LIHAO YAN

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EDUCATION

University of Notre Dame *May 2021*
B.S. in Physics (Honors)
Double Major in Philosophy (Honors)
Overall GPA: 3.919
Physics Major GPA: 3.978

RESEARCH EXPERIENCE

Theoretical Condensed Matter Physics September 2019 - Present
Notre Dame, IN

- Worked on confined vortex matter in mesoscopic superconductors under the direction of Prof. Boldizsár Jankó at the University of Notre Dame and in collaboration with Prof. Milorad Milošević from the University of Antwerp
- **Showed that the triangular superconductor samples can be used to identify experimentally the existence of the anisotropic interaction and unconventional pairing**
- Used molecular dynamics simulations (MD) and numerical Ginzburg-Landau calculations to systematically study how the vortices rearrange themselves in mesoscopic containers when the anisotropic interaction is presented
- Studied how the interplay between sample geometry and anisotropy results in qualitative changes in the structure of the confined vortex matter in mesoscopic superconductors
- A manuscript is under preparation

Applied Math and Theoretical Nuclear Physics Summer 2019, Summer 2020
Berkeley, CA

- Worked on solving the eigenvalue problem of large sparse matrices of nuclear quantum many-body systems with Senior Scientist Dr. Chao Yang from Lawrence Berkeley National Laboratory, Prof. Mark Caprio from Notre Dame, and Prof. Weiguo Gao from Fudan University
- **Developed a novel reinforcement learning (RL) based selected configuration interaction (CI) method that has higher accuracy comparing to the existing perturbation based methods**
- Our RL algorithm belongs to the approximate Q learning scheme. It is able to effectively identify the most important rows and columns of a large sparse matrix. We then use this information to reduce the computational cost of solving the original matrix
- Realized several existing perturbation based selected CI algorithms in MATLAB to reduce the cost of ab-initio calculations of nuclear quantum many-body system

Experimental Nuclear Physics January 2018 - May 2020, Nov 2020 - Present
Notre Dame, IN

- Worked on the development of the next generation Active-Target Time Projection Chamber (ND Cube) with Prof. Tan Ahn at Notre Dame Nuclear Science Laboratory under the Institute for Structure and Nuclear Astrophysics
- **Analyzed the resolution of the ND Cube using electron drift line simulations**

- Simulated the electric field inside the detector with the finite element analysis software COMSOL, calculated the electron drift line using Garfield++, a toolkit developed by The European Organization for Nuclear Research (CERN)
- Designed the door of the detector using Autodesk Inventor, devised the electronic ZAP board using Autodesk Eagle, and participated in the commissioning and testing of the ND Cube
- Published a research article *Simulation of the ND Cube Active-Target Time Projection Chamber in Notre Dame's student science journal Scientia (Volume 10)*

PUBLICATIONS

1. Li Zhou, Lihao Yan, Mark A. Caprio, Weiguo Gao, and Chao Yang. Solving the k-sparse eigenvalue problem with reinforcement learning, 2020. https://arxiv.org/abs/2009.04414. Manuscript submitted for publication to the journal *CSIAM Transactions on Applied Mathematics*

PRESENTATIONS

To be presented at the 2021 APS March Meeting (Contributed Talk) March 2021
"Detecting anisotropic interaction between vortices under extreme confinement" *Virtual*

The APS Division of Nuclear Physics Meeting (Contributed Talk) October 2020
"Selected configuration interaction using reinforcement learning" *Virtual*

The 2020 APS March Meeting (Contributed Talk) March 2020
"Confined vortex matter with anisotropic interaction" *Virtual*

The APS Division of Nuclear Physics Meeting (Poster) October 2019
"Selected configuration interaction using reinforcement learning" *Crystal City, VA*

LBNL Computing Sciences Summer Student Poster Session (Poster) August 2019
"Selected configuration interaction using reinforcement learning" *Berkeley, CA*

Notre Dame College of Science Joint Annual Meeting (COS-JAM) (Poster) May 2019
"Development and simulation of the ND Cube Active Target Time Projection Chamber" *Notre Dame, IN*

Notre Dame's the Fall Undergraduate Research Fair (FURF) (Poster) October 2018
"Simulation of the ND Cube Active Target Time Projection Chamber" *Notre Dame, IN*

TEACHING ACTIVITIES

Physics Tutor Fall 2019, Spring 2020
Tutoring physics I and II for pre-med students *Notre Dame, IN*

HONORS & AWARDS

College of Science Joint Annual Meeting Best Poster Award May 2019
Won one of the seven Best Poster Award out of about ninety participants *Notre Dame, IN*

Notre Dame Eagan Fellowship 2018 - 2020
Awarded a $5000 yearly fund for summer research *Notre Dame, IN*

RELEVANT COURSES

Graduate Level

- Solid State Physics
- Quantum Mechanics I
- Mathematical Methods in Physics

Advanced Undergraduate/ Beginning Graduate Level

- Intro to Solid State Physics
- Intro to Quantum Computing
- Particle Physics and Cosmology

Computational Physics

- Computational Methods in Physics (Final Project: Lipkin's Model)
- Computational Laboratory in Statistical Mechanics

Undergraduate Level

- Complex Variables
- Quantum Mechanics I & II
- Thermal Physics
- Electromagnetics I & II
- Intermediate Mechanics

TECHNICAL SKILLS

Programming	C/C++, Python, Unix Shell Scripting, Machine Learning Programming, MATLAB, Mathematica
Engineering Software	ANSYS, COMSOL, Autodesk Inventor, Autodesk Eagle
Others	Linux, Git, LaTeX