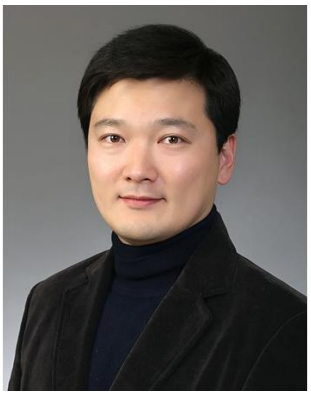
Seminar

Origin of chirality in the charge density wave semimetal 1T-$TiSe_2$

Bumjoon Kim

Department of Physics, POSTECH, Republic of Korea



Time: 10:00 am, Dec.12, 2024 (Thursday)

时间：2024年12月12日 （周四）上午10:00

Venue: Room w563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

Chirality is a ubiquitous phenomenon in which a symmetry between left- and right-handed objects is broken, examples in nature ranging from subatomic particles and molecules to living organisms. However, mechanisms that lead to chirality in condensed matter systems remain poorly understood. In this talk, I will discuss on a novel mechanism of chiral charge density wave formation in the transition-metal dichalcogenide 1T-$TiSe_2$. Based on a rigorous symmetry analysis, we show that charge density modulations and ionic displacements, which transform as a continuous scalar field and a vector field on a discrete lattice, respectively, follow different irreducible representations of the space group, despite the fact that they propagate with the same wave-vectors and are strongly coupled to each other. This charge-lattice symmetry frustration is resolved by further breaking of all symmetries not common to both sectors through induced lattice distortions, thus leading to chirality. Our theory is verified using Raman spectroscopy and inelastic x-ray scattering, which reveal that all but translation symmetries are broken at a level not resolved by state-of-the-art diffraction techniques.

About the speaker

Bumjoon Kim is a Professor in the Department of Physics, Pohang University of Science and Technology (POSTECH). Prof. Kim is a leading researcher in condensed matter physics, focusing on the ordering phenomena in transition metal oxides. His work primarily employs advanced techniques such as resonant X-ray diffraction (RXD), resonant inelastic X-ray scattering (RIXS), Raman spectroscopy, neutron spectroscopy and angle-resolved photoemission spectroscopy (ARPES). He has published 69 research papers, which have garnered over 8,000 citations. His pioneering studies using RIXS on iridates led to several high-impact publications. In recognition of his contributions, Prof. Kim received the Next-Generation Scientist Award from the Korean Academy of Science and Technology in 2022.

Host: 彭莹莹<yingying.peng@pku.edu.cn>