JIAO LIN

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Research interests: Advanced data analysis in Neutron scattering and imaging, especially virtual experiments with Monte Carlo neutron ray-tracing, super-resolution techniques and their applications.

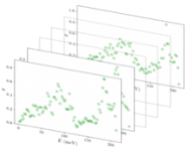
EXPERIENCE

2015 – Now: Software Scientist, Oak Ridge National Lab
2012 – 2015: Visiting Scientist, Oak Ridge National Lab
2011 – 2015: Director of information system, Imagin'Labs Corporation
2008 – 2015: Computational Scientist, California Institute of Technology
2005 – 2008: Assistant Scientist, California Institute of Technology
2004 – 2005: Postdoctoral Fellow, California Institute of Technology

EDUCATION

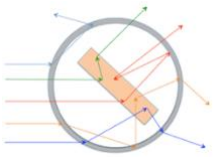
JUNE 2004, PhD, Materials Science, California Institute of Technology
JUNE 1999, Master of Science, Condensed Matter Physics, Chinese Academy of Sciences
JUNE 1996, Bachelor of Science, Physics, Peking University

ACHIEVEMENTS



Emerging applications of super resolution imagery techniques in neutron scattering data

Super resolution satellite image correlation helps study glacier erosion law



Monte Carlo neutron ray-tracing simulations for neutron scattering experiments

iMars3D: Neutron tomography reconstruction

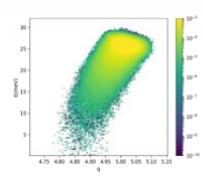
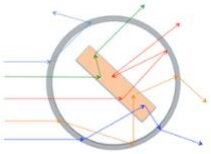
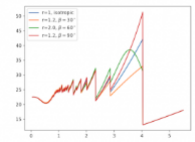
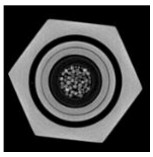
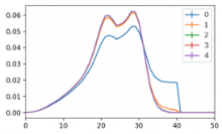
SKILLS

- **Scientific research**
- Neutron scattering/Direct geometry inelastic spectroscopy/Neutron imaging/…
- Computer vision/Satellite imagery
- Physics / Materials science

- **Scientific computing**
- Python/C++/JAVA/Fortran; javascript; Matlab/Mathematica; conda/Jupyter/plotly/…
- Monte Carlo ray-tracing: MCViNE/McStas
- CT reconstruction; Avizo/Amira
- High performance computing. MPI/OpenMP

SOFTWARE

I am the main developer for the following software packages:

	**DGSRES** The resolution function in direct geometry neutron chopper spectrometers are fascinating. They exist up to up to 4 dimensions in powder and single crystal experiments. This package is used to calculation point spread functions	• Web app • Experimental data for ARCS and SEQUOIA • Published ARCS data • Source code
	**MCViNE** A software package for simulation of modern, complex neutron sample/sample environments, and detector systems. ~240k lines of C++/Python	• Homepage • Publications • Source code
	**BraggEdgeModeling** given lattice structure of a material and optionally a texture model and an instrument beam model, calculate neutron Bragg Edge spectrum as a function of neutron wavelength.	• Publication • Source code
	**iMars3D** Neutron tomography is finding applications in engineering, material science, biology, and archeology. This package is in use by ORNL neutron imaging beamlines for neutron CT reconstructions.	• Source code
	**Multiphonon** Obtain phonon density of states from neutron DGS data, applying multiphonon corrections.	• Publication • source code

More at https://linjiao.info/software

PROJECTS

@ ORNL

- Initiate and lead the project to apply optical super-resolution techniques to data analysis for direct-geometry time-of-flight neutron spectrometers
- Continue expanding applications of the MCViNE package for virtual neutron experiments, design of neutron instruments at the Second Target Station of the Spallation Neutron Source, and aid in design of sample environments including collimators and furnaces
- Day to day support of SNS/HFIR users for data reduction, modeling, simulation, and optimization, for direct geometry spectrometers and neutron imaging instruments
- Mentor postdocs, and PhD and college students
- Review papers for the Journal of Open Source Software
- Contribute to SANS reduction software development
- Developed CT reconstruction workflow for CG1D neutron imaging beamline at HFIR and facilitated automatic CT reconstruction
- Improved software engineering practice for the MCViNE project by switching to github, cmake, travis-CI, conda, and docker.
- Created and maintain linux-64 conda recipe for Mantid, a large neutron data reduction C++/python package (1M lines of code), and its system-tests jenkins task

@ Caltech CACR

- Developed MCViNE, a Monte Carlo neutron ray-tracing simulation package (~240k lines) with python and C++

- Developed a python/C++ package (~50k lines), including a semi-global matching algorithm, for the COSI-Corr project, a satellite image correlation tool.
- Led the inelastic neutron scattering team of the DANSE software project, developing a series of data reduction, analysis, and modeling tools.

