Ceri Nunn

Institution:	Jet Propulsion Laboratory - California Institute of Technology 4800 Oak Grove Drive M/S: 183-501 Pasadena, CA 91109	Telephone:	+1 626 379-6521
	Female, British	Email:	ceri.nunn@jpl.nasa.gov

Employment

2022 - present: Research Scientist, Jet Propulsion Laboratory, Pasadena, CA, U.S.A.
2018 - 2022: Postdoctoral Researcher, Jet Propulsion Laboratory, Pasadena, CA, U.S.A.
2016 - 2018: Marie Skłodowska-Curie fellow, LMU, Munich, Germany
2015 - 2016: Postdoctoral Researcher, Durham University, U.K.

Education

2014 PhD University of Cambridge

Thesis: Tomographic images of the crust and upper mantle beneath the Tibetan Plateau: using body waves, surface waves and a joint inversion.
Keith Priestley (University of Cambridge), Steven Roecker (RPI), Frederik Tilmann (GFZ, Berlin)

2009 MSci University of Cambridge

Thesis: The Lower Martian Atmosphere: constraining the temperature, depth of the convective boundary layer and turbulence with a 1D and 3D model.
Stephen Lewis (Open University), Alexander Piotrowski (University of Cambridge)

2008 BA University of Cambridge

Mission Experience

2021 - ongoing: Farside Seismic Suite, Co-investigator. Selected June 2021 for 2025 launch.
2020 - ongoing: NASA InSight archivist of seismic data to the Planetary Data System
2020 - ongoing: Co-Investigator for NASA's Lunar Geophysical Network (a candidate for a New Frontiers 5 mission) and co-author of mission concept study.

Funding Record

2021: NASA Roses – Lunar Data Analysis Program (*LDAP*) (~$475,000)
2020: JPL A-team Funding - Penetrating Seismometers for the Moon ($30,000)
(led a JPL internal study on building a lunar seismic network with seismometers delivered by penetrators)
2019: NASA Roses - Planetary Data Archiving, Restoration, and Tools (*PDART*) (~$100,000)
2018: International Space Science Institute Workshop, Beijing - Supported Young Scientist (~€1,000)
2017: International Space Science Institute Workshop, Bern - Supported Young Scientist (~€1,000)
2015: Marie Skłodowska-Curie individual fellowship (~€160,000)
2013: Cambridge Philosophical Society Research Studentship (£3000)
2011: Schlumberger Travel Bursary (£1000)

Academic Service

Planetary Science Summer School: Contributor, 2022
NASA Panel Reviewer: 2019
NASA External Reviewer: 2022
Co-supervisor: JPL Intern 'Measuring Scattering in the Lunar Crust', 2019
Supervising Master's Projects on 'Modelling scatter on the Moon with Salvus' and 'Stacking Deep Moonquakes', 2018, LMU, Munich
Co-convener: Interiors of Planets and Moons: Learning from Spacecraft Observations, Simulations, and in Situ Data, AGU 2020
Convener: Seismic Modeling and Inversion: Exploring the Earth's Interior, AGU 2015
Organizer and chair: Discussion: Applying Best Practices in Seismic Tomography, with panelists Fiona Ann Darbyshire, Gary Pavlis, Nick Rawlinson, Kazunori Yoshizawa, AGU 2015
Journal Reviews: Nature Astronomy, Geophysical Journal International, Surveys in Geophysics, Nonlinear Processes in Geophysics, Geomatics, Natural Hazards and Risk, Earth and Space Science
Proposal Reviews: UK Space Agency's Aurora Science
Judge: Outstanding Student Presentation Award, AGU (judge in 2013-2020 and session coordinator in 2015)
Judge: Outstanding Student Poster and PICO, EGU, 2017, 2018

Invited Talks

2020	**Nunn, C.** Moonquakes: an introduction to what we know about the Moon from Lunar Seismology, Open Planetary Lunch Talks, https://www.youtube.com/watch?v=sCT3lVvjaZk

2018 **Nunn, C.**, Nakamura, Y., Igel, H., Apollo Passive Seismic Experiments: SEED format for lunar data, Institute of Geology and Geophysics, Chinese Academy of Sciences, 22 June 2018

2017 **Nunn, C.**, Julian, B.R., Foulger, G.R., Mhana, N**.,** Seismic tomography of Mount Etna: No evidence for time-dependent changes during the 2002-3 flank eruption, TIDES (TIme-DEpendent Seismology) Training School: Seismic Tomography: Theory, Inversion, Uncertainties, University of Oxford, invited talk and attendance at training workshop

