PCS NEWSLETTER

August 2021

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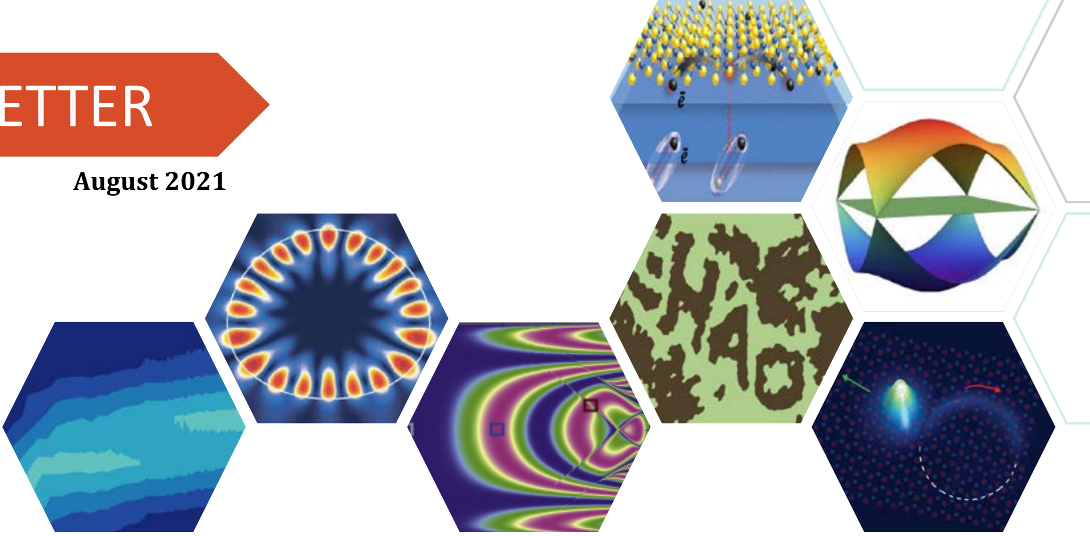
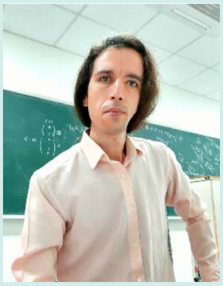


New members

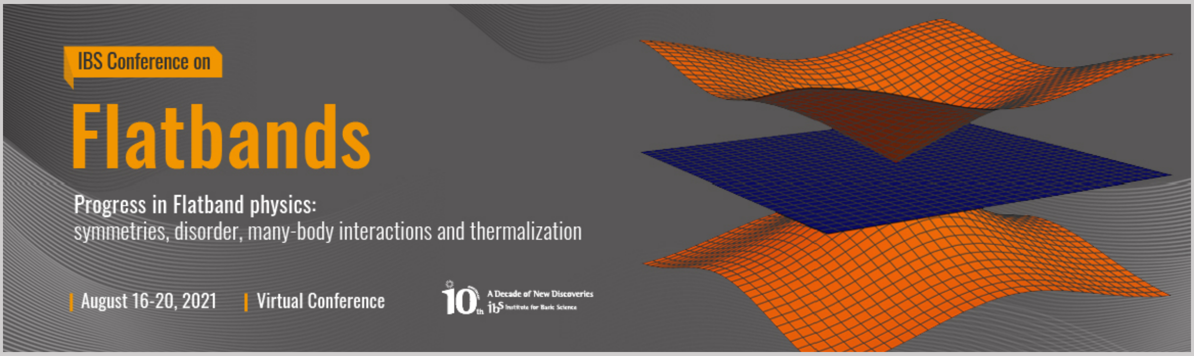
PCS welcomes **Barbara Dietz** as a Research Fellow. She works on quantum chaos and quantum chaotic scattering problems using random matrix theory as well as semiclassical approaches in nonrelativistic & relativistic quantum billiards, quantum graphs, and graphene billiards. She is also interested in experimental modeling with microwave billiards, microwave networks, and microwave photonic crystals.

