Xun (Jack) Li

Ph.D. in Geophysics jack.li@ed.ac.uk

PROFILE

I am a geophysicist working at the interface of laboratory seismology, rock physics, and subsurface monitoring. I aim to develop breakthrough technologies and fundamental theories in support of the energy transition to a net-zero world. My expertise spans seismic methods and rock physics, which are central to decision-making in subsurface renewable energy exploration. I am committed to teaching, mentoring, and sharing insights from my academic training and research experience.

PROFESSIONAL CAREER

Postdoctoral Research Associate, University of Edinburgh, UK Nov 2023 – Present

- Participated in and led laboratory experiments combining synchrotron X-ray tomography, active-source ultrasonics, and passive microseismic monitoring under triaxial loading.
- Developed CPU/GPU-based workflows for continuous seismic/acoustic data processing, including event detection, feature extraction, seismic velocity analysis, and fracture interpretation.
- Built digital twins and numerical models to optimize experimental design, source-receiver configurations, and monitoring capability.
- Processed large-scale datasets, including continuous seismic recordings and 3D synchrotron X-ray tomography volumes, and applied Digital Volume Correlation to quantify internal deformation and fracture evolution.
- Developed a real-time seismic velocity monitoring and forecasting system for small-scale rock deformation experiments.
- Investigated seismic velocity transients and their relationship to damage accumulation, rupture nucleation, and catastrophic failure.
- Curated a literature database of transient seismic-velocity changes for comparative analysis and mechanism-focused research.

EDUCATION

ETH Zurich (Swiss Federal Institute of Technology), Switzerland Sep 2018 – Sep 2022

- Ph.D. in Geophysics
  - Advisor: Prof. Johan Robertsson
- Thesis: *Elastic immersive wave experimentation*
  - Solved boundary-reflection challenges in 3D elastic wave experiments.
  - Developed internal absorbing boundary conditions enabling closed-aperture wavefield decomposition in solid media.
  - Implemented digital twins to optimize experimental design and correct source signatures.
  - Automated scanning laser Doppler vibrometry via robotics for dense seismic measurements.

Colorado School of Mines, Golden, CO, United States Sep 2016 – May 2018

- M.S. in Geophysics GPA: 3.99
  - Advisor: Prof. Roel Snieder
- Thesis: *A unified interpretation of nonlinear elasticity in granular solids*
  - Proposed a qualitative thermodynamics-based model for nonclassical nonlinear elasticity in rocks.
  - Explained the bifurcation observed in resonance bar experiments.
- Research project: Investigated seismic velocity changes during hydraulic fracturing.

University of Edinburgh, United Kingdom Aug 2014 – June 2016

- B.S. in Geophysics (First-Class Honors) GPA: 77/100
- Undergraduate research: (1) Induced seismicity at the UK's "hot dry rock" experiment (supervised by Dr. Ian Main) and (2) Marchenko imaging (supervised by Dr. Andrew Curtis).

Nanjing University, China — Sep 2012 – July 2014
- B.S. in Geology — GPA: 4.52/5.0
- Geological fieldwork (one month), Tangshan. — July 2013

PEER-REVIEWED PUBLICATIONS

Waves and Laboratory Acoustics

- **Li, X.**, Robertsson, J., and van Manen, D.-J., Elastic immersive wave experimentation, *Geophysical Journal International*, 2023.

→ This paper proposes a method to overcome boundary-reflection challenges in 3D elastic wave propagation experiments carried out in size-limited experimental volumes.

- **Li, X.**, Robertsson, J., Curtis, A., and van Manen, D.-J., Internal absorbing boundary conditions for closed-aperture wavefield decomposition in solid media with unknown interiors, *The Journal of the Acoustical Society of America*, 2022.

→ This work introduces an internal numerical absorbing boundary for wave simulations involving elastic solid media, enabling the retrieval of all orders of outgoing elastic wavefield constituents from real data recorded on a closed stress-free physical surface.

- **Li, X.**, Koene, E., van Manen, D.-J., Robertsson, J., and Curtis, A., Elastic immersive wavefield modeling, *Journal of Computational Physics*, 2022.

→ This publication extends immersive boundary conditions (IBCs) to the context of elastic wave propagation and offers a practical solution for reducing the computational cost in scenarios requiring repeated numerical simulations through models with only local changes in target subdomains.

- **Li, X.**, Becker, T., Ravasi, M., Robertsson, J., and van Manen, D.-J., Closed-aperture unbounded acoustics experimentation using multidimensional deconvolution, *The Journal of the Acoustical Society of America*, 2021 (**front cover feature, March 2021**).

