PCS NEWSLETTER

September 2022

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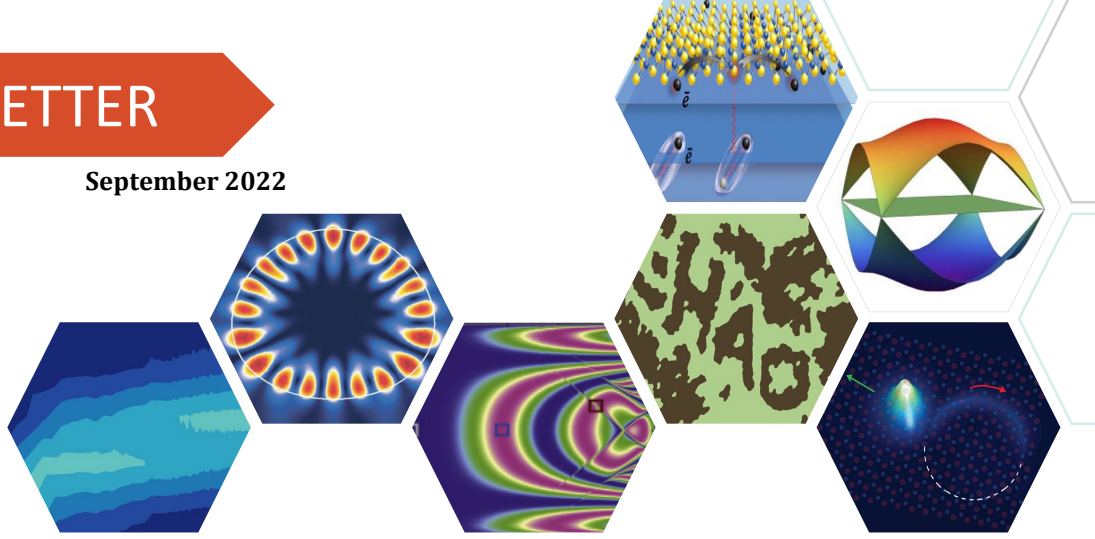
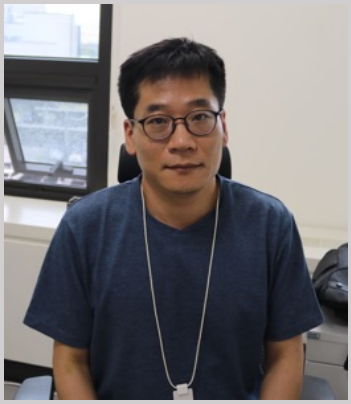


PCS New members



Dr. Sunghun Park has joined PCS as a Young Scientist Fellow. He received his PhD in 2011 from KAIST, South Korea. He has worked as a postdoc at KAIST, TU Braunschweig in Germany, and Autonomous University of Madrid in Spain. His main research area includes theoretical modelling of hybrid superconducting systems, coherent interaction between quantum states and a microwave, as well as collaborations with experimentalists in the field, with the aim to discover and explore new quantum states which can potentially be used as qubits for quantum computing.
He is currently inviting new team members who are interested in the theoretical analysis of electronic and transport properties of hybrid superconducting devices. For those who would like to join his team, please contact **sunghun.park@ibs.re.kr**.

PCS IBS Seminars

"Active systems. A blind spot in physics"
by Robert Alicki, University of Gdańsk, Poland (August 2)

"A Variational Ansatz for the Ground State of the Quantum Sherrington-Kirkpatrick Model"
by Paul Schindler, MPIPKS, Germany (August 4)

"Aharonov-Bohm cages, flat bands, and gap labeling in hyperbolic tilings"
by Remy Mosseri, Sorbonne University, France (August 9)

"Phenomenology of the Prethermal Many-Body Localized Regime"
by David Long, Boston University, USA (August 11)

"Variational Tensor Network Operator"
by Ying-Jer Kao, National Taiwan University, Taiwan (August 23)

"Quantum Thermometers, Quantum Batteries, and lesser demons"
by Stefan Nimmrichter, University of Siegen, Germany (August 25)

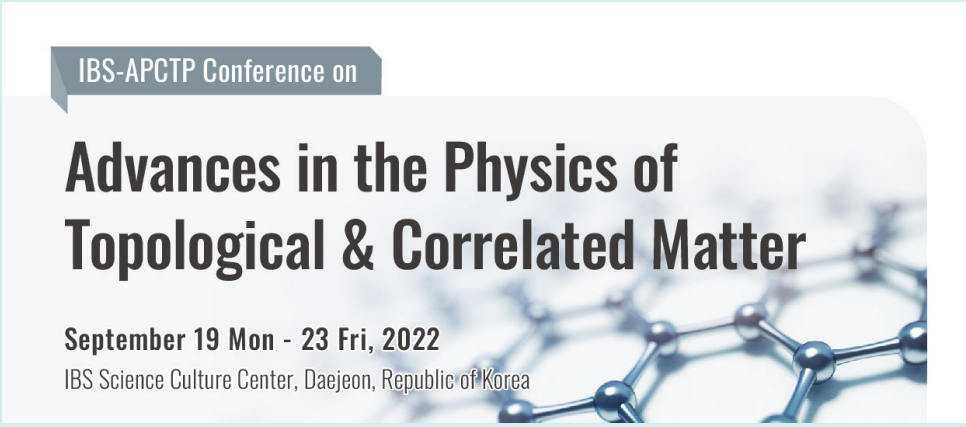
"Universal principles of moiré band structures"
by Jinhong Park, University of Cologne, Germany (August 30)

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

PCS Workshops and Meetings

PCS, with the Asia Pacific Center for Theoretical Physics, sucessfully hosted *IBSPCS-APCTP International Workshop Computational Approaches to Magnetic Systems* August 17 - 19, 2022. We enjoyed twenty invited talks with 69 participants.

