Quantum nanoeletronics in graphene and 2D materials

Dr. DongKeun Ki, Department of Physics, The University of Hong Kong

Confined in low-dimensions, electrons can exhibit their quantum nature in a macroscopic energy and length scale that are ready to be observed in transport experiments. This has led to the discoveries of many fascinating physical phenomena, such as quantum Hall effect, and shown exciting possibilities to build quantum nanoelectronic devices with new functionalities. In this context, graphene and 2D materials provide a unique and nearly ideal platform as charge carriers are confined in an atomic thickness. Moreover, due to such an ultimate 2D nature, their properties can be further tuned and designed on demand by various experimental techniques. In this talk, I will provide a general overview of the past and ongoing efforts in the field to investigate and engineer various quantum transport phenomena in the system and discuss remaining challenges. First, I will briefly discuss key features of graphene and 2D materials that are most relevant for quantum transport studies, and list experimental techniques that are involved. After the introduction, I will talk about various efforts to reveal and design new quantum phenomena by focusing specifically on two device architectures, ultraclean suspended graphene and van der Waals (vdW) heterostructures. Lastly, I will discuss what are the remaining challenges in the field and our group's ongoing efforts to tackle some parts of them.

*Short Bio

Dong-Keun Ki received PhD from POSTECH, Korea in 2010, and is currently appointed as an Assistant Professor in The University of Hong Kong (HKU) since 2018. Before joining the HKU, he has worked as a Senior Research Associate in the University of Geneva in Switzerland with Prof. Alberto Morpurgo. He focuses on understanding quantum transport properties of various types of low-dimensional nanostructures, including graphene and 2D materials. He has published several high-impact papers in Nature Physics, Nature Comm., PRL, and Science.