Jack Broderick Muir

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Education

10/2021	PhD (Geophysics), California Institute of Technology, Pasadena CA
06/2019	MSc (Geophysics), California Institute of Technology, Pasadena CA
12/2014	PhB (Physics), Australian National University, Canberra ACT 1^{st} class honours with the University Medal

Professional Positions

03/2022–Present	Marie Skłodowska-Curie Individual Fellow, University of Oxford, Oxford, UK
03/2022–Present	Junior Research Fellow, Wolfson College, University of Oxford, Oxford, UK
01/2021–02/2022	Visiting Researcher, Australian National University, Canberra ACT, Australia
06/2015–10/2021	Graduate Student Researcher, California Institute of Technology, Pasadena CA, USA
01/2012–01/2013	Intern Researcher, Australian Nuclear Science and Technology Organization, Lucas Heights NSW, Australia

Currently Active Projects

TerraPINN: Toward fully physics based probabilistic seismic hazard assessment using physics informed neural networks
with: Tarje Nissen-Meyer (Oxford Earth Sciences)

Soil seismology and bioacoustic signatures
with: Tarje Nissen-Meyer (Oxford Earth Sciences), Simon Jeffery (Harper-Adams Soil Ecology)

Extracting macroseismic observables from historical manuscripts using natural language processing
with: Federico Nanni, Kasra Hosseini and Mariona Ardanuy (Alan Turing Institute), Maria Tsekhmistrenko (University College London)

Semi-supervised learning via the eikonal equation
with: Ollie Dunbar (Caltech Climate Dynamics), Andrew Stuart (Caltech Applied Mathematics)

Publications

In review	*Bayesian eikonal tomography using Gaussian processes*, J.B. Muir
In review	*False positives are common in single-station template matching*, J. B. Muir & B. Fernando
07/2023	*A deep Gaussian process model for seismicity background rates*, J. B. Muir & Z. E. Ross, GJI, (2023) 234 (1): 427–438, https://doi.org/10.1093/gji/ggad074
09/2022	*Long-wavelength topography and multi-scale velocity heterogeneity at the core-mantle boundary*, J.B. Muir et al., GRL, (2022) e2022GL099943, https://doi.org/10.1029/2022GL099943
04/2022	*Wavefield-based evaluation of DAS instrument response and array designs*, J.B. Muir & Z. Zhan, GJI, (2022) 229 (1): 21–34, https://doi.org/10.1093/gji/ggab439
02/2022	*Parsimonious velocity inversion applied to the Los Angeles Basin, CA*, J.B. Muir et al., JGR: Solid Earth, (2022) 127 (2): e2021JB023103, https://doi.org/10.1029/2021JB023103
01/2022	*Sub-kilometer correlation between near-surface structure and ground motion measured with distributed acoustic sensing*, Y. Yang et al., GRL, (2022) 49 (1): e2021GL096503, https://doi.org/10.1029/2021GL096503
01/2022	*HypoSVI - Hypocentral earthquake location analysis using machine learning based Stein variational gradient descent*, J. Smith et al., GJI, (2022) 228 (1): 698–710, https://doi.org/10.1093/gji/ggab309
10/2021	*Seismic wavefield reconstruction using a preconditioned wavelet-curvelet compressive sensing approach*, J.B. Muir & Z. Zhan, GJI, (2021) 227 (1): 303–315, https://doi.org/10.1093/gji/ggab222
12/2020	*Probabilistic lowermost mantle P-Wave tomography from hierarchical Hamiltonian Monte Carlo and model parametrisation cross-validation*, J.B. Muir & H. Tkalčić, GJI, (2020) 223 (3): 1630–1643, https://doi.org/10.1093/gji/ggaa397
02/2020	*Geometric and level set tomography using ensemble Kalman inversion* J.B. Muir & V.C. Tsai, GJI (2020) 220 (2): 967–980, https://doi.org/10.1093/gji/ggz472
01/2020	*Did Oldham discover the core after all? Handling imprecise historical data with hierarchical Bayesian model selection methods*, J.B. Muir & V.C. Tsai, SRL (2020) 91 (3): 1377–1383, https://doi.org/10.1785/0220190266
09/2017	*Rayleigh wave H/V via noise cross-correlation in Southern California*, J.B. Muir & V.C. Tsai, BSSA (2017) 107 (5): 2021–2027, https://doi.org/10.1785/0120170051

12/2015 *Strong, multi-scale heterogeneity in Earth's lowermost mantle*,
H. Tkalčić et al. Sci. Rep. (2016) 5: 18416, https://doi.org/10.1038/srep18416

