# Zhuan Li

Ph.D. Candidate in Physics

Phone: +1(412)-773-9726
Email: zhl153@pitt.edu
Webpage: https://zhuanli.netlify.app
Address: Los Alamos, NM 87544

## Education

**University of Pittsburgh** — PA, United States
Ph.D. in Physics, Advisor: Prof. Roger Mong — 08/05/2019 – 05/01/2025 (expected)

**University of Bristol** — Bristol, United Kingdom
Visiting student — 01/01/2018 – 06/01/2018

**University of Chinese Academy of Sciences** — Beijing, China
B.Sc. in Physics, Advisor: Prof. Pan Zhang — 09/01/2015 – 06/30/2019

## Skills

- **Coding**: Python, Julia, SQL, Mathematica, Qiskit, LaTeX.
- **Machine Learning Tools**: PyTorch, Scikit-Learn, TensorFlow.
- **Knowledge Background**: Probability and Statistics, Machine Learning, Convex Optimization, Linear Algebra, Computational Physics, Quantum Information and Quantum Computation.

## Research Experience

- **Ultra-High Fidelity Sampling** (Los Alamos National Lab, Aug 2024 - present)
  - Applied machine learning algorithms, including **Neural Networks** and **Linear/Quadratic models**, to accurately predict the response function of the D-Wave quantum annealer.
  - Developed and implemented **Importance Sampling** method to enhance the efficiency and accuracy of Gibbs sampling, achieving an accuracy increase from **95% to 99.8%**.
- **Quantum Error Correction & Topological Phase** (University of Pittsburgh, May 2020 - Jul 2024)
  - Conducted **Tensor Network** (MPS and PEPS) analyses to the impact of noise on surface code quantum error correction.
  - Implemented modern algebra method (**category theory**) to classify noised induced topological phases of the Toric Code model into 5 sub-categories.
  - Investigated quantum noise-induced phase transitions, and designed robust error correction protocols based on postselection strategies to mitigate noise effects.
- **Quantum System Simulations**
  - Applied **Markov Chain Monte Carlo** and **Metropolis-Hastings algorithms** for analyzing entropy properties in random quantum systems, contributing to statistical mechanics research.
  - Developed and implemented a **numerical PDE** method to optimize the efficiency of the parametric Josephson amplifier, increasing the theoretical energy conversion efficiency to 50% (compared to 2% in existing amplifiers).
  - Utilized **Ansys HFSS** for 3D electromagnetic field simulations across multiple device designs, optimizing device functionality through detailed electromagnetic property analysis.

## Personal Projects

- **Credit Card Fraud Detection** [Detailed Description] [Code]
  - Developed and optimized credit card fraud detection models (**logistic regression, random forest, shallow neural networks**) with undersampling to manage class imbalance.
  - Assessed model efficacy using confusion matrices and F1 scores.
- **Galaxy Classification Using Machine Learning** [Detailed Description] [Code]
  - Adapted **ResNet** for feature extraction from images, applying **PCA** for dimensionality reduction.
  - Implemented **K-means** and **Spectral clustering** to classify galaxies into different distinct types, achieving consistent results across methods.