PCS NEWSLETTER

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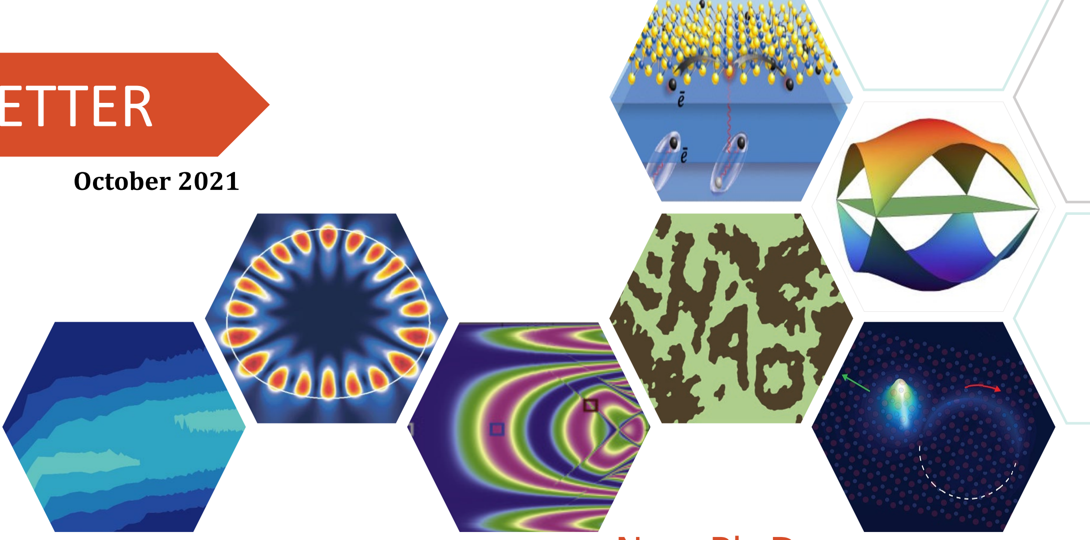
October 2021



New members

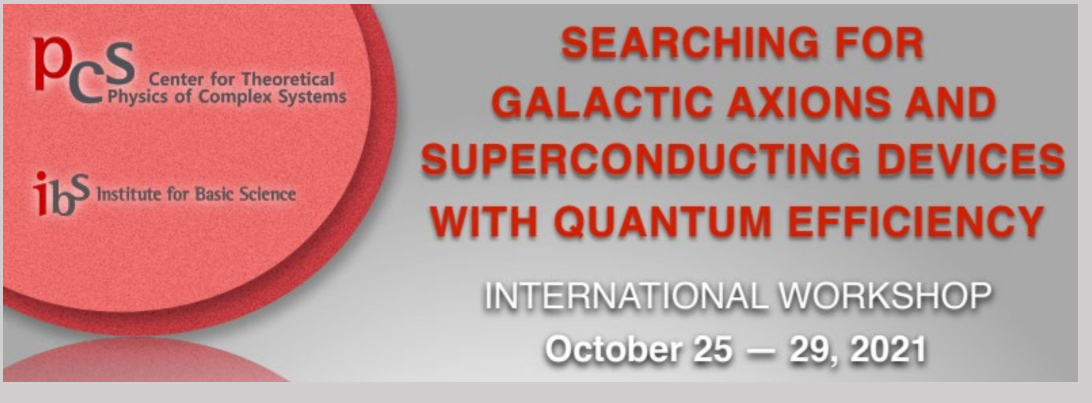
PCS welcomes **Sergei Koniakhin** as a Junior Research Team Leader. His research interest on condensed matter physics covers diverse areas that goes to directions, from the first glance incompatible, including optical properties of carbon nanostructures and dynamics of topological defects in exciton-polariton Bose-Einstein condensates. However these systems can be often described using similar theoretical approaches. The main goal of Sergei is to contribute to our fundamental understanding of nature in terms of physics as well as to answer practical questions for researchers in modern material sciences.
He is currently inviting new team members. *For those who would like to* ***join his team****, please contact* ***kon@ibs.re.kr***.

PCS welcomes **Jan Olle** (Physics at High Energy Physics Institute, Spain) as a student trainee in the team Quantum Chaos in Many-Body Sytems for three months. He is a PhD student in his final year at the Institut de Física d'Altes Energies (IFAE), Barcelona, Spain. His research interests range from quantum many-body dynamics to quantum computing. We are collaborating on understanding the dynamics of quantum operators in many-body setups and on the associated notion of K-complexity.

New Ph.D

Yagmur Kati has successfully achieved her Ph.D degree from University of Science & Technology. We cogratulate her for PCS third Ph.D with flying colors! Well done, Dr. Yagmur Kati.

PCS Workshops and Meetings

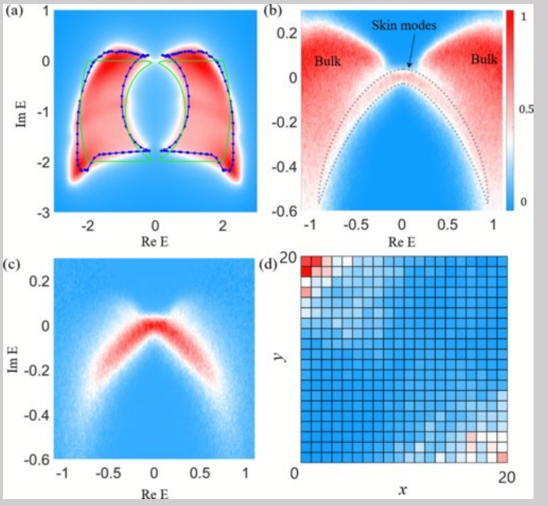


PCS will run International Workshop *Searching for Galactic Axions and Superconducting Devices with Quantum Efficiency* through PCS Video Conference, October 25 - 29, 2021.