PCS welcomes **Vahid Shaghaghi** (Insubria University, Italy, Ph.D advisor is Prof. Giuliano Benenti) as a student trainee in the team Quantum Chaos in Many-Body Systems for one year. His research is mostly focused on quantum thermal machines and quantum batteries. While visiting us he will mostly work on quantum many-body effects in quantum thermodynamics.



PCS welcomes **Olha Bahrova** (National Academy of Sciences of Ukraine, Kharkiv, Ukraine) as a student trainee in the team Quantum Many-Body Interactions and Transport for one year. She is interested in various properties of nano-electromechanical systems (NEMS) such as the vibron-assisted electron transport in molecular transistors, effects of the Franck-Condon blockade and Schrodinger-cat states.

PCS Workshops and Meetings



PCS will run IBS Conference on Flatbands: symmetries, disorder, interactions and thermalization through PCS Video Conference, **Aug. 16-20, 2021**.

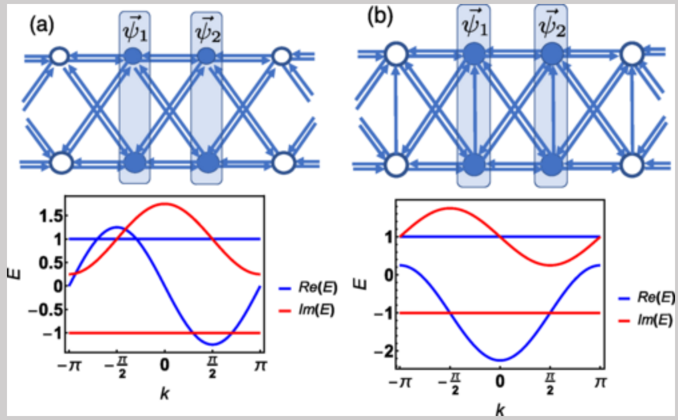
Institute for Basic Science

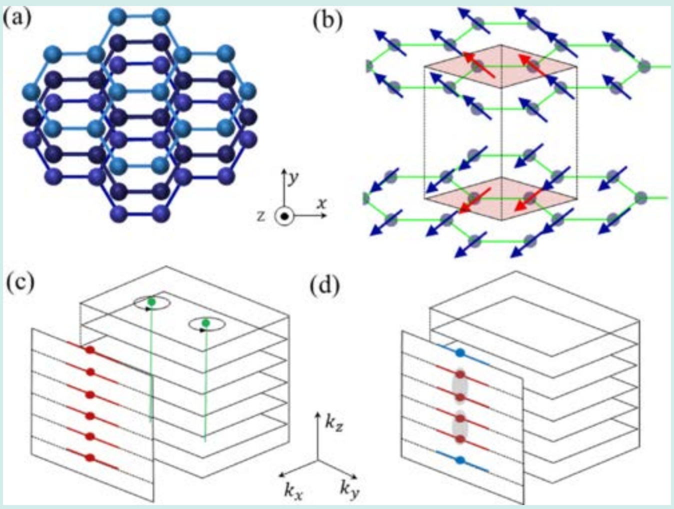
Center for Theoretical Physics of Complex Systems

New research results

Non-Hermitian flat-band generator in one dimension
Wulayimu Maimaiti and Alexei Andreanov
[Phys. Rev. B **104**, 035115]

The authors discuss various types of flat bands in the presence of dissipation, which is approximated by non-Hermitian Hamiltonians. Gain and loss extends the possible types of flat bands, adding partial flat bands to the perfect flat bands existing for Hermitian systems. In this paper, they describe all the possible non-Hermitian flat bands for the simplest case of a 1D system with two bands and discuss the properties.



