

KYLE QIANLI MA, PHD - PHYSICS

1 Bethel Valley Road, Oak Ridge, TN, USA.37831

kyleqianlima@gmail.com

+1 865-253-0212

SUMMARY

- Physicists at Oak Ridge National Laboratory with a strong background in condensed matter physics, quantum material and modeling of strong correlated systems.
- Experience in applying optimization algorithms and various Neural Network (NN) structures to physics models.
- Strong data analysis skills (data cleaning, modeling, feature selections etc)
- Scientific software development with Python, Matlab.
- Machine learning experience with PyTorch, TensorFlow, Keras, sci-kit learn
- Publications on top peer-reviewed journals (Nature, PRB, PRM, JAC)

SKILLS

Machine Learning: Feed-forward NN, Convolutional Neural Network (CNN), Dimension reduction (PCA), auto-encoder, Vision Transformer (ViT).

Optimization: Particle-Swarm-Optimization (PSO), Covariance matrix adaptation evolution strategy (CMA-ES).

Software Languages: Python(advanced), Matlab(advanced), Julia(intermediate), MySQL(intermediate), Labview (occasional)

Version Control: Git, GitHub

Parallel Computing: mpi4py, CUDA

WORK EXPERIENCE

- **2022/02-present:** Postdoctoral research associate at Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee, USA
Supported by the fellowship:
Investigation of Local Site Susceptibility through neutron scattering - Dr.Huibo Cao
Efficient and reliable machine learning for leadership facility scientific data analytics -Dr. Guannan Zhang

EDUCATION

- **2017/09-2022/02:** PhD, Condensed Matter Physics, McMaster University
(Highlighted Courses: Foundation of Scientific Computation A-, Foundations of Machine Learning Theory A+)
- **2015/09-2017/09:** MSc, Condensed Matter Physics, McMaster University
- **2013/09-2015/09:** BS, Physics, University of Waterloo (with Distinction)

VISITING SCIENTIST

- **09/2017 - 11/2017:** UT, Austin: Joined Nobel laureate John B.Goodenough's group on new energy material development. Resulted 1 publication at **Phys. Rev. Materials 4, 114801, 2020.**

PROJECTS

- **2022-present:** Initiated the first effort in single crystal neutron diffraction group at ORNL to develop prototypical machine learning models, Spin-AI, within PyTorch frame to predict physical Hamiltonian exchange matrices that describes 4-D inelastic neutron data. Project involves building training data pipeline, training the auto-encoder based neural network, hyper-parameter tuning and train-test validation through multiple techniques such as dimensional reduction (PCA, auto-encoder), parallel computing (CUDA) etc. Github: <https://github.com/KyleQianliMa/Spin-AI>
- **2020-present:** Published an efficient python package - CrysFieldExplorer, that performs extremely efficient multivariate optimization of the crystal electric field problems using PSO and CMA-ES algorithms. The performance improvement of CrysFieldExplorer is estimated to be 10-50 faster than currently existing algorithms depending on the dimension of search space. Results published at **J. Appl. Cryst.** (2023). 56, 1229-1241. Github: <https://github.com/KyleQianliMa/CrysFieldExplorer>.
- **2015-2022:** Revolutionized the understanding of the magnetic ground states of high T_C superconducting material $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$ through a series of first author publications. Performed multiple (30+) neutron/x-ray diffraction experiments at national labs (ORNL, ANSTO, CHESS, Argonne etc). Analyzed $\sim 1TB$ of neutron data using specialized softwares (Mantid, Dave, etc) on ORNL supercomputing clusters. Facilitated the collaborations between multi-national research groups.
- **2017-2018:** Maintained and updated existing repository of an Add-on for World of Warcraft with over 3.4million using Lua language through pull requests. <https://github.com/KyleQianliMa/Gladius>

PUBLICATIONS: 10 PUBLICATIONS ON TOP JOURNALS (NATURE, PNAS, PRM, JAC)