@ Caltech Materials Science

Development of Mossbauer Powder Diffractometry

Theory

- Systematically analyzed polarization effects in Mossbauer scattering by using spherical harmonics expansions
- Developed a kinematical theory of Mossbauer diffraction, including interference between electronic and nuclear resonant scattering

Experiment

- Made substantial improvements to instrumentation (hardware and software) of the Mossbauer powder diffractometor.
- For the first time, measured a full spectrum of Mossbauer diffraction patterns of a polycrystalline Fe_3Al sample; carried out systematic analysis of Mossbauer diffraction data in two dimensions: diffraction angle (traditional diffraction technique) and photon energy; studied the defect chemical environments in the sample using data derived from Mossbauer diffraction, and TEM experiments. Comparison between data and various simulations (including Monte Carlo simulation of ordering in the alloy) revealed structures of defects.

Characterization of CZT/CT X-ray Detectors

- Studied the performance of detectors in connection with leakage current, etc.
- Developed data analysis software using C++/python

@ Chinese Academy of Sciences

- Studied in theory the mechanism of the linear and nonlinear optical properties of crystals, especially borate series, using *ab initio* calculations; developed a new calculation method.
- The work is being cited 30-40 times per year since 2015, showing the long-lasting impact of an original computational research.

FUNDING

2018-Now: ORNL LDRD *A streamlined strategy for integrated collimator design and sample environment*. $290K/year. Co-Investigator

2017-2018: ORNL LDRD *Super-resolution reconstruction for Inelastic Neutron Scattering Spectra from Direct Geometry Chopper Spectrometers*. $190K/year. Principal Investigator

2012-2015: ORNL subcontract *Virtual Neutron Facility at SNS*. $170K/year. Lead Investigator

2013-2014: Caltech/JPL President's and Director's Fund. *The Advanced Rapid Imaging and Analysis (ARIA) Co-laboratory for Natural Hazards Research*. $298K/year. Co-Investigator

2011-2013: KISS technical program *Monitoring Earth Surface Changes from Space* $240K/year. Architect

2006-2012: NSF DANSE software project. $2.4M/year. Lead developer of the inelastic group

SUPERVISION / MENTORING

- Dr. Fahima Islam, Postdoc fellow, "*Super-resolution reconstruction for Inelastic Neutron Scattering Spectra from Direct Geometry Chopper Spectrometers"*, ORNL
- Ian Lumsden, "*SCADGen: converting MCViNE 3D models to OpenSCAD models*", ORNL
- Dr. Hillary Smith, Postdoc fellow, "*Virtual neutron facilities at SNS"*, Caltech.

PUBLICATION

Books and book chapters

1. B. Fultz, T. Kelley, **J. Lin**, J. Lee, O. Delaire, M. Kresch, M. McKerns, and M. Aivazis, *Experimental inelastic neutron scattering: introduction to DANSE*, 2009.
2. B. Fultz and **J. Lin**, "Mössbauer diffractometry," in *Material research in atomic scale by mössbauer spectroscopy*, Springer, Dordrecht, 2003, p. 285–295.
3. **J. Lin**, "Mossbauer diffractometry: principles, practice, and an application to a study of chemical order in iron aluminide," PhD Thesis, California Institute of Technology, 2004.

Refereed Journal Papers

2019

1. Fahima Islam, **Jiao Y. Y. Lin**, Richard Archibald, Douglas L. Abernathy, Iyad Al-Qasir, Anne A. Campbell, Matthew B. Stone, Garrett E. Granroth, "Super-resolution energy spectra from neutron direct-geometry spectrometers", submitted
2. **Jiao Y. Y. Lin**, Fahima Islam, Gabriele Sala, Ian Lumsden, Hillary Smith, Mathieu Doucet, Matthew B. Stone, Douglas L. Abernathy, Georg Ehlers, John F. Ankner, and Garrett E. Granroth, "Recent developments of MCViNE and its applications at SNS", submitted
3. Jean-Christophe Bilheux, Hassina Bilheux, **Jiao Lin**, Yuxuan Zhang, "Neutron Imaging Analysis using Python Jupyter Notebook", submitted
4. J. Leiner, H. O. Jeschke, R. Valent{'i}, S. Zhang, A. Savici, **J. Lin**, M. Stone, M. Lumsden, J. Hong, O. Delaire, and others, "Frustrated magnetism in mott insulating $(V_{1-x}Cr_x)_2O_3$," *Physical Review X*, vol. 9, iss. 1, p. 11035, 2019.
5. M. Stone, G. Sala, and **J. Lin**, "Design of a radial collimator for the sequoia direct geometry chopper spectrometer," *Physica B: condensed matter*, vol. 564, p. 17–21, 2019.
6. **J. Y. Lin**, A. Banerjee, F. Islam, M. D. Le, and D. L. Abernathy, "Energy dependence of the flux and elastic resolution for the arcs neutron spectrometer," *Physica B: condensed matter*, 2019.