11/2015 *Spherical harmonic analysis in the geosciences via Bayesian inference*,
J.B. Muir & H. Tkalčić, GJI (2015) 203 (2): 1164 –1171, https://doi.org/10.1093/gji/ggv361

07/2012 *A single-probe-beam double-heterodyne polarimeter-interferometer for plasma Faraday rotation measurements*,
J. Howard et al. JINST (2012) 7 P07009, https://doi.org/10.1088/1748-0221/7/07/p07009

Funding Awarded

10/2022–09/2023 University Researcher Representative Fellowship
2,000.00 GBP

03/2022–10/2022 Alan Turing Institute Postdoctoral Enrichment Award
2,000.00 GBP

03/2022–03/2024 *TerraPINN: Toward fully physics based probabilistic seismic hazard assessment using physics informed neural networks*
Marie Skłodowska-Curie Actions Individual Fellowship
Co-I Tarje Nissen-Meyer
224,933.76 EUR

08/2020–07/2023 *Improving the Interpretability of Tomographic Images Using Geologically Motivated Parametrizations*
National Science Foundation Award 2011079
PI Victor C. Tsai, JBM wrote scientific justification of proposal
255,859.00 USD

02/2020–03/2021 *Combining High-Resolution Local Models with the SCEC CVMS*
Southern California Earthquake Center Award 20024
PI Robert W. Clayton, JBM wrote scientific justification of proposal
23,460.00 USD

06/2015–06/2018 Origin Energy Foundation / General Sir John Monash Scholarship
180,000.00 AUD

Honours and Awards

02/2021 Marie Skłodowska-Curie Individual Fellowship

02/2015 General Sir John Monash Scholarship

12/2014 ANU University Medal in Physics

12/2014 Director of Science Education Commendation (ANU)

12/2014 Australian Society of Exploration Geophysicists ACT Branch Student Award

01/2014 ANU Dunbar Scholarship for Physics Honours

12/2013 Australian Meteorological and Oceanographic Society ACT Branch Student Award

12/2011,13 Dean's Science Commendation (ANU)

12/2010,11,13 ANU National Merit Scholarship

Invited Talks

10/2022 Solving seismic problems with prior knowledge,
Dublin Institute for Advanced Studies

06/2022 Solving seismic problems forwards and backwards by compressing the model,
University College London

03/2022 Better seismic models of the Los Angeles Basin using geologically informed tomography,
Weeks Lecture, University of Wisconsin-Madison

03/2022 Curvelet based wavefield reconstruction - theory and applications from regional tomography to DAS / nodal integration,
University of Wisconsin-Madison

12/2021 Seismic Wavefield Reconstruction using a Preconditioned Wavelet-Curvelet Compressive Sensing Approach,
American Geophysical Union Fall Meeting

12/2021 Wavefield Reconstruction-based evaluation of DAS instrument response and array design,
American Geophysical Union Fall Meeting

09/2021 Preconditioned Compressive Sensing for Wavefield Reconstruction,
Australian Society of Exploration Geophysicists

12/2020 Level-set imaging of the Los Angeles Basin using the Community Seismic Network,
ETH Zürich

09/2020 Parsimoniously introducing high-resolution local updates into the SCEC CVMs using a level-set approach,
Southern California Earthquake Center workshop on "Multi-scale seismic velocity models—Imaging and validation studies"

06/2020 Imaging the Los Angeles Basin using the July 5 2019 Mw 7.1 Ridgecrest Earthquake,
Oxford University

01/2019 Geometric and Level Set Tomography using Ensemble Kalman Inversion,
Australian National University

11/2017 Rayleigh Wave H/V via Noise Cross-Correlation in Southern California,
Los Alamos National Laboratory

Conference Presentations

10/2022 A deep Gaussian Process Model for Seismicity Background Rates
StatSei12 Poster

05/2022 Curvelet based wavefield reconstruction - theory and applications to DAS / nodal integration,
SPIN-ITN workshop talk

09/2021 Parsimonious velocity inversion applied to the Los Angeles Basin, CA,
SCEC annual meeting poster

07/2021 Bayesian Joint Inversion Implies a Complex Multiscale Lowermost Mantle Overlaying Simple Core-Mantle Boundary Topography,
Goldschmidt Poster

03/2021 Level-set Imaging of the Los Angeles Basin using the Hierarchical Ensemble Kalman Sampling
SSA virtual tomography meeting talk

