Center for Artificial Low D Electronic Systems

2020 Fall Seminar
with CALDES, IBS & SRC, POSTECH

- ✓ **Date&Time:** November 13 (Fri), 3:00PM~
- ✓ **Venue:** Online (Zoom)
- ✓ **Speaker & Title**

1) 3:00PM~ Prof. JaeDong Lee (DGIST)
Ultrafast dynamics of infinite systems: Insights from time-resolved photoemission spectroscopy

2) 4:10PM~ Prof. Sangjun Jeon (Chung-Ang University)
Topological superconductivity at the helical edge states

Organized by Prof. Jun Sung Kim (js.kim@postech.ac.kr, 054-279-2098)
Dr. Jewook Park (jewookpark@ibs.re.kr, 054-279-9893)

- **3:00PM~**

Ultrafast dynamics of infinite systems: Insights from time-resolved photoemission spectroscopy

JaeDong Lee
Department of Emerging Materials Science, DGIST

We develop a new theoretical formulation of the time-resolved photoemission spectroscopy (TRPES), which enables to explore the real-time electron dynamics of infinitely periodic crystalline solids. With TRPES, we now address the following issues; (i) the early-stage dynamics of the valence band edges of strongly correlated electron systems NiO and CuO, (ii) the dephasing dynamics of optically excited carriers in the massless Dirac band in graphene, accompanying a field-induced gliding of the Dirac cone, (iii) the Floquet-Bloch dynamics of graphene and 2-dimensional transition metal dichalcogenides, and (iv) the petahertz (PHz) quantum oscillation on the Floquet-Bloch Dirac cone. Finally, we introduce our recent interests of the time-resolved dichroic photoemission spectroscopy toward the transient topological phenomena.

- **4:10PM~**

Topological superconductivity at the helical edge states

Sangjun Jeon
Department of Physics, Chung-Ang University

Localized Majorana zero modes (MZMs) are non-Abelian quasiparticles that emerge at the ends of one-dimensional topological superconductors. MZMs are promised to be a building block of fault-tolerant quantum computation. To date, a variety of condensed matter systems is proposed and studied to engineer topological superconductivity and MZMs. This talk will introduce the concepts of topological superconductor and MZMs, and how to use MZMs as fault-tolerant quantum computation. More specifically, I will review the recent experimental and theoretical progress in the study of MZMs at the edge of the bismuth bilayer platform and discuss how to engineer a new platform to host MZMs.

References:
1. Stevan Nadj-Perge, Ilya K. Drozdov, Jian Li, Hua Chen, Sangjun Jeon, Jungpil Seo, Allan H. MacDonald, B. A. Bernevig, and Ali Yazdani, "Observation of Majorana fermions in ferromagnetic atomic chains on a superconductor", Science 346, 602-607 (2014)
2. Sangjun Jeon, Yonglong Xie, Jian Li, Zizun Wang, B. Andrei Bernevig, Ali Yazdani, "Distinguishing a Majorana zero mode using spin-resolved measurements", Science 358, 772 (2017)
3. Jäck, B.; Xie, Y.; Li, J.; Jeon, S.; Bernevig, B. A.; Yazdani, "A. Observation of a Majorana Zero Mode in a Topologically Protected Edge Channel", Science 364, 6447 (2019)