Publications

submitted **Nunn, C.,** Nakamura, Y., Kedar, S., Panning, M.P., A New Archive of Apollo's Lunar Seismic Data, submitted to Planet. Sci. J.

submitted **Nunn, C**., Moon: Seismicity, in in: Cudnik, B. (Ed.), Encyclopedia of Lunar Science. Springer International Publishing.

accepted Marusiak, A.G., Panning, M.P., Vance, S.D., **Nunn, C**., Stähler, S.C., Tharimena, S., 2022. Seismic detection of euroquakes originating from Europa's silicate interior. Earth and Space Science.

2022 Knapmeyer, M., Marusiak, A.G., Horleston, A., Nunn, C., Knapmeyer-Endrun, B., 2022. Seismology across the Solar System. Deutsche Geophysikalische Gesellschaft, Geophysik im Wandel, https://dgg-online.de/WordPress_01/wp-content/uploads/2022/03/DGG100_Geophysik_im_Wandel_3_EN.pdf

2022 **Nunn, C**., 2022. Legacy of the Apollo Seismic Experiments, in: Cudnik, B. (Ed.), Encyclopedia of Lunar Science. Springer International Publishing, Cham, pp. 1–11. https://doi.org/10.1007/978-3-319-05546-6_165-1

2021 Karakostas, F., Schmerr, N., Maguire, R., Huang, Q., Kim, D., Lekic, V., Margerin, L., **Nunn, C.,** Menina, S., Kawamura, T., Lognonné, P., Giardini, D., Banerdt, B., 2021. Scattering Attenuation of the Martian Interior through Coda-Wave Analysis. Bulletin of the Seismological Society of America. https://doi.org/10.1785/0120210253

2021 **Nunn, C.**, Pike, W.T., Standley, I.M., Calcutt, S.B., Kedar, S., Panning, M.P., 2021. Standing on Apollo's Shoulders: A Microseismometer for the Moon. Planet. Sci. J. 2, 36. https://doi.org/10.3847/PSJ/abd63b

2020 **Nunn, C.**, Garcia, R.F., Nakamura, Y., Marusiak, A.G., Kawamura, T., Sun, D., Margerin, L., Weber, R., Drilleau, M., Wieczorek, M.A., Khan, A., Rivoldini, A., Lognonné, P., Zhu, P., 2020. Lunar Seismology: A Data and Instrumentation Review. Space Sci Rev 216, 89. https://doi.org/10.1007/s11214-020-00709-3

2020 Panning, M.P., Pike, W.T., Lognonné, P., Banerdt, W.B., Murdoch, N., Banfield, D., Charalambous, C., Kedar, S., Lorenz, R.D., Marusiak, A.G., McClean, J.B., **Nunn, C.**, Stähler, S.C., Stott, A.E., Warren, T., 2020. On-

Deck Seismology: Lessons from InSight for Future Planetary Seismology. J. Geophys. Res. Planets 125. https://doi.org/10.1029/2019JE006353

2019 Garcia, Raphael F., Khan, A., Drilleau, M., Margerin, L., Kawamura, T., Sun, D., Wieczorek, M.A., **Nunn, C.**, Weber, R.C., Marusiak, A.G., Lognonné, P., Nakamura, Y., Peimin, Z., Lunar Seismology: An Update on Interior Structure Models. Space Science Reviews 215, no. 8., doi: 10.1007/s11214-019-0613-y

2018 Krischer, L., Aiman, Y.A., Bartholomaus, T., Donner, S., Driel, M. van, Duru, K., Garina, K., Gessele, K., Gunawan, T., Hable, S., Hadziioannou, C., Koymans, M., Leeman, J., Lindner, F., Ling, A., Megies, T., **Nunn, C**., Rijal, A., Salvermoser, J., Soza, S.T., Tape, C., Taufiqurrahman, T., Vargas, D., Wassermann, J., Wölfl, F., Williams, M., Wollherr, S., Igel, H., 2018. seismo-live: An Educational Online Library of Jupyter Notebooks for Seismology. Seismological Research Letters 89, 2413–2419. https://doi.org/10.1785/0220180167

2014 **Nunn, C**., Roecker, S. W., Priestley, K. F., Liang, X., Gilligan, A. Joint Inversion of Surface Waves and Teleseismic Body Waves Across the Tibetan Collision Zone: the Fate of Subducted Indian Lithosphere, *Geophys. J. Int*, 198, 1526–1542 (2014), doi: 10.1093/gji/ggu193

