Jack Broderick Muir

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Education

10/2021	PhD (Geophysics), California Institute of Technology (Caltech), Pasadena CA
06/2019	MSc (Geophysics), California Institute of Technology (Caltech), Pasadena CA
12/2014	PhB (Science, Honours in 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)

Multiscale nonparametric inference of seismicity background rates using deep Gaussian processes
with: Zach Ross (Caltech Seismolab)

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

Joint inversion of the core-mantle boundary topography and lowermost mantle velocity structure with hierarchical Hamiltonian Monte Carlo
with: Hrvoje Tkalčić (ANU Earth Sciences), Satoru Tanaka (JAMSTEC)

Publications

In review	*Convection of the Earth's Inner Core*, H. Tkalčić et al.
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

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

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

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

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

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

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 Reviews	GRL, JGR: Solid Earth, GJI, BSSA, PAAG
08/2018–Present	General Sir John Monash Foundation Reviewer

07/2016–07/2019	Caltech Graduate Student Council Academics Chair 07/2017–07/2018 Treasurer 07/2018–07/2019 Steering Committee 07/2017–07/2019
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. Victor C. Tsai, Department of Earth and Planetary Sciences, Brown University, Providence, RI USA, victor_tsai@brown.edu, +1-401-863-1190

Prof. Zhongwen Zhan, Department of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA USA, zwzhan@caltech.edu, +1-626-395-6906

Prof. Robert W. Clayton, Department of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA USA, rclayton@caltech.edu, +1-626-395-6909

Oxford, UK, March 11, 2022