2018

7. **J. Y. Lin**, F. Islam, and M. Kresh, "Multiphonon: phonon density of states tools for inelastic neutron scattering powder data," *Journal of open source software*, vol. 3, iss. 21, 2018.
8. **J. Y. Lin** and G. Song, "BEM: modeling for neutron Bragg-edge imaging.," *J. open source software*, vol. 3, iss. 30, p. 973, 2018.
9. G. Sala, **J. Y. Lin**, V. B. Graves, and G. Ehlers, "Conceptual design of chess, a new direct-geometry inelastic neutron spectrometer dedicated to studying small samples," *Journal of applied crystallography*, vol. 51, iss. 2, p. 282–293, 2018.

2017

10. H. L. Smith, C. W. Li, A. Hoff, G. R. Garrett, D. S. Kim, F. C. Yang, M. S. Lucas, T. Swan-Wood, **J. Y. Lin**, M. B. Stone, and others, "Separating the configurational and vibrational entropy contributions in metallic glasses," *Nature physics*, vol. 13, iss. 9, p. 900, 2017.
11. J. L. Niedziela, R. Mills, M. J. Loguillo, H. D. Skorpenske, D. Armitage, H. L. Smith, **J. Y. Lin**, M. S. Lucas, M. B. Stone, and D. L. Abernathy, "Design and operating characteristic of a vacuum furnace for time-of-flight inelastic neutron scattering measurements," *Review of scientific instruments*, vol. 88, iss. 10, p. 105116, 2017.
12. G. Song, **J. Lin**, J. Bilheux, Q. Xie, L. Santodonato, J. Molaison, H. Skorpenske, A. M Dos Santos, C. Tulk, K. An, and others, "Characterization of crystallographic structures using Bragg-edge neutron imaging at the spallation neutron source," *Journal of imaging*, vol. 3, iss. 4, p. 65, 2017.

2016

13. S. Diallo, **J. Lin**, D. Abernathy, and R. Azuah, "Momentum and energy dependent resolution function of the arcs neutron chopper spectrometer at high momentum transfer: comparing simulation and experiment," *Nuclear instruments and methods in physics research section a: accelerators, spectrometers, detectors and associated equipment*, vol. 835, p. 34–41, 2016.

14. Y. Yiu, A. A. Aczel, G. E. Granroth, D. L. Abernathy, M. B. Stone, W. Buyers, **J. Lin**, G. D. Samolyuk, G. M. Stocks, and S. E. Nagler, "Light atom quantum oscillations in UC and US," *Physical review b*, vol. 93, iss. 1, p. 14306, 2016.
15. D. Kim, O. Hellman, J. Herriman, H. Smith, **J. Lin**, N. Shulumba, J. Niedziela, C. Li, D. Abernathy, and B. Fultz, "Pure phonon anharmonicity and the anomalous thermal expansion of silicon", PNAS, 2016.
16. **J. Y. Lin**, H. L. Smith, G. E. Granroth, D. L. Abernathy, M. D. Lumsden, B. Winn, A. A. Aczel, M. Aivazis, and B. Fultz, "MCViNE–an object oriented Monte Carlo neutron ray tracing simulation package," *Nuclear instruments and methods in physics research section A: accelerators, spectrometers, detectors and associated equipment*, vol. 810, p. 86–99, 2016.

