TIXUAN TAN

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EDUCATION

University of Hong Kong Sept 2018 - Present
Bsc in Physics(starting from September 2020) *GPA: 4.3/4.3, ranking 1/44*[1]

University of Chicago Jan 2021- June 2021
Two-Quarter Exchange *GPA: 4.0/4.0*

RESEARCH INTEREST

Primary Interest (Trained)

- **Condensed Matter Theory**, including strongly correlated system, topological system, Moiré system, superconductivity, etc.
- **High Energy Theory**, including gravity, collider physics, models beyond SM (dark matter, SUSY, etc.), etc.

Other Interest

- Condensed Matter Experiment, Quantum Information

RESEARCH EXPERIENCE

Condensed Matter Theory Jan 2021 - Present
Moiré physics/Edge State physics *Prof. Wang Yao (HKU)*

- We study Moiré potential from hBN substrate. A collaboration with experimental group has been carried out and the result has been submitted. I am responsible for theoretical calculation on the phase transition.
- We observe a new kind of edge state in bilayer graphene with phase transition. I am responsible for all calculation involved and writing. For detail, see publication.
- We study the anomalous Bloch Oscillations and electrical control of edge magnetization in the above-mentioned graphene-based system. I am responsible for the calculation and writing.
- We study the correlated electron/exciton states in Moiré platform and dual Moiré platform. I am responsible for all calculation involved, electron states, topological invariants etc.

High Energy Theory July 2021 - Dec 2021
Dark Matter *Prof. Tao Liu (HKUST)*

- We focus on fuzzy dark matter, and probe the possibility of using binary black hole to probe their existence. I am responsible for dark matter evolution calculation.
- We study how to use the coupling of axion with photon and gravity to detect its existence.

High Energy Theory Jan 2022 - Present
Axion Detection *Prof. Liantao Wang (UChicago) and Prof. Zhen Liu (Minnesota)*

- We study the dynamics of necleus under the influence of cosmological axion background and the possibility of using the mechanism to probe the parameter space of axion. I work independetly with help of my advisors. I am responsible for all the literature review, as well as code implementation of my advisors' advice.

[1] I have transferred program, and this GPA includes only post-transfer courses, according to HKU's policy. GPA including pre-transfer courses would be 4.18/4.3. Before 2020, I was in other programs in the Business School. For ranking, see awards.

HONORS AND AWARDS

Dean's Honors List	In Business& Economics Faculty, by HKU	2019
Grace Wei Huang Memorial Prize	Academic-merit-based scholarship, by HKU	2019 Jun
Noel Chau Scholarship	Academic-merit-based scholarship, by HKU	2020 Jun
AEON Scholarship	Academic-merit-based scholarship, by HKU	2020 May
Zhi Yuan Scholarship	Academic-merit-based scholarship, by Soong Ching Ling Foundation	2018-2022
Lam Chi Him Memorial Prize in Physics	For being the best Year 2 physics student, by HKU	2021
Outstanding Poster Presentation	In the university-wide research poster presentation, by HKU	2021
Undergraduate Research Fellowship	With Research Award (awarded to $\frac{1}{3}$ of fellowship recipient), by HKU	2021
PLANCKS2022 Hong Kong District Champion	International theoretical physics competition, by Physical Society of Hong Kong	2022

PUBLICATION, PREPRINTS AND TALKS

Published

- **T. Tan** , C. Li, and W. Yao, Edge state in AB-stacked bilayer graphene and its correspondence with SSH ladder, Phys. Rev. B **104**, 245419 (2021)
- **T. Tan**, F. Fan, C. Li, and W. Yao, Anomalous Bloch oscillation and electrical switching of edge magnetization in bilayer graphene nanoribbon, Phys. Rev. B **106**, 045405 (2022)

Submitted

- D. Kim, R. Mayorga-Luna, D. Ye, **T. Tan** et al., Engineering Universal Potential of hBN Double Moiré Superlattices, **Under Review**.

Working Paper

- **Excitonic insulator states on the dual Moiré platform, with W. Yao.**
  We study how the electron correlation may manifest itself on the platform via symmetry breaking, superfluid state, and charge-transfer exciton states.
- **Axion detection via qubit decoherence, with L. Wang and Z. Liu**
  We work on how the interaction between axion and nucleon may be understood using quantum information formuation, and how this interaction may be implemented in near future for axion detection.

Talks and Poster

- **Talk** at **APS March Meeting**, March 15, 2022, Chicago. Connecting edge states in bilayer graphene nanoribbon with SSH ladder. Session F56.00013
- **Invited Talk** at **Research Colloquium** hosted by University of Hong Kong, October 28, 2021, on projects involving graphene nanoribbon.
- **Poster** at **Poster Presentation of SRF and ORF Schemes and Summer Research Internship of URFP Programme 2020-21 of University of Hong Kong**, October 21, 2021, on projects involving graphene nanoribbon.
- **Poster** at **The 24th International Conference on High Magnetic Fields in Semiconductor Physics (HMF-24)**, July, 2022

PROFESSIONAL SKILLS

Language

- IELTS:8/9, speaking 7, Dec 2021
- GRE 336 (V:166 Q:170), **pGRE in 2022 is cancelled due to Covid-19 in Hong Kong**.

Programming

- Mathematica (advanced), Matlab (advanced, primary use), Python, HTML
- Moire band caclulation (tight-binding, continuum), tight-binding calculation, topological invariant calculation, Hartree-Fock calculation, etc.

Courses

- All physics courses are full grade point.
- Graduate Courses: Particle Physics, Group Theory in Physics (Lie algebra & manifold), Graduate QM(Scattering & Quantum Information), Graduate EM I&II, Graduate Stat Mech, General Relativity.

Miscellaneous

- Particle Physics course project, available at *An Introduction to Quantum Field Theory and Feynman Rules*
- I investigated into the theory of topological insulator, as requested by Prof. Wang Yao during my project.
- Participated in the writing of the textbook *Advanced Classical Electromagnetism* by R. Wald and was mentioned in preface