Center for Artificial Low D Electronic Systems

2022 IBS-CALDES Seminar

- ✓ **Date & Time** 4:00PM, April 18th (Mon), 2022
- ✓ **Zoom ID: 891 5332 7518 / PW: 149328**
- ✓ **Speaker & Title**

04:00PM~ Prof. Takahiro Morimoto (Univ. of Tokyo)

Nonlinear optical effects in correlated electron systems with inversion breaking

05:10PM~ Prof. Kai Rossnagel (Kiel Univ.)

Ultrafast dynamics of charge unordering and charge transfer

Organized by Prof. Gil Young Cho (gilyoungcho@postech.ac.kr, 054-279-2097)
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- **04:00PM~**

Nonlinear optical effects in correlated electron systems with inversion breaking

Takahiro Morimoto
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The responses of materials to high intensity light, i.e., nonlinear optical responses, constitute a vast field of physics and engineering. One of nonlinear optical responses that is attracting a recent attention is a bulk photovoltaic effect called shift current which arises from Berry phase of a Bloch wave function and has a close relationship to the modern theory of electric polarization [1]. While most previous studies of the bulk photovoltaic effects have focused on band insulators of noninteracting electrons, correlated electron systems have a potential to support a novel nonlinear functionality. In this talk, I will present our recent efforts in seeking nonlinear optical effects in magnets [2], superconductors [3], and electron-phonon coupled systems [4], focusing on the role of characteristic collective excitations in those correlated systems.

[1] T. Morimoto, and N. Nagaosa, Sci. Adv. 2, e1501524 (2016).
[2] T. Morimoto, S. Kitamura, S. Okumura, Phys. Rev. B 104, 075139 (2021).
[3] T. Kamatani, S. Kitamura, N. Tsuji, R. Shimano, T. Morimoto, Phys. Rev. B 105, 094520 (2022).
[4] Y. Okamura et al. PNAS 119, e2122313119 (2022).

- **05:10PM~**

Ultrafast dynamics of charge unordering and charge transfer

Kai Rossnagel
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Electrons drive our fastest switches and every chemical reaction. If we want to understand how electrons move and interact in materials and across interfaces, we need to capture them in action. The most powerful technique for this is time- and momentum-resolved pump-probe photoelectron spectroscopy. Here, we will use this technique to address two different fundamental questions. First, how fast and how efficient can an electronic gap be quenched? We will take a helicopter view and discuss various mechanisms for energy gap melting in charge-density-wave systems and superconductors. Second, what is the initial pathway from femtosecond laser excitation to chemical reaction at a surface? We will focus on one specific molecule/2D material interface, CuPc/TiSe2, and present a complete molecular movie capturing the complex interplay of electronic and structural dynamics after photoexcitation.