→ This work proposes and validates a method for removing the imprints of boundary reflections due to the size-limited experimental volumes from the data recorded along a closed-aperture geometry.

- **Li, X.**, Robertsson, J., Curtis, A., and van Manen, D.-J., Compensating for source directivity in immersive wave experimentation, *The Journal of the Acoustical Society of America*, 2019.

→ This publication proposes a method to compensate for physical source directivity in the laboratory implementation of acoustic immersive wave experimentation, which allows immersing a physical experimental volume into a surrounding virtual environment.

- Müller, J., Becker, T. S., **Li, X.**, Aichele, J., Serra-Garcia, M., Robertsson, J. O. A., van Manen, D.-J., Acoustic cloning, *Physical Review Applied*, 2023.

→ This paper shows how to clone acoustic scattering objects, digitizing the acoustic imprints of a scatterer, transferring the imprints to general-purpose acoustic lab experiments, acquiring a digital twin, and bringing it back to life.

- Becker, T. S., van Manen, D.-J., Haag, T., Bärlocher, C., **Li, X**., Börsing, N., Curtis, A., Serra-Garcia, M., and Robertsson, J., Broadband acoustic invisibility and illusions, *Science Advances*, 2021.

→ This work demonstrates the novel concept of acoustic cloaking and holography, based on immersive boundary conditions, in a reduced-size laboratory acoustic wave propagation experiment.

- van Manen, D.-J., **Li, X.***, Vasmel, R., Broggini, F., and Robertsson, J., Exact extrapolation and immersive modeling with finite-difference injection, *Geophysical Journal International*, 2020.

→ This paper shows a practical implementation of wavefield extrapolation in numerical finite-difference modeling, achieving perfect machine-precision accuracy.

* Corresponding author

Rock Physics

- Smith, J.-A., Mangriotis, M.-D., Curtis, A., **Li, X.**, Cartwright-Taylor, A., Main, I. G., and Butler, I. B., P and S wave speed evolution during rock deformation from coda wave interferometry and energy partitioning inversion, *Geophysical Journal International*, 2026.

→ This work combines coda wave interferometry and energy partitioning inversion to track the evolution of both P-wave and S-wave velocities during rock deformation.

- Sens-Schönfelder, C., Snieder, R., and **Li, X.**, A model for nonlinear elasticity in rocks based on internal friction and contact aging, *Geophysical Journal International*, 2019.

→ This article presents a theoretical model for understanding the nonclassical nonlinear elasticity of rocks.

- **Li, X.**, Sens-Schönfelder, C., and Snieder, R., Nonlinear elasticity in resonance experiments, *Physical Review B*, 2018.

→ This work proposes a thermodynamics-based model to explain the nonclassical nonlinear features observed in laboratory resonance experiments of rocks and concrete.

- **Li, X.**, Main, I., and Jupe, A., Induced seismicity at the UK 'hot dry rock' test site for geothermal energy production, *Geophysical Journal International*, 2018.

→ This publication involves analyzing induced seismicity data at a UK geothermal site (Rosemanowes, Cornwall).

EXPANDED ABSTRACTS

- **Li, X.**, Börsing, N., Becker, T., van Manen, D.-J., Curtis, A., and Robertsson, J., Immersive Wave Control Experiments Using Non-isotropic Sources: Laboratory Applications, *Forum Acusticum 2020* (no peer review).

- **Li, X.**, Becker, T., Ravasi, M., Robertsson, J., and van Manen, D.-J., Multidimensional Deconvolution for Boundary Reflection Removal and Complete Scattering Characterization in Physical Acoustics Experiments, *32nd Parallel Computational Fluid Dynamics Conference (ParCFD 2021)* (limited peer review).

CONFERENCE ABSTRACTS

- **Li, X.**, Chandler, M., Cartwright-Taylor, A., Freitas, D., Mangriotis, M.-D., Woldemichael, B., Liptak, A., Atwood, R., Chapman, M., Fusseis, F., et al., Exploring seismic velocity transients using in-situ acoustic monitoring and synchrotron-based X-ray tomography in triaxial dynamic loading experiments, *EGU General Assembly*, 2026.

- van Manen, D.-J., Becker, T., **Li, X.**, Müller, J., Aichele, J., Serra-Garcia, M., and Robertsson, J., Acoustic Cloning, *International Conference on Underwater Acoustics*, 2022.

- **Li, X.**, Becker, T., Ravasi, M., Robertsson, J., and van Manen, D.-J., Unbounded full-aperture acoustic wave experimentation using multidimensional deconvolution, *Meeting of the Acoustical Society of America (ASA), Fall 2021*.
- **Li, X.**, Börsing, N., Becker, T., van Manen, D.-J., Curtis, A., and Robertsson, J., Immersive wave control experimentation using compensated directive sources, *Meeting of the Acoustical Society of America (ASA), Fall 2019*.
- Sens-Schönfelder, C., Snieder, R., and **Li, X.**, A physics-based model for seismic velocity changes induced by dynamic strain, *EGU General Assembly*, 2018.

