NTML(BRL)-APCTP SEMINAR SERIES

Topological Matter Out of Equilibrium

Period April 2022 ~ June 2022

Venue Online (ZOOM)

Overview

Recently, a small but ambitious research group, funded by National Research Foundation (NRF) for three years, Nonlinear Topological Matter Laboratory (NTML) has been launched to investigate dynamical phase transitions in topological matter driven by electromagnetic fields including light. Our research group consists of three experimentalists (Prof. Heon-Jung Kim, Prof. Jong-Soo Rhyee, and Prof. Jungkil Kim) and one theorist (Prof. Ki-Seok Kim), which cover material preparation, electrical and thermal transport, light-matter interaction, device, and anomaly and transport theory. Additionally, the Junior Research Group "Non-equilibrium many-body physics" (Ryo Hanai) started in April 2021 with a broad interest in collective phenomena out of equilibrium. To promote this research direction in Korean Physical Society, we open NTML-APCTP seminar series on topological matter out of equilibrium, inviting several well-known experts in this direction mentioned above.

Invited Speakers (Tentative)

- Mark S. Rudner (University of Washington) 15th April
- Alexey Gorshkov (University of Maryland and NIST) 6th May
- Liang Wu (University of Pennsylvania) 20th May
- Takahiro Morimoto (University of Tokyo) 3rd June
- Hai-Zhou Lu
  (Southern University of Science and Technology) 24th June

Organizers

- Heonjung Kim (Daegu Univ.)
- Jongsoo Rhyee (Kyung Hee Univ.),
- Jungkil Kim (Jeju Nat. Univ.)
- Kiseok Kim (POSTECH)
- Ryo Hanai (APCTP)

apctp

The APCTP is supported by the Korean Government through the Science and Technology Promotion Fund and Lottery Fund and strives to maximize social value through its various activities.
아시아태평양이론물리센터는 정부의 과학기술진흥기금 및 복권기금 지원으로 사회적 가치 제고에 힘쓰고 있습니다.

NTML(BRL)-APCTP SEMINAR SERIES

3D Quantum Hall Effect

Prof. Hai-Zhou Lu

SUSTech

June 24th (Fri.) 10:00

Online via ZOOM

The discovery of the quantum Hall effect has led to three Nobel prizes and the booming field of topological phases of quantum matter. The quantum Hall effect is usually observed in 2D. It has been a long-standing challenge to realize a quantum Hall effect in 3D.

We predict a new mechanism of 3D quantum Hall effect in topological semimetals [1-2]. Topological semimetals, which host topologically-protected surface states, known as the Fermi arcs. The Fermi arcs at two opposite surfaces can form a 2D electron gas that supports a 3D quantum Hall effect. Possible signatures are observed in the topological Dirac semimetal Cd_3As_2 [e.g., Faxian Xiu et al., Nature 565, 331 (2019)]. This 3D quantum Hall give an example of (d-2)-dimensional boundary states in higher-order topological phases of matter [3].

On the other hand, the charge-density-wave mechanism of the 3D quantum Hall effect has been observed recently in ZrTe5 [Liyuan Zhang et al., Nature 569, 537 (2019)]. We develop a theory for the CDW mechanism of the 3D quantum Hall effect [4] and coexisting meta-insulator transition [5]. The theories can capture the main features in the experiment. More importantly, it poses a rare case, in which one magnetic field can induce an order-parameter phase transition in one dimension but a topological phase transition in other two dimensions.

References:
[1] C. M. Wang et al., PRL 119, 136806 (2017).
[2] Hai-Zhou Lu, National Science Review 6, 208 (2019).
[3] Rui Chen et al., PRL 127, 066801 (2021).
[4] Fang Qin et al., PRL 125, 206601 (2020).
[5] Peng-Lu Zhao et al., PRL 127, 046602 (2021).

■ **ZOOM Webinar**

1) Please register through this ZOOM link (password 0)
https://us06web.zoom.us/meeting/register/tZMrd-uhqzMvGdRw9dvqwwDBMOLLwx_TiIB_
2) Join the webinar with a link generated after the registration
3) Please rename your profile - E.g. **Full name (affiliation)**

■ **Contact information**

- Organizer: Ryo Hanai (ryo.hanai@apctp.org)
- Office: Research Support Team (ra@apctp.org)

The APCTP is supported by the Korean Government through the Science and Technology Promotion Fund and Lottery Fund and strives to maximize social value through its various activities.
아시아태평양이론물리센터는 정부의 과학기술진흥기금 및 복권기금 지원으로 사회적 가치 제고에 힘쓰고 있습니다.