

IBS CINAP Seminar

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Room 86120 (N Center), Sungkyunkwan University, Suwon

Optical and transport properties, and interaction effects in 2D Dirac materials

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Abstract

In recent years, there has been much interest in two-dimensional Dirac materials such as graphene, transition metal dichalcogenides, and few-layer black phosphorus. In this talk, first we discuss optical [1] and transport [2] properties of few-layer black phosphorus in each phase (a gapped insulator phase, gapless semi-Dirac transition point, or gapless Dirac semimetal phase depending on the sign of the band gap) and present the characteristic frequency and density dependence of the conductivity. Next, we discuss the condensation of polaritons (emergent bosons from the hybridizations of cavity photons and excitons) in transition metal dichalcogenides and demonstrate that symmetry breaking or topological phase transitions can occur due to the competition between the electron-photon coupling and the electron-electron interaction [3].

[1] Jiho Jang, Seongjin Ahn, and Hongki Min, Optical conductivity of black phosphorus with a tunable electronic structure, *2D Mater.* 6, 025029 (2019).

[2] Sanghyun Park, Seungchan Woo, and Hongki Min, Semiclassical Boltzmann transport theory of few-layer black phosphorus in various phases, *2D Mater.* 6, 025016 (2019).

[3] Ki Hoon Lee, Changhee Lee, Hongki Min*, and Suk Bum Chung*, Phase transitions of the polariton condensate in 2D Dirac materials, *Phys. Rev. Lett.* 120, 157601 (2018).

Brief Bio

Education

Ph. D. Physics, The University of Texas at Austin, USA (2008)

Advisor: Dr. Allan H. MacDonald, Thesis title: Possible ordered states in graphene systems

B.S. Physics, Seoul National University, Korea (2001)

Professional Experiences

Associate Professor 09/2015–present
Department of Physics and Astronomy, Seoul National University, Korea

Visiting Scholar 02/2016–01/2017
Department of Physics and Astronomy, University of Pennsylvania, USA

Assistant Professor 09/2011–08/2015
Department of Physics and Astronomy, Seoul National University, Korea

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Dr. Sankar Das Sarma, University of Maryland, USA

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