北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Divergent bulk photovoltaic effects in Weyl semimetals

Prof. Ying Ran

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Time: 2:00pm, Jan. 30, 2017 (Tuesday)

时间：2018年01月30日 （周二）下午2:00

Venue: Room W563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

Weyl semimetals (WSM) have been discovered in time-reversal symmetric materials, featuring monopoles of Berry's curvature in momentum space. Would the divergent Berry's connection in these materials lead to any divergence in measurable effects? We focus on the shift-current response ($\sigma_{shift}(\omega)$), a second order optical effect generating photocurrents. Surprisingly we find that up to an order unity constant, $\sigma_{shift}(\omega)\sim e^3/(h^2\omega)$ in Type-II WSM, diverging in the low frequency limit. This is in stark contrast to the vanishing behavior ($\sigma_{shift}(\omega)\propto\omega$) in Type-I WSM. In addition, in both Type-I and Type-II WSM, a nonzero chemical potential μ relative to nodes leads to a large peak of shift-current response with a width $\sim|\mu|/\hbar$ and a height $\sim e^3/(h|\mu|)$, the latter diverging in the low doping limit. We show that the origin of these divergences is the singular Berry's connections and the Pauli-blocking mechanism. Similar results hold for the real part of the second harmonic generation, a closely related nonlinear optical response.

Reference: Xu Yang, Kenneth Burch and Ying Ran, arXiv:1712.09363

About the speaker

Ying Ran, associate professor in the Physics department of Boston College. His current research interests include strongly correlated systems and topological phenomena in quantum condensed matter physics. Homepage: https://www2.bc.edu/ying-ran/