PCS, with the Asia Pacific Center for Theoretical Physics, will host *IBS-APCTP Conference on Advances in The Physics of Topological and Correlated Matter* on September 19 - 23, 2022.



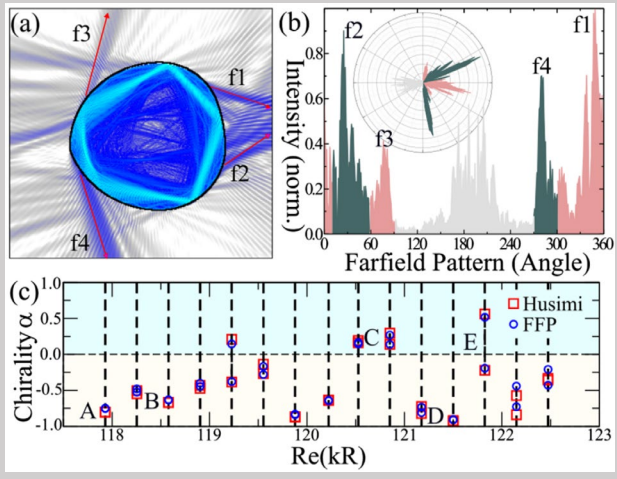
New research results

Far-Field Correlations Verifying Non-Hermitian Degeneracy of Optical Modes

Sunjae Gwak, Jinhyeok Ryu, Hyundong Kim, Hyeon-Hye Yu, Chil-Min Kim, and Chang-Hwan Yi

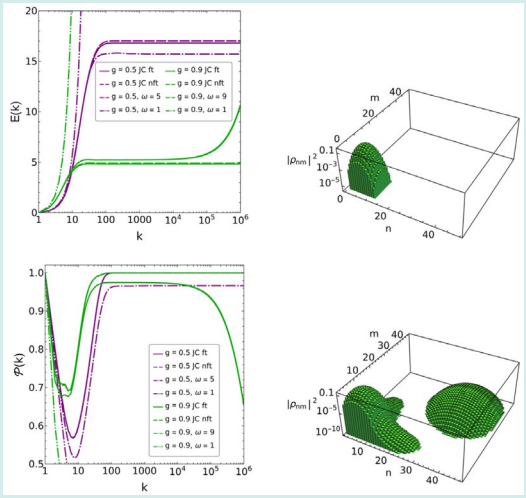
Phys. Rev. Lett. **129**, 074101

The authors study the unambiguous verification of the non-Hermitian degeneracy, the so-called exceptional point (EP), in open optical systems. At EPs, both multiple numbers of eigenvalues and corresponding eigenstates coalesce simultaneously. Their results indicate that the nearly degenerate complex eigenvalues are not enough to confirm EPs because the eigenstate can still be disturbed by other mode couplings. Examination of the eigenstate coalescence, which is thereby required to ensure EPs, is, however, impossible since the experimentally accessible quantities are not the wavefunctions but their absolute square, i.e., far-field intensity (FFI). By demonstrating direct relationship between the wavefunction coalescence and the FFI correlation, this work demonstrates that the FFI can be used to verify the eigenstate coalescence.



New research results

Micromasers as quantum batteries
Vahid Shaghaghi, Varinder Singh, Giuliano Benenti and Dario Rosa
Quantum Sci. Technol. 7, 04LT01 (arXiv:2204.09995)
This work shows that a micromaser is an excellent model of quantum battery. When a battery is in a mixed state, since it cannot be transformed into the ground state by means of unitary transformations, it is impossible to extract all of its energy. The authors show that for a micromaser, due to the fact that its nearly-steady states are approximately pure, almost all the energy can be reversibly extracted. A state of a cavity mode charged by coherent qubits, that is highly excited, pure and effectively steady, can be achieved also in the ultrastrong coupling regime of field-matter interaction.



Puzzle of the month

August puzzle answer:

56 pieces. Before the first cut, we have one piece. The first cut adds one more piece. The second cut adds two more pieces. The third cut adds three more pieces. And so on. Already young Carl Friedrich Gauss figured that the result is $1 + n\,(n + 1) / 2$. With $n = 10$ we obtain 56 pieces.

Congratulations to Sinan Gundogdu (Berlin) and Ihor Vakulchyk (Vancouver) for the correct answer! Bon appetit, we hope the pizza in your geographic locations is at least as good as the one in Daejeon!

Puzzle of the month:

A train carries 40 loaded wagons. The total load is 5700 tons. Nearest neighbor wagons have different loads. Three wagons in a row always weigh 430 tons. What's the load of the two wagons in the middle?

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