

# TOMMY YINGZHE TAI

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## ABOUT MYSELF

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A dedicated and self-motivated research student who is highly passionate in condensed matter physics.

## EDUCATION

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**PhD candidate in Physics, Massachusetts Institute of Technology** **2022-2028**  
Nuh Gedik group, Condensed Matter Physics Experiment (CMX) Divison

**Bachelor of Arts in Natural Sciences (Physics), University of Cambridge** **2018-2021**  
First class honours (top 25%) with theoretical physics specialization:

1. Research review topic: using scanning Nitrogen-vacancy magnetometry to study magnetic skyrmions for reservoir computing applications (Supervisor: Prof. Mete Atatüre)
2. Computational project topic: study magnetic skyrmions using Metropolis algorithm (best project in cohort)

## RESEARCH/WORK EXPERIENCE

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**A\*STAR Institute of Materials Research and Engineering, Singapore** **2020-2022**

- Performed micromagnetic simulations to design magnetic multilayer stacks
- Performed magnetometry to characterize magnetic multilayer stacks
- Performed transport measurements to study anomalous Hall effect
- Designed Hall bars using autoCAD

**A\*STAR Institute for High Performance Computing, Singapore** **2018-2019**  
Theoretical/Computational Projects:

- Computed the semi-classical optical response of nodal loop materials
- Studied the topological properties of non-Hermitian spectra
- Simulated various topological Hamiltonians on the quantum computer IBM-Q

## CONFERENCES

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**International Conference on ‘Materials for Humanity (MH 21)’** **2021**  
Contributed a talk for our work on zero-field magnetic skyrmions

**Institute of Physics Singapore Meeting** **2021**  
Presented an invited talk on ‘The topology of non-Hermitian systems’

## FUNDING AND AWARDS

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**Burnett Prize** **2021**  
Awarded by Hughes Hall, University of Cambridge, for obtaining first class in BA degree

**National Science Scholarship (NSS-BS)** **2017**  
Awarded by Agency for Science, Technology, and Research, Singapore (A\*STAR)

## MANUSCRIPTS AND PUBLICATIONS

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### Engineering tunable zero-field ferromagnetic skyrmions on a modular multilayer platform using interlayer exchange coupling

XY Chen\*, **T Tai\***, HR Tan, HK Tan, R Lim, S Finizio, P Ho, A Soumyanarayanan  
Manuscript in preparation (Experimental work)

### Higher-order topological states on a quantum computer

JM Koh, **T Tai**, CH Lee  
Manuscript in preparation (Computational work)

### Zoology of non-Hermitian spectra and their graph topology

**T Tai**, CH Lee  
Submitted to Physical Review Letters, arXiv preprint [arXiv:2202.03462](https://arxiv.org/abs/2202.03462) (Theoretical work)

### Simulation of interaction-induced chiral topological dynamics on a digital quantum computer

JM Koh, **T Tai**, CH Lee  
[Physical Review Letters 129, 140502](https://doi.org/10.1103/PhysRevLett.129.140502) (2022)(Computational work)

### Designing non-Hermitian real spectra through electrostatics

R QX Yang, JW Tan, **T Tai**, JM Koh, L Li, S Longhi, CH Lee  
[Science Bulletin \(2022\)](https://doi.org/10.1126/science.1220104), arXiv preprint [arXiv:2201.04153](https://arxiv.org/abs/2201.04153) (Theoretical work)

### Stabilizing multiple topological fermions on a quantum computer

JM Koh, **T Tai**, YH Phee, WE Ng, CH Lee  
[npj Quantum Information 8 \(1\), 1-10](https://doi.org/10.1103/npjqi.2022.1) (2022) (Computational work)

### Anisotropic non-linear optical response of nodal loop materials

**T Tai**, CH Lee  
[Physical Review B 103 \(19\), 195125](https://doi.org/10.1103/PhysRevB.103.195125) (2021) (Theoretical work)

### Tidal surface states as fingerprints of non-Hermitian nodal knot metals

CH Lee, G Li, Y Liu, **T Tai**, R Thomale, X Zhang  
[Communications Physics 4 \(1\), 1-10](https://doi.org/10.1103/PhysRevX.4.011001) (2021) (Theoretical work)

### Enhanced higher harmonic generation from nodal topology

CH Lee, HH Yap, **T Tai**, G Xu, X Zhang, J Gong  
[Physical Review B 102, 035138](https://doi.org/10.1103/PhysRevB.102.035138) (2020) (Theoretical work)

## SELECTED SKILLS

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### Computational skills (in descending order of proficiency)

Python, L<sup>A</sup>T<sub>E</sub>X, Mathematica, Machine Learning, MATLAB, C++

### Laboratory Skills

Variable-temperature magnetometry, transport measurements, wirebonding, mask aligner, Terahertz spectroscopy

## SELECTED NON-ACADEMIC EXPERIENCES

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### Co-Chair of Cambridge University Physics Society

**2019-2020**

Led a team of enthusiastic physicists in organizing various activities for the school's Physics community - hosting weekly academic talks, organizing career conferences, socials and workshops.

### Course supervisor, University of Cambridge

**2021-2022**

Remotely conducted small-group supervisions for 29 and 15 students in third-year Relativity and Quantum Condensed Matter Physics respectively.