- CrysFieldExplorer: Rapid optimization of the Crystal Field Hamiltonian First author, **J. Appl. Cryst.** (2023). 56, 1229-1241
- Field-induced partial disorder in a Shastry-Sutherland lattice. Co-author, **Nature Communications** 14 (1), 3641, 2023
- Magnetic Field Tuning of Parallel Spin Stripe Order and Fluctuations near the Pseudogap Quantum Critical Point in $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$. First author, **Phys. Rev. B** 106, 214427, 2022.
- Dynamic Parallel Spin Stripes from the 1/8 anomaly to the End of Superconductivity in $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$. First Author, **Phys. Rev. Research** 4, 013175, 2022
- Parallel Spin Stripes and Their Co-existence with Superconducting Ground States at Optimal and High Doping in $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$. First author, **Phys. Rev. Research** 3 (2), 023151

- Materials preparation, single crystal growth and the phase diagram of the high temperature superconductor $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$. Co-first author, **Phys. Rev. Materials** 4, 114801, 2020
- Vanishing nematic order beyond the pseudogap phase in overdoped cuprate superconductors. Co-author, **PNAS** 2021 118 (34) e2106881118.
- Thermopower across the phase diagram of the cuprate $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$: signatures of the pseudogap and charge-density-wave phases. Co-author, **Phys. Rev. B** 103 (15), 155102
- Thermodynamic signatures of quantum criticality in cuprate superconductors. Co-author, **Nature** 567 (7747), 218-222.
- Long-wavelength correlations in ferromagnetic titanate pyrochlores as revealed by small-angle neutron scattering. Co-author, **Physical Review B** 97 (22), 224401.

CONFERENCE PRESENTATIONS

- CrysFieldExplorer: Rapid Optimization of the Crystal Field Hamiltonian. APS, Las Vegas, 2023
- Parallel Spin Stripes and Their Coexistence with Superconducting Ground States at Optimal and High Doping in $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$. APS online, 2021
- Applications of Machine learning and deep learning to the search of high temperature superconductors, Journal Club, McMaster University 2019.
- Neutron Scattering Study of Single Crystals of the High Tc Superconductor Nd-LSCO at High Doping, APS, Boston 2018
- Structural Phase Transitions: a Limiting Factor for Quantum Criticality and Superconductivity in $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$, APS, Los Angeles 2018
- Crystal Field Excitations Across High Tc Phase Diagram in $La_{1.6-x}Nd_{0.4}Sr_xCu_2O_4$, APS New Orleans 2017

SUMMER SCHOOL AND COURSES

- CSE 700/CAS 708 Scientific Computing A-
- CAS 774 Introduction to Machine learning A+
- Harnessing Quantum Matter Data Revolution Virtual Symposium and Summer School (June, 2021)
Introduction and hands-on tutorial of empowering machine learning in physics to identify phase transitions.
- NXS summer School (August, 2015)
Highly selective summer school hosted by US Department of Energy among young scientist in condensed matter physicists.

CERTIFICATIONS

- Financial Engineering and Risk Management Specialization (work in progress)
- Deep Learning and Reinforcement Learning - Issued October 2021, IBM
- Supervised Machine Learning: Regression - Issued August 2021, IBM
- Exploratory Data Analysis for Machine Learning - Issued July 2021, IBM

LEADERSHIP AND SERVICE

- 2015-2022: Supervising undergraduate students at McMaster University in junior and senior courses.
- 2017-current: External reviewer for experimental design at Australian Nuclear Science and Technology.
- 2017-2020 Captain for McMaster Science soccer team. 1 Graduate Soccer League Cup champion, 5 intramural champions.
- 2017-current: American Physics Society general member.

LINKS

Website: <https://www.kyleqianlima.com/>

Github: <https://github.com/KyleQianliMa>

linkedin: <https://www.linkedin.com/in/qianli-ma-4950aaa5/>

Google Scholar: <https://scholar.google.com/citations?user=L9c-3KcAAAAJ&hl=en>