INVITED PRESENTATIONS

- SINOPEC Geophysical Research Institute, Nanjing, China — Dec 2025
- Nanjing University, Nanjing, China — Sep 2025
- University of Science and Technology of China, Hefei, China — Sep 2025
- Langevin Institute, ESPCI Paris, France — Feb 2023

RESEARCH GRANTS

- *Imaging damage associated with transient seismic velocity events in rocks, with applications for risk-reduction in subsurface engineering.* 15-shift (5-day) Beamtime (MG42877) awarded by Diamond Light Source. Principal Investigator: Dr. Ian Butler; Co-investigator: X. Li et al., 2025.
- *Correlation between grain-scale deformations and seismic event locations corresponding to seismic velocity changes prior to rupture.* 18-shift (6-day) Beamtime (MG37177) awarded by Diamond Light Source. Principal Investigator: Dr. Ian Butler; Co-investigator: X. Li et al., 2024.
- *Laser ultrasonic laboratory for studying nonlinear wave propagation in granular materials.* Postdoc.Mobility fellowship awarded by the Swiss National Science Foundation. Funding: CHF 106,600, 2023.

MAJOR COLLABORATIVE PROJECTS

- **On the Edge? (NERC: Pushing the Frontiers)**, University of Edinburgh 2023 – Present
  - Role: software development, experimental design, laboratory setup, and data acquisition for coupled seismic and imaging studies of rock failure.
- **MATRIX (ERC Advanced Grant)**, ETH Zurich 2018 – 2022
  - Role: software development, physical experiment design, data acquisition, and data processing for immersive acoustic/elastic wave experimentation.

TEACHING EXPERIENCE

- Teaching assistant for *Numerical Modeling in Applied Geophysics*, ETH Zurich 2019 – 2022
  - Led 9 two-hour tutorials per semester (graduate level).
  - Graded weekly assignments (about 30 students) for four weeks and 10 project reports per semester; provided feedback to students.
  - Delivered pre-exam Q&A sessions.
  - Contributed to the redesign of five two-hour sessions of the course. 2020
- Teaching assistant for *Exploration and Environmental Geophysics*, ETH Zurich 2019
  - Graded 10 assignments across three weekly exercise sessions (undergraduate level).

PROFESSIONAL SERVICE

University of Edinburgh – Early-Career Researcher Representative Oct 2024 – Present

- Attend discussions on ECR matters with academic staff at monthly institute meetings.
- Serve on the School ECR Committee.
- Co-develop a career advice booklet for new postdocs.
- Co-organise the institute's Postdoc Away Day.

PUBLIC ENGAGEMENT

- *Presenter*. Arthur's Seat Volcano Trail 2025, Edinburgh, UK Sep 2025
  - Staffed outreach stations around Holyrood Park to discuss the park's geology with visitors.
- *Presenter and Panelist*. Project launch meeting (On the Edge?), Edinburgh, UK May 2024
  - Presented approaches to suppress induced seismicity related to subsurface energy projects, including geothermal energy exploitation and carbon dioxide storage.
  - Discussed approaches and challenges with researchers from energy companies, as well as regulators and policymakers.
- *Speaker*, INNOVATICA 2022, Zurich, Switzerland June 2022
  - Guided a tour of ETH WaveLab on a public day at the innovation park in Dübendorf. Visitors included the general public, primarily local families.
- *Presenter*, Startbahn 29, Zurich, Switzerland May 2022
  - Guided a tour of our WaveLab for high school students at the innovation park in Dübendorf.

PEER REVIEW SERVICE

Geophysics (5 reviews); Geophysical Research Letters (2); Geophysical Prospecting (1); The Journal of the Acoustical Society of America (3); Petroleum Science (1)

AWARDS

ETH Zurich

- Chinese Government Award for Outstanding Student Abroad 2021
  - Awarded annually by the Ministry of Education of China to 500 students worldwide across all disciplines; included a certificate of merit and a cash prize of $6,000.

University of Edinburgh

- Mobil North Sea Prize (Class Medal for Third-Year Geophysics) 2015
  - Awarded £200 by the School of GeoSciences to the best junior student.

Nanjing University

- China National Scholarship 2013
  - Awarded a certificate of merit and a ¥8,000 cash prize by the Ministry of Education of China to the top 0.2% of undergraduate students nationwide.