Condensed Matter Physics Seminar Series

Berry-curvature physics of magnons

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Magnons with nontrivial Berry curvatures have emerged as a new research area in magnetism and spintronics due to their fundamental interest as well as practical utilities such as back-scattering-free spin-transport channels of topological magnons. In this talk, we will discuss recent developments in the Berry-curvature physics of magnons and their related cousins in two-dimensional (2D) magnets. We will begin by discussing one of the first magnonic topological insulators realized in a honeycomb 2D ferromagnet such as CrI_3, which is shown to give rise to the thermal Hall effect via the finite Berry curvature of magnons. Recently, the field of topological magnons has been expanded into the field of topological bosons beyond simple magnons. As one concrete example, we will introduce a new concept of topologically non-trivial magnon-phonon hybridized mode called a topological magnon-polaron, which can be realized in a 2D ferromagnet and antiferromagnet such as $MnPS_3$ via generic magnetoelastic coupling. In the last part of the talk, we will discuss the recently-discovered relation between the Berry curvature of magnons and their orbital angular momentum in 2D antiferromagnets, which gives rise to the intrinsic orbital Hall effect of magnons without any spin-orbit coupling. The talk will be concluded with a future outlook on the research of topological magnons and beyond.

Se Kwon Kim obtained his Ph.D. from Johns Hopkins University in 2014 under the supervision of Oleg Tchernyshyov. After conducting research at the University of California, Los Angeles, as a Postdoctoral Research Fellow under the supervision of Yaroslav Tserkovnyak from 2014 to 2018, and working at the University of Missouri as an Assistant Professor, Vineyard Chair, from 2018 to 2020, he joined the Korea Advanced Institute of Science and Technology (KAIST) as an Assistant Professor in 2020. His research focuses on quantum spin dynamics, including the fundamental physics of magnetism and superconductivity.

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