2007-2015

17. F. Herman, O. Beyssac, M. Brughelli, S. N. Lane, S. Leprince, T. Adatte, **J. Y. Y. Lin**, J. Avouac, and S. C. Cox, "Erosion by an alpine glacier," *Science*, vol. 350, iss. 6257, p. 193–195, 2015.
18. **J. Lin**, A. A. Aczel, D. L. Abernathy, S. E. Nagler, W. Buyers, and G. E. Granroth, "Using Monte Carlo ray tracing simulations to model the quantum harmonic oscillator modes observed in uranium nitride," *Physical Review B*, vol. 89, iss. 14, p. 144302, 2014.
19. D. L. Abernathy, M. B. Stone, M. Loguillo, M. Lucas, O. Delaire, X. Tang, **J. Lin**, and B. Fultz, "Design and operation of the wide angular-range chopper spectrometer arcs at the spallation neutron source," *Review of scientific instruments*, vol. 83, iss. 1, p. 15114, 2012.
20. B. J. Keith, J. R. Fennick, D. R. Nelson, C. E. Junkermeier, **J. Y. Lin**, C. W. Li, M. M. McKerns, J. P. Lewis, and B. Fultz, "Atomsim: web-deployed atomistic dynamics simulator," *Journal of applied crystallography*, vol. 43, iss. 6, p. 1553–1559, 2010.
21. A. D. Christianson, M. D. Lumsden, O. Delaire, M. B. Stone, D. L. Abernathy, M. A. McGuire, A. Sefat, R. Jin, B. C. Sales, D. Mandrus, and others, "Phonon density of states of $LaFeAsO_{1-x}F_x$," *Physical Review Letters*, vol. 101, iss. 15, p. 157004, 2008.
22. M. Kresch, M. Lucas, O. Delaire, **J. Lin**, and B. Fultz, "Phonons in aluminum at high temperatures studied by inelastic neutron scattering," *Physical Review B*, vol. 77, iss. 2, p. 24301, 2008.
23. O. Delaire, M. Kresch, J. Muñoz, M. Lucas, **J. Lin**, and B. Fultz, "Electron-phonon interactions and high-temperature thermodynamics of vanadium and its alloys," *Physical Review B*, vol. 77, iss. 21, p. 214112, 2008.
24. M. Kresch, O. Delaire, R. Stevens, **J. Lin**, and B. Fultz, "Neutron scattering measurements of phonons in nickel at elevated temperatures," *Physical Review B*, vol. 75, iss. 10, p. 104301, 2007.

2001-2004

25. C. H. Chen, W. R. Cook, F. A. Harrison, and **J. Y. Lin**, "Characterization of a large-format, fine-pitch CdZnTe pixel detector for the heft balloon-borne experiment," *IEEE transactions on nuclear science*, vol. 51, iss. 5, p. 2472–2477, 2004.
26. C. H. Chen, W. R. Cook, F. A. Harrison, **J. Y. Lin**, P. H. Mao, and S. M. Schindler, "Characterization of the heft CdZnTe pixel detectors," in *Hard x-ray and gamma-ray detector physics v*, 2004, p. 9–19.
27. **J. Y. Lin** and B. Fultz, "Spatial periodicities of defect environments in 57Fe3Al studied by Mössbauer powder diffractometry," *Zeitschrift für kristallographie-crystalline materials*, vol. 219, iss. 3, p. 172–178, 2004.
28. **J. Lin** and B. Fultz, "Site-specific long-range order in 57Fe3Al measured by Mössbauer diffractometry," *Philosophical magazine*, vol. 83, iss. 22, p. 2621–2640, 2003.
29. B. Fultz, T. Stephens, **J. Lin**, and U. Kriplani, "Mössbauer diffractometry on polycrystalline 57 Fe3Al," *Physical Review B*, vol. 65, iss. 6, p. 64419, 2002.
30. **J. Lin**, B. Fultz, and U. Kriplani, "Mössbauer diffractometry on chemical sites of 57Fe in Fe3Al," *Hyperfine interactions*, vol. 141, iss. 1-4, p. 145–150, 2002.
31. U. Kriplani, **J. Lin**, M. Regehr, and B. Fultz, "Intensities of Mössbauer diffractions from polycrystalline bcc 57Fe," *Physical Review B*, vol. 65, iss. 2, p. 24405, 2001.

32. **J. Lin**, U. Kriplani, M. Regehr, and B. Fultz, "Polarization factors for 57 Fe Mössbauer diffractions from polycrystals," *Hyperfine interactions*, vol. 136, iss. 3-8, p. 663–672, 2001.

1999-2001

33. Z. Lin, **J. Lin**, Z. Wang, Y. Wu, N. Ye, C. Chen, and R. Li, "Theoretical calculations and predictions of the nonlinear optical coefficients of borate crystals," *Journal of physics: condensed matter*, vol. 13, iss. 23, p. R369, 2001
34. Z. Lin, **J. Lin**, Z. Wang, C. Chen, and M. Lee, "Mechanism for linear and nonlinear optical effects in LiB3O5, CsB3O5, and CsLiB6O10 crystals," *Physical review b*, vol. 62, iss. 3, p. 1757, 2000.
35. C. Chen, Z. Shao, J. Jiang, J. Wei, **J. Lin**, J. Wang, N. Ye, J. Lv, B. Wu, M. Jiang, and others, "Determination of the nonlinear optical coefficients of YCa4O(BO3)3 crystal," *JOSA B*, vol. 17, iss. 4, p. 566–571, 2000.
36. C. Chen, N. Ye, **J. Lin**, J. Jiang, W. Zeng, and B. Wu, "Computer-assisted search for nonlinear optical crystals," *Advanced materials*, vol. 11, iss. 13, p. 1071–1078, 1999.
37. **J. Lin**, M. Lee, Z. Liu, C. Chen, and C. J. Pickard, "Mechanism for linear and nonlinear optical effects in β-BaB2O4 crystals," *Physical Review B*, vol. 60, iss. 19, p. 13380, 1999.