＼オープン形式で開催！どなたでも出入り自由／

AOS Quantum Forum & Seminars

｜開催日時

2024.3.14(木) 13:00～17:45

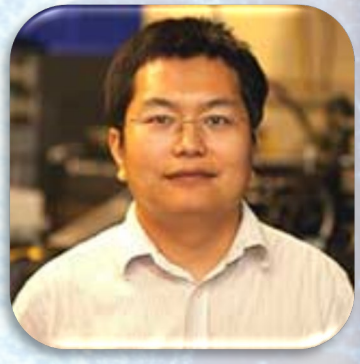
※セミナーは15:00～17:00

｜開催場所

片平北門会館2階･エスパス

｜主催　UW-TU Academic Open Space (AOS)
｜共催　材料科学国際共同大学院（GP-MS）
スピントロニクス国際共同大学院（GP-Spin）

｜講師



Xiaodong Xu 教授

ワシントン大学材料工学科/物理学科

セミナー①15:00～16:00
分数量子異常ホール効果の観測
強い電子-電子相互作用下での分数量子異常ホール（FQAH）効果の実験的観測を報告。また、異常ホール状態の発見やその関連効果による電荷の分数化やanyon統計の研究への新たな展望について。

Di Xiao 教授

ワシントン大学材料工学科/物理学科

セミナー②16:00～17:00
ねじれ二層TMDsにおけるトポロジカル状態
零磁場での整数および分数の量子ホール効果に注目が集まるねじれ二層TMDsについて解説。機械学習や極化電荷の役割、さまざまな充填における相図などを議論。

全体のスケジュール：
13:00-13:15　開会あいさつ等
13:15-13:40　東北大学の量子研究の概要（山下太郎教授）
13:40-14:40　研究紹介（佐藤宇史教授、好田誠教授、加藤俊顕准教授）
15:00-17:00　セミナー（Xiaodong Xu教授、Di Xiao教授）
17:10-17:40　ラウンドテーブルディスカッション

｜お問い合わせ　国際企画課国際事業係：✉kokusai-r@grp.tohoku.ac.jp

OBSERVATION OF FRACTIONAL QUANTUM ANOMALOUS HALL EFFECT

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University of Washington, Seattle, WA

The interplay between spontaneous symmetry breaking and topology can result in exotic quantum states of matter. A celebrated example is the quantum anomalous Hall (QAH) effect, which exhibits an integer quantum Hall effect at zero magnetic field due to topologically nontrivial bands and intrinsic magnetism. In the presence of strong electron-electron interactions, fractional-QAH (FQAH) effect at zero magnetic field can emerge, which is a lattice analog of fractional quantum Hall effect without Landau level formation. In this talk, I will present experimental observation of FQAH effect in twisted $MoTe_2$ bilayer, using combined magneto-optical and -transport measurements. In addition, we find an anomalous Hall state near the filling factor -1/2, whose behavior resembles that of the composite Fermi liquid phase in the half-filled lowest Landau level of a two-dimensional electron gas at high magnetic field. Direct observation of the FQAH and associated effects paves the way for researching charge fractionalization and anyonic statistics at zero magnetic field.

Reference

1. Observation of Fractionally Quantized Anomalous Hall Effect, Heonjoon Park *et al*., ***Nature***, https://www.nature.com/articles/s41586-023-06536-0 (2023);
2. Signatures of Fractional Quantum Anomalous Hall States in Twisted MoTe2 Bilayer, Jiaqi Cai *et al.*, ***Nature***, https://www.nature.com/articles/s41586-023-06289-w (2023);
3. Programming Correlated Magnetic States via Gate Controlled Moiré Geometry, Eric Anderson *et al*., ***Science***, https://www.science.org/doi/full/10.1126/science.adg4268 (2023).

Short Bio.

Xiaodong Xu is a Boeing Distinguished Professor in the Department of Physics, and Department of Materials Science and Engineering at the University of Washington. He obtained a PhD in Physics from the University of Michigan in 2008. After postdoc research at Cornell University, he joined the University of Washington in 2010. He is a Fellow of American Physical Society and Optical Society of America.

TOPOLOGICAL STATES IN TWISTED BILAYER TRANSITION METAL DICHALCOGENIDES

Di Xiao
Department of Materials Science and Engineering, Department of Physics,
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Recently, both the integer and fractional quantum Hall effect has been observed in twisted bilayer transition metal dichalcogenides (TMDs) at zero magnetic field, generating widespread interest in this materials system. In this talk, I will first briefly review the route towards materials realization of topological states, and then focus on the basic models describing twisted bilayer TMDs, including the origin of the nontrivial topology. I will then discuss how machine learning method can be used to establish the microscopic Hamiltonian and the important role of polarization charges in determining the band topology. Phase diagrams at various fillings as a function of twist angle and gate voltage will be discussed as well.

Reference

1. Interface engineering of quantum Hall effects in digital transition metal oxide heterostructures, Xiao et al, Nature Commun. 2, 596 (2011)
2. Fractional Chern insulator in twisted bilayer MoTe2, Wang et al, Phys. Rev. Lett. 132, 036501 (2024)
3. Polarization-driven band topology evolution in twisted MoTe and WSe2, Zhang et al, arXiv: 2311.12776

Short Bio.

Di Xiao is the Robert J. Campbell Professor of Materials Science and Engineering, and Professor of Physics at the University of Washington. He obtained his PhD in Physics from the University of Texas at Austin in 2007. After a four year stint at Oak Ridge National Laboratory, he joined Carnegie Mellon University in 2012, and moved to the University of Washington in 2021. He is a Fellow of American Physical.