IBS Institute for Basic Science

PCS Center for Theoretical Physics of Complex Systems

New research results

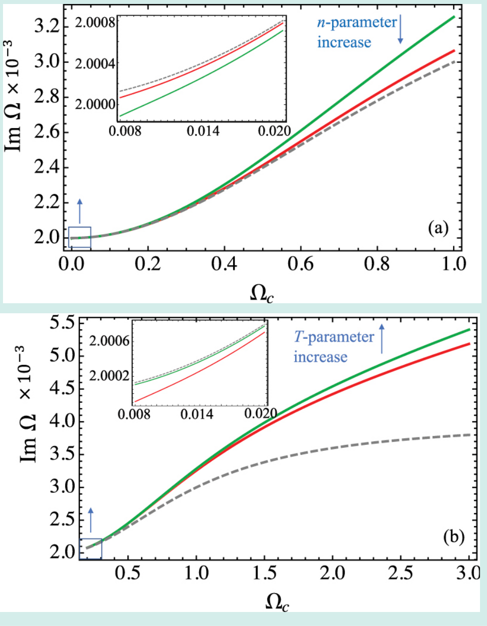


Disorder-driven phase transition in the second-order non-Hermitian skin effect

Kyoung-Min Kim and Moon Jip Park

[Phys. Rev. B 104, L121101](#) ([arXiv:2106.13209](#))

The non-Hermitian skin effect exhibits a collapse of extended bulk modes into an extensive number of localized boundary states in the open boundary condition. The authors demonstrate a disorder-driven phase transition of a trivial non-Hermitian system to the higher-order non-Hermitian skin effect phase. In contrast to clean systems, the disorder-induced boundary modes form an arc in the complex energy plane. At the phase transition, localized corner modes and bulk modes characterized by trivial Hamiltonians coexist within a single band, while they remain separated in the complex energy plane. Such behavior is analogous to the mobility edge phenomena in disordered Hermitian systems.



Magnetoplasmon resonance in two-dimensional fluctuating superconductors

K. Sonowal, V. M. Kovalev and I. G. Savenko

[New J. Phys. **23**, 093009](#)

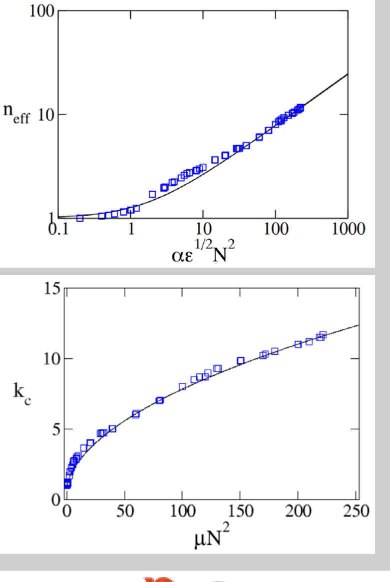
The fluctuating regime in superconducting materials refers to one where the temperature is very close to, but above the critical temperature of superconducting transition. Owing to the presence of Cooper pair fluctuations, a lot of intriguing physics occurs in this regime, specially in lower dimensions where corrections due to pair fluctuations get enhanced. Unpaired electrons and fluctuating Cooper pairs coexist in the system and interact with each other via long-range Coulomb forces, forming a Bose–Fermi mixture. Studying the phenomena of Magnetoplasmon resonance, the authors find that presence of such fluctuations results in narrowing and broadening of the Magnetoplasmon damping and the effect of the fluctuation contributions get significantly amplified with stronger magnetic fields.

Measuring α-FPUT Cores and Tails

Sergej Flach

[Physics 3(4), 879-887](#)

Almost 70 years ago, the Fermi–Pasta–Ulam–Tsingou (FPUT) paradox was formulated in, observed in, and reported using normal modes of a nonlinear, one-dimensional, non-integrable string. The author recap the paradox. One normal mode is excited, which drives three or four more normal modes in the core. Then, that is it for quite a long time. So why are many normal modes staying weakly excited in the tail? Furthermore, how many? In this work, a quantitative, analytical answer to the latter question is given using resonances and secular avalanches. A comparison with the previous numerical data is made and extremely good agreement is found.



Puzzle of the month

September puzzle answer:

$V^2=gR$. The mass is in the top position. This follows easily from working in the co-moving frame in which the wheel axis is not moving, but the wheel simply rotating. Then the velocity in the top point is V, the centrifugal acceleration V^2/R which has to equal g.

The correct answer came from Sergei Koniakhin. Congratulations!

Puzzle of the month:

There is another solution for the wheel problem. For that we remember from our Mechanics course that a rolling wheel can be approximated by a wheel which is rotating around the wheel-ground touching point. Then the top point of the wheel has distance $2R$, and velocity $2V$. The centrifugal acceleration appears to be $4V^2/2R=2V^2/R$. It follows that the critical velocity $V^2=gR/2$. Oops. Something went wrong. What? Did they teach us the wrong thing in the Mechanics course?

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