Yingkai Liu

Department of Physics
Katz School of Science and Health
Yeshiva University
Mobile: 917-292-8603
Email: yliu20@mail.yu.edu
Website: https://yk-liu.github.io

Education

2019 - present: Master of Science, Katz School of Science and Health, Yeshiva University, USA. (Anticipated Graduation Date: May 2019)

2015 - 2019: Bachelor of Science, Boling Class of Physics (Honor Program), Nankai University, China.

Publications

[1] Liu, Yifei, **Yingkai Liu***, and Emil Prodan. "Braiding flux-tubes in topological quantum and classical lattice models from class-D." *Annals of Physics* (2020): 168089.
*Yifei Liu and Yingkai Liu contributed equally to the paper.

[2] **Liu, Yingkai**, and Emil Prodan, "Quantum Spin Systems Over Triangulated Surfaces." *arXiv preprint arXiv:1912.12964* (submitted to *International Journal of Modern Physics C*) (2019).

[3] **Liu, Yingkai***, Yifei Liu, and Li-Wei Yu. "Happer model with puzzling degeneracy in periodic magnetic field." *arXiv preprint arXiv:1908.04726* (submitted to *Annual of Physics*) (2019).
*Yifei Liu and Yingkai Liu contributed equally to the paper.

Invited Talk

[1] **Topological Quantum Qudits: Principles and Simulations**, Mathematical Physics Seminar, Yeshiva University (New York), January 2020.

Research Interest

Learning Mathematical tools that explain the topological aspects of materials. Understanding the phenomenon of integer discreetness arising from continuous symmetry. Describing and discovering topological quantum systems. Learning through examples and models, especially coding and seeing the numerical result. Understanding how particles subject to simple individual laws can exhibit novel collective properties.

Research Experience

Sep. 2019 – Present: Student assistant, Yeshiva University, USA (Advisor: Prof. Emil Prodan).

- ❑ Learning and implementing realizations of the toric code.
- ❑ Learning converting visual diagrams of braiding to algebraic relations.

Dec. 2017 – June 2019: Undergraduate research fellow, Chern Institute of Mathematics (CIM), Nankai University, China (Advisor: Prof. Molin Ge).

- ❑ Calculated Berry phase of spin-1 particles in anomalous Zeeman effect.
- ❑ Studied gauge theory in topological calculations.

July. 2018 - Sept. 2018: Visiting undergraduate, Yeshiva University, USA (Advisor: Prof. Emil Prodan).

- ❑ Calculated the Chern number of a 2-D bulk model and winding number of edge model under fluctuation as an example of Index Theorem.
- ❑ Studied the Non-Abelian braiding of flux tubes as an implementation of quantum computation.

July 2017 - Oct. 2017: Visiting undergraduate, University of Nevada, Las Vegas, USA (Advisor: A. Prof. Qiang Zhu).

- ❑ Built a database prototype for processing, storing and querying VASP calculation results using Python.
- ❑ Built an Evolutionary Algorithm package using Python.

Apr. 2016 - Oct. 2017: Undergraduate research fellow, Nankai University, China (Advisor: Prof. Xiangfeng Zhou).

- ❑ Studied calculation methods of the Berry phase in 2D materials
- ❑ Investigated band structures of multiple 2D materials using the tight-binding method.

Awards and Scholarships

Dean's Scholarship ($10000) of Yeshiva University (2019);
Receives stipend total of $10000 from Prof. Emil Prodan (2019);
Boling scholarship of Nankai University (2015, 2016, 2017);
MCM Honorable Mentioning prize (2017);
MCM Successful Modeling prize (2016)