

# Yingkai Liu

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## Education

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2015 - present: Currently a senior undergraduate at Boling Class of Physics (Honor Program), Nankai University, China. GPA: 3.45 (Top 20%).

## Research Interest

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I am interested in the topological properties of materials and the phenomenon of integer discreteness arising from continuous symmetry. In particular, I am interested in learning advanced Mathematics tools, bridge it with actual Physics systems, by describing and discovering topological quantum systems. I am also interested in how particles subject to relatively simple laws can exhibit collective novel properties as a whole.

## Research Experience

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**Dec. 2017 - present: Undergraduate research fellow, Chern Institute of Mathematics (CIM), Nankai University, China (Advisor: Prof. Molin Ge).**

- ❑ Learning Berry phase of spin-1 particle in anomalous Zeeman effect.

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

- ❑ Studied index theorem and K-theory. Calculated the Chern number of a 2-D bulk model and winding number of edge model under fluctuation.
- ❑ Studied the Non-Abelian braiding of Majorana excitations 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 Berry phase in 2D materials
- ❑ Investigated the band structure of multiple 2D materials using tight-binding model.

## Awards and Scholarships

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MCM Successful Modeling prize (2016);  
MCM Honorable Mentioning prize (2017);  
Second scholarship of Nankai University (2016);  
Boling scholarship of Nankai University (2015, 2016, 2017);

## Courses Taken

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Theoretical Mechanics  
Quantum Mechanics  
Electrodynamics  
Thermodynamics  
Optics  
Introduction to Group theory  
Computational Physics  
Solid Physics (till June, 2019)  
Quantum Field Theory  
Advanced Quantum Mechanics (till Jan., 2019)

## Extracurricular Activities

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- ☐ Director of Academic Department, Student Union of School of Physics  
Responsible for holding college-wide and school-wide English and Physics activities and organize lectures of Physics.
- ☐ Participated in Physicists' Tournament of Nankai University and won the 4<sup>th</sup> place as group leader.