2014 **Nunn, C.**, Roecker, S. W., Tilmann, F. J., Priestley, K. F., Heyburn, R., Sandvol, E. A., Ni, J. F., Chen, Y. J., Zhao, W. and the INDEPTH IV and ASCENT Team, Imaging the lithosphere beneath NE Tibet: teleseismic P and S body wave tomography incorporating surface wave starting models, *Geophys. J. Int,* 196, 1724–1741 (2014), doi:10.1093/gji/ggt476

2014 Gilligan, A., Roecker, S. W., Priestley, K. F., **Nunn, C**., Shear velocity model for the Kyrgyz Tien Shan from joint inversion of receiver function and surface wave data, *Geophys. J. Int,* 199, 480–498 (2014), doi: 10.1093/gji/ggu225

Conferences and Training Schools

2022 Nunn, C., Nakamura, Y., Kedar, S., Panning, M.P., 2022. The Lunar Geophysical Package (LGP): A New Archive of Apollo Seismic Data. 53rd Lunar Planetary Science Conference, LPSC, 2022, virtual poster

2021 Improving the Accessibility of the Apollo Passive Seismic Data: Archiving at the PDS and IRIS, AGU Fall Meeting 2021, virtual poster

2021 The Lunar Geophysical Package and Farside Seismic Suite: A “suitcase science” approach to building a long-lived, human-deployed, lunar network, LPSC, 2021

2020 MoonShake: a Future Lunar Seismic Network delivered by Penetrators, AGU Fall Meeting 2020, virtual, e-lightning talk

2020 Improving the Accessibility of the Apollo Seismic Data: Archiving at IRIS and the PDS, LPSC 51, 2020, https://www.hou.usra.edu/meetings/lpsc2020/pdf/2269.pdf, proceedings only

2019 Standing on Apollo's Shoulders: MEMS seismometers for the Lunar Geophysical Network, AGU Fall Meeting 2019, eLightning talk

2019 Scoping MEMS seismometers for the Moon, EGU, Vienna, 2019, talk

2019 Scoping MEMS seismometers for the Moon, https://www.hou.usra.edu/meetings/lpsc2019/pdf/2223.pdf, LPSC 50, The Woodlands, TX, poster

2018 Artificial Impacts and Meteoroid Strikes on the Moon: Observations from seismic data with insights from synthetic models, AGU Fall Meeting 2018, Washington DC, poster

2018 Workshop: An International Reference for Seismological Data Sets and Internal Structure Models of the Moon, International Space Science Institute, Beijing, China, 18-22 June 2018, working group to prepare papers and reference data for the Moon

2017 **Nunn, C**., Nakamura, Y. and Igel, H. Apollo Passive Seismic Experiments: lunar data in SEED Format, AGU Fall Meeting 2017, New Orleans, poster

2017 Workshop: An International Reference for Seismological Data Sets and Internal Structure Models of the Moon, International Space Science Institute, Bern, Switzerland, 23-27 October 2017, working group to prepare papers and reference data for the Moon

2017 **Nunn, C**., Nakamura, Y. and Igel, H. Apollo Passive Seismic Experiments: lunar data in SEED Format, AG Seismologie 2017, Bad Breisig, poster

2017 **Nunn, C.** and Igel, H., Lunar Structure from Coda Wave Interferometry, EGU 2017, PICO (interactive presentation)

2016 **Nunn, C.** and Igel, H., Lunar Structure from Coda Wave Interferometry, AGU Fall Meeting 2016, poster

2016 **Nunn, C**. and Igel, H. Lunar Structure from Coda Wave Interferometry, AG Seismologie 2016, Bad Salzschlirf, poster

2015 **Nunn, C.**, Julian, B.R, Foulger, G.R. Patanè, D., Ibáñez, J.M., Briole, P., Mhana, N. and the MED-SUV Team, Mount Etna: 3-D and 4-D structure using seismic tomography, AGU Fall Meeting 2015, San Francisco, abstract #S23D-2779, poster

2013 **Nunn, C**., Roecker, S. W., Priestley, K. F., Liang , X., Heyburn, R., A joint inversion of surface waves and teleseismic body waves across the Tibetan collision zone, AGU Fall Meeting 2013, San Francisco, abstract #S33A-2394, poster

