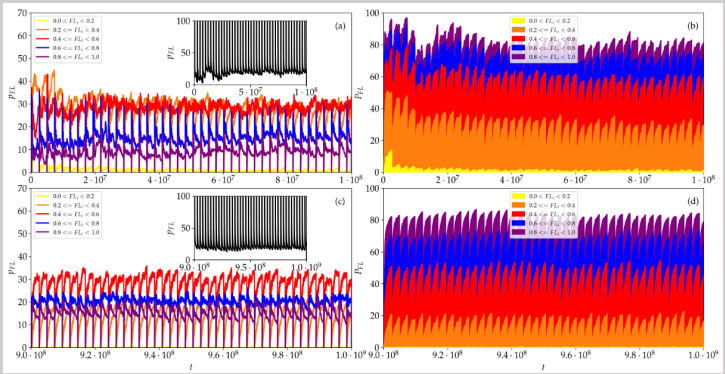
Impact of non-Hermitian mode interaction on inter-cavity light transfer
Hyeon-Hye Yu, Sunjae Gwak, Jinhyeok Ryu, Hyundong Kim, Ji-Hwan Kim, Jung-Wan Ryu, Chil-Min Kim, and Chang-Hwan Yi
Photon. Res. 10(5), 1232-1237
The authors study the inter-cavity light transfer demonstrating that only the non-Hermitian coupling can correctly account for the light transfer between two coupled optical cavities. Also, it reveals that the non-Hermitian coupling effect becomes crucial as the system dimension decreases. This result provides important insight for handling general-coupled devices in the subwavelength regime.

New research results

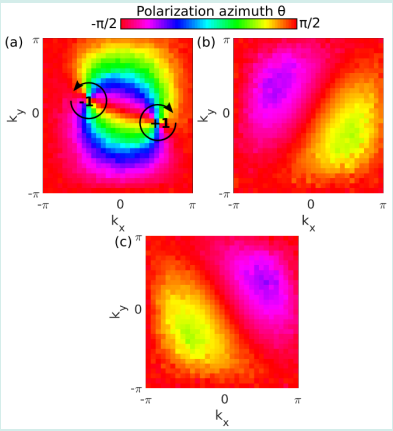
Frequency Map Analysis of Spatiotemporal Chaos in the Nonlinear Disordered Klein–Gordon Lattice

Charalampos Skokos, Enrico Gerlach and Sergej Flach

International Journal of Bifurcation and Chaos 32(5), 2250074 (arXiv:2112.04190)



The authors study the characteristics of chaos evolution of initially localized energy excitations in a nonlinear disordered Klein-Gordon lattice of anharmonic oscillators, in `weak' and `strong chaos' spreading regimes for which Anderson localization is destroyed. In both regimes chaos is more intense at the central regions of the wave packet, while the oscillators at the edges exhibit regular motion. When compared to the weak chaos regime, they show that, in the strong chaos regime the extent of the zones of regular motion at the edges is much smaller, the chaotic component of the wave packet is more extended, the fraction of strongly chaotic oscillators is much higher, and a significantly large number of frequencies are excited.



Nonlinear signatures of Floquet band topology

Aleksandra Maluckov, Ekaterina Smolina, Daniel Leykam, Sinan Gündoğdu, Dimitris G. Angelakis, and Daria A. Smirnova

Phys. Rev. B 105, 115133 (arXiv:2111.10229)

The authors study how the nonlinear propagation dynamics of bulk states in nonlinear waveguide arrays may be used to distinguish topological phases of Floquet systems. First, they show how instabilities of nonlinear Bloch waves may be used to populate Floquet bands and measure their Chern number via the emergence of nontrivial polarization textures in a similar manner to static (undriven) lattices. Second, the nonlinear dynamics of non-stationary superposition states may be used to identify dynamical symmetry inversion points in the intra-cycle dynamics, thereby allowing anomalous Floquet phases to be distinguished from trivial ones.

Puzzle of the month

Disappointingly we did not get any answers this time. Come on! There is no puzzle that physicists can't solve!
We repeat the puzzle from the previous issue. Find a hint from the previous answer.

Puzzle of the month (April – May)

Paul and Mary play a game with a fair coin - both heads (H) and tails (T) have same probability 1/2. Paul chooses the sequence TTT. Mary chooses HTT.
They start flipping the coin several times in a row, until either TTT or HTT happen. What is the probability for Mary to win?
Paul chooses HHT. Mary chooses THH. Who wins, and with what probability?
Paul chooses HTH. Mary chooses HHT. Who wins, and with what probability?

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