北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Special Seminar

Integer and fractional quantum anomalous Hall effects in 2D semiconductor moiré superlattices

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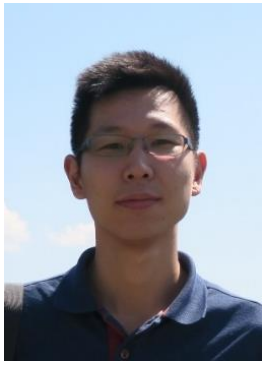

Time: 3:00 pm, Oct. 26, 2023 (Thursday)

时间：2023年10月26日 （周四）下午3:00

Venue: Room w563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

The emergence of topological moiré flat bands provides exciting opportunities to realize the lattice analogs of both the integer and fractional quantum Hall effects without the need for an external magnetic field. These effects are known as the integer and fractional quantum anomalous Hall (IQAH and FQAH) effects. In this talk, I will mainly present electrical transport studies of moiré superlattices built on 2D transition metal dichalcogenide (TMDc) semiconductors. We have successfully achieved highly tunable topological phases in both TMDc heterobilayer and TMDc homobilayer moiré superlattices. Specifically, we have observed a robust IQAH effect and signatures of quantum spin Hall effect in AB-stacked $WSe_2/MoTe_2$. In addition, both the IQAH effect and the long-sought FQAH effect have been realized in twisted bilayer $MoTe_2$. Furthermore, the band topology in TMDc moiré superlattices is highly tunable by external electric fields, which enable us to realize novel topological quantum phase transitions. Our studies pave the path for the investigation of fractionally charged excitations and anyonic statistics at zero magnetic field based on 2D moiré materials.

[1] F. Xu et al. PRX 13, 031037 (2023).
[2] T. Li et al. Nature 600, 641-646 (2021).
[3] T. Li et al. Nature 597, 350-354 (2021).

About the speaker

李听昕，2011年于西北大学获学士学位，2016年于北京大学获博士学位。2016年至2021年先后在美国莱斯大学（2016.9-2018.3）和美国康奈尔大学（2018.3-2021.5）从事博士后研究，2021.6加入上海交通大学物理与天文学院，任长聘教轨副教授，博士生导师。从事实验凝聚态物理研究，主要研究兴趣为低维量子材料中的拓扑物理、强关联物理、磁性物理和超导物理。近几年在二维半导体莫尔超晶格、二维拓扑绝缘体、二维磁性材料等方向取得了一系列研究成果，发表学术论文20余篇，其中包括第一作者/通讯作者 Nature 两篇、Nature 子刊四篇、PRX/PRL 三篇。