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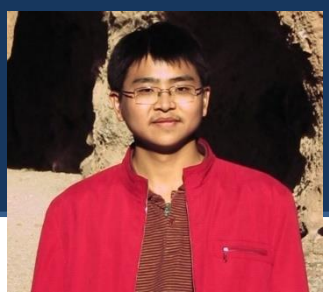
Berry Curvature Enhanced Nonlinear Photo Response of Type-II Weyl Semimetals



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The experimental manifestation of topological effects in bulk materials under ambient conditions, especially those with practical applications, has attracted enormous research interest. Recent discovery of Weyl semimetal provides an ideal material platform for such endeavors. The Berry curvature in a Weyl semimetal becomes singular at the Weyl node, creating an effective magnetic monopole in the k–space. In this talk, signatures of the singular topology in a type–II Weyl semimetal TaIrTe4 is revealed in the photo responses, which are shown to be directly related to the divergence of Berry curvature. As a result of the divergence of Berry curvature at the Weyl nodes, TaIrTe4 exhibits unusually large photo responsivity of 130.2 mA/W with 4– m excitation in an unbiased field effect transistor at room temperature arising from the third–order nonlinear optical response. Furthermore, the circularly polarized galvanic response is also enhanced at 4– m, possibly due to the same Berry curvature singularity enhancement with the shift current. Considering the optical selection rule of Weyl cones with opposite chirality, it may open new experimental possibilities for studying and controlling the chiral polarization of Weyl Fermions through an in–plane DC electric field in addition to the optical helicities.

SHORT BIO:

Dong Sun, associate professor in International Center of Quantum Materials of Peking University, China. He obtained his bachelor degree in physics from University of Science and Technology of China in 2004 and Ph.D in physics from University of Michigan in 2009 with Professor Theodore Norris. After that he works as postdoc research fellow in Center for Ultrafast Optics Science of University of Michigan and research scientist in University of Washington. In 2012, he started to work in international center for quantum materials of Peking University and got tenured in 2017. His research mainly focusing on using various ultrafast spectroscopy method, including pump probe spectroscopy, scanning photocurrent spectroscopy and THz spectroscopy to study various quantum materials and functional optoelectronics devices.

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