LIHAO YAN

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EDUCATION

Yale University *May 2027*
Ph.D. in Physics

University of Notre Dame *May 2021*
B.S. in Physics (Honors)
Double Major in Philosophy
GPA: 3.904
Honors: The Dean's Research Award, *cum laude*

RESEARCH EXPERIENCE

Theoretical Optical Physics September 2022 - December 2022
New Haven, CT

- Did a semester long rotation project with Prof. Douglas Stone on the Steady-state *ab initio* Laser Theory (SALT)
- Implemented a numerical code for solving arbitrary 1D laser cavities using SALT with single-pole approximation
- Compared two different approximation regimes of the numerical SALT
- Prepared a tutorial article for SALT with single-pole approximation

Theoretical Condensed Matter Physics May 2022 – August 2022
New Haven, CT

- Worked on using information geometry to study spin glass systems under the direction of Prof. Nicholas Read at Yale University
- Investigated how the divergence of mutual information between the pure states of a spin glass relates to the spin-spin correlation functions

Theoretical Condensed Matter Physics September 2019 – May 2021
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**
- Studied how the interplay between sample geometry and anisotropy results in qualitative changes in the structure of the confined vortex matter in mesoscopic superconductors
- Used numerical Ginzburg-Landau calculations and molecular dynamics (MD) simulations to systematically study how the vortices rearrange themselves in mesoscopic containers when the anisotropic interaction is presented
- For the MD simulations, we used an isotropic potential but assumed an anisotropic penetration depth, which was proposed by Prof. Gianni Blatter and his collaborators, and we also used a phenomenological anisotropic potential proposed by Prof. Morten Eskildsen and his collaborators for MgB_2
- A manuscript is under preparation

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

- Worked on using reinforcement learning to solve large-scale eigenvalue problems as a Student Assistant intern under the direction of Senior Scientist Dr. Chao Yang from Lawrence Berkeley National Laboratory and in collaboration with 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**
- 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 the quantum many-body systems

Experimental Nuclear Physics January 2018 – May 2020, Nov 2020 – May 2021
Notre Dame, IN

- Worked on the development of the next generation Active-Target Time Projection Chamber (ND Cube) under the direction of Prof. Tan Ahn at Notre Dame Nuclear Science Laboratory and the Institute for Structure and Nuclear Astrophysics
- **Analyzed the resolution of the ND Cube using electron drift line simulations. The calculated resolution will be compared with the actual experimental data**
- 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 the 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. *CSIAM Transactions on Applied Mathematics*, 2(4), November 2021
2. T. Ahn, J. S. Randhawa, S. Aguilar, D. Blankstein, L. Delgado, N. Dixneuf, S. L. Henderson, W. Jackson, L. Jensen, S. Jin, J. Koci, J. J. Kolata, J. Lai, J. Levano, X. Li, A. Mubarak, P. D. O'Malley, S. Ramirez Martin, M. Renaud, M. Z. Serikow, A. Tollefson, J. Wilson, and L. Yan. The Notre-Dame Cube: An active-target time-projection chamber for radioactive beam experiments and detector development. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 1025:166180, February 2022

PRESENTATIONS

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" *Denver, CO*

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*

HONORS & AWARDS

The Dean's Research Award May 2021
The recipient of the Class of 2021 *Notre Dame, IN*

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*

Eagan Summer Fellowship 2018 – 2021
Awarded $5000 summer research funding each year for three years *Notre Dame, IN*

RELEVANT GRADUATE COURSES

- Solid State Physics
- Relativistic Field Theory
- Quantum Many-Body Theory
- Statistical Mechanics
- Mathematical Statistical Mechanics
- Electromagnetic Theory
- Advanced Classical Mechanics
- Quantum Mechanics
- Mathematical Methods in Physics
- Intro to Quantum Computing
- Particle Physics and Cosmology
- Intro to Representation Theory

TECHNICAL SKILLS

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