12/2020 Level-set imaging of the Los Angeles Basin using the Community Seismic Network,
AGU fall meeting talk

09/2020 A Level-Set Approach to Parsimoniously Updating the SCEC CVMs,
SCEC annual meeting poster

12/2019 Wavefield Reconstruction and Surface Wave Tomography from LassoCV,
AGU fall meeting talk

09/2019 Visualising the Ridgcrest Earthquakes using Wavefield Reconstruction,
SCEC annual meeting poster

12/2018 Taming the tomographic null space using geometric and level set parameterizations of the Earth,
AGU fall meeting talk

09/2018 Geometric and Level Set Tomography for Interface Detection in the Near Surface,
SCEC annual meeting poster

12/2017 Wavefield Reconstruction using Compressive Sensing and Distributed Acoustic Sensing,
AGU fall meeting poster

12/2016 Rayleigh Wave H/V via Noise Cross-Correlation in Southern California,
AGU fall meeting talk

12/2015 Joint Bayesian Tomography of the Core-Mantle Boundary Topography and Lowermost Mantle Velocity,
AGU fall meeting talk

12/2014 Spherical Harmonic Analysis via Bayesian Inference,
AGU fall meeting poster

09/2013 Bayesian inference applied to the differential rotation of Earth's inner core,
Australian Conference of Undergraduate Research poster

09/2012 A single-probe-beam double-heterodyne polarimeter-interferometer for plasma Faraday rotation measurements,
Australian Conference of Undergraduate Research poster

General Audience Publications

06/2021 *Interview*,
The Scholars Podcast
`https://player.whooshkaa.com/episode?id=842498`

05/2019 *Listening to the Heartbeat of our Planet*,
Caltech Letters

https://caltechletters.org/science/historical-seismology

Teaching Assistantships

10–12/2022	Oxford Year 3 *Vector Calculus*
04–06/2020	Caltech Ge264 *Machine Learning in Geophysics*
04–06/2019	Caltech Ge111B *Field Geophysics B*
01–03/2018	Caltech Ge162 *Seismology*
01–03/2017	Caltech Ge111A *Field Geophysics A*

Internships & Intensives

05/2022	SPIN-ITN Workshop and Short Course
07/2019	Dr. Lucy Jones Center for Science and Society Science Activation Workshop
06/2018	Gene Golub SIAM Summer School: Inverse Problems
11/2014–01/2015	Student Internship in Geophysics Australian National University
11/2013–01/2014	Student Fellowship in Astrophysics Australian Astronomical Observatory (AAO)
01/2012–01/2013	Year in Industry Internship in Condensed Matter Physics Australian Nuclear Science and Technology Organisation (ANSTO)
11/2011–01/2012	Summer Internship in Optics Australian National University
07/2011	Winter School in Astronomy Australian National University

Service Activities & Roles

Journal Editing	Seismica (Standards & Copy)
Journal Reviews	Geophysical Research Letters, Journal of Geophysical Research: Solid Earth, Geophysical Journal International, Bulletin of the Seismological Society of America, Pure and Applied Geophysics, Physical Review Research
10/2022–Present	Oxford Research and Innovation Committee Postdoctoral Representative
10/2022–Present	Oxford Research Staff Consultation Group
10/2022–Present	Oxford Mathematical, Physical & Life Sciences Research Staff Forum Co-Chair
12/2020	AGU General Seismology Session Co-Convener
08/2018–Present	General Sir John Monash Foundation Reviewer
07/2016–07/2019	Caltech Graduate Student Council Steering Committee 07/2017–07/2019 Treasurer 07/2018–07/2019 Academics Chair 07/2017–07/2018

07/2015–12/2020 Caltech Graduate Honor Council

02–09/2014 Australasian Conference for Undergraduate Research (ACUR) — Planning Committee

Professional Memberships & Roles

12/2016–Present Seismological Society of America

08/2014–Present American Geophysical Union

08/2014–Present Australian Society of Exploration Geophysicists

References

Prof. Tarje Nissen-Meyer, Department of Earth Sciences, University of Oxford, Oxford, UK, tarje.nissen-meyer@earth.ox.ac.uk, +44-1865-282149

Prof. Victor C. Tsai, Department of Earth and Planetary Sciences, Brown University, Providence, RI USA, victor_tsai@brown.edu, +1-401-863-1190

Prof. Andreas Fichtner, Institut für Geophysik, ETH Zürich, Switzerland, andreas.fichtner@erdw.ethz.ch, +41-44-632-2597

Oxford, UK, May 23, 2023