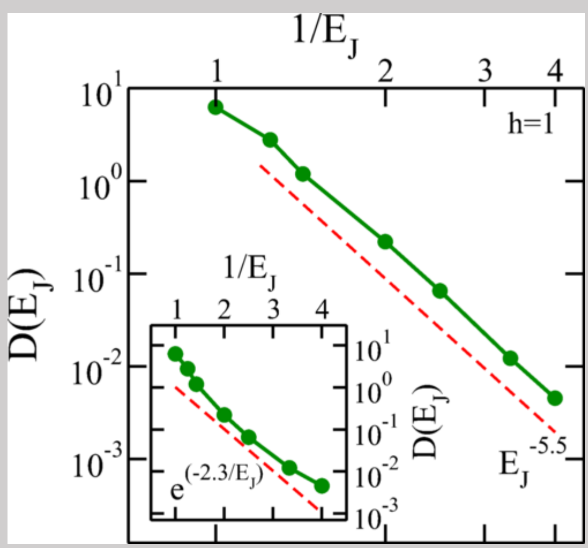


Hinge magnons from noncollinear magnetic order in a honeycomb antiferromagnet
Moon Jip Park, SungBin Lee, and Yong Baek Kim
[Phys. Rev. B **104**, L060401] ([arXiv:2103.01919])

Higher-order topological insulators are newly proposed topological phases of matter, whose d-dimensional bulk topology manifests as localized modes at (d-2) or (d-3) dimensional lower boundaries. In this work, the authors propose the concept of the higher-order topological magnon phase. Furthermore, they show that this phase can be realized in a simple honeycomb antiferromagnet such as CrI_3.

Fragile many-body ergodicity from action diffusion
Thudiyangal Mithun, Carlo Danieli, M. V. Fistul, B. L. Altshuler, Sergej Flach
[Phys. Rev. E **104**, 014218] ([arXiv:2006.07179])

Weakly nonintegrable many-body systems can restore ergodicity through chaotic dynamics caused by action resonances. Differently from long-range networks, however, short-range networks yield a dramatic slowing down of ergodization in action space leading to rare resonance diffusion. The authors identify an action resonance diffusion regime responsible for the slowing down using Josephson junction chains. They extract the diffusion coefficient of that slow process and measure its dependence on the proximity to the integrable limit. The observed fragile diffusion relies on weakly chaotic dynamics in spatially isolated action resonances.



Puzzle of the month

July puzzle answer:

The canonical answer is - no change. As usual, discretizing helps. Consider the flow of sand as a one-dimensional sequence of falling grains. You need to compare the weight of the free falling grains with the force exerted by the landing grain(s) which is assumed to be completely inelastic. The time between two landing collisions t gives the force mv/t. Now take the limit of one grain in the flow. Then t becomes the falling time. The rest is simple mechanics which tells you that both forces are equal, and therefore there is no change in the weight.
Congratulations to Sungjong Woo!

Interestingly the canonical answer is debated in the literature, e.g. due to the fact that the center of mass of the sand is accelerating, see [1-4].

[1] K. Y. Shen and Bruce L. Scott. The Hourglass Problem. Am. J. Phys. 53, 787 (1985)
[2] Achim Sack and Thorsten Poeschel. Weight of an hourglass—Theory and experiment in quantitative comparison. Am. J. Phys. 85,98 (2017)
[3] Volker Becker and thorsten Poeschel. Hourglass of Constant Weight. Granular Matter 10, 231 (2008)
[4] Ian H. Redmount and Richard H. Price. The Weight of Time. The Physics Teacher 36, 432 (1998)

Puzzle of the month:

Imagine that you have three boxes. One containing two black marbles, one containing two white marbles, and the third, one black marble and one white marble. The boxes were labeled for their contents---BB, BW, WW---but someone switched the labels so that every box is now incorrectly labeled. You are allowed to take one marble at a time out of any box, without looking inside, and by this process of sampling you are to determine the contents of all three boxes. What is the smallest number of drawings needed to do this?

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