2012 **Nunn, C**., Roecker, S. W., Tilmann, F. J., Priestley, K. F., Heyburn, R., Mechie, J., Sandvol, E. A., Ni, J. F., Chen, Y. J., Zhao, W., Velocity structure of the NE Tibetan Plateau: P and S body wave tomographic model of the northeastern Tibetan Plateau and its margins with additional constraints from surface wave tomography, AGU Fall Meeting 2012, San Francisco, abstract #T54B-05, talk

2011 **Nunn, C**., Tilmann, F. J., Roecker, S. W., Priestley, K. F, Heyburn, R, Mechie, J., Sandvol, E. A., Ni, J. F., Chen, Y. J., Zhao, W., and the INDEPTH IV and ASCENT Team, P- and S-wave tomographic structure of NE Tibet, AGU Fall Meeting 2011, San Francisco, abstract #T43A-2302, poster

2011 **Nunn, C.** ,Tilmann, F. J., Roecker, S. W., Priestley, K. F, Heyburn, R, Mechie, J., Sandvol, E. A., Ni, J. F., Chen, Y. J., Zhao, W., and the INDEPTH IV and ASCENT Team, P- and S-wave tomographic structure of NE Tibet, UKSEDI: Study of the Earth's Deep Interior meeting, Royal Astronomical Society, London, November 2011, poster

2011 **Nunn, C**, Tilmann, F. J., Roecker, S. W., Priestley, K. F, Heyburn, R. and the INDEPTH IV and ASCENT Team, P-wave tomographic structure of NE Tibet, EGU, Vienna, 2011, poster

NRC Planetary Science and Astrobiology Decadal Survey

2020 **Nunn, C.**, Calcutt, S., Clark, P.E., Eubanks, T.M., Kedar, S., Panning, M.P., Pike, W.T., Radley, C.F., Standley, I.M., Sutin, B.M., Zimmerman, W.F., 2020. MoonShake: a future Lunar Seismic Network Delivered by Penetrators (A White Paper for the National Research Council's Planetary Science and Astrobiology Decadal Survey). https://baas.aas.org/pub/2021n4i219/release/1

2020 Neal, C., Weber, R.C., Amato, M., J., Seas, A., Science Team [including **Nunn, C**], Engineering Team, 2020. The Lunar Geophysical Network (Planetary Missions Concept Studies Report), Submitted in response to: NNH18ZDA001N-PMCS.

2020 Gulick, S.P., Kawamura, T., **Nunn, C.**, Neal, C.R., Christeson, G.L., Tsuji, T., Schmerr, N., Garcia, R.F., Logonné, P., 2020, Active Seismic Subsurface Exploration on Artemis III: Exploration and Science Goals (A White Paper for the National Research Council's Planetary Science and Astrobiology Decadal Survey)

2020 Neal, C.R., Dell'Agnello, S., Grimm, R., Gulick, S.P.S., James, P., Lognonné, P., **Nunn, C.,** Panning, M.P., Petro, N., Schmerr, N., Watters, T., Zacny, K., 2020, Enabling Elements for Artemis Surface Science (A White Paper for the National Research Council's Planetary Science and Astrobiology Decadal Survey)

2020 Panning, M.P., Weber, R.C., Kedar, S., Bugby, D.C., Calcutt, S., Currie, D., Dell'Agnello, S., Elliott J., Grimm R., Gulick[7,] S.P.S., Fuqua Haviland, H. He, Y., Johnson, C.L., Kawamura, T., Lognonné, P., Nagihara, S., Neal, C.R., **Nunn, C.**, Pike, W.T., Standley, I.M., Walsh, W., Wieczorek, M., 2020, Building a lunar network using a long-lived, human-deployed Lunar Geophysical Package (LGP)

(A White Paper for the National Research Council's Planetary Science and Astrobiology Decadal Survey)

2020 Daubar, I. J., R. A. Beyer, V. Hamilton, A. McEwen, N. Bardabelias, S. M. Brooks, P. K. Byrne, S. Byrne, F. Calef III, J. Castillo-Rogez, S. Diniega, V. C. Gulick, C. W. Hamilton, D. Jha, A. Keresztur, **C. Nunn,** P. Schenk, S. S. Sutton. (2020) Extended Missions in Planetary Science: Impacts to Science and the Workforce. (A White Paper for the National Research Council's Planetary Science and Astrobiology Decadal Survey) http://dx.doi.org/10.3847/25c2cfeb.1d8e902b

Software Products

https://github.com/cerinunn/pdart
Planetary Data Archiving, Restoration, and Tools (PDART) for the Apollo missions

https://github.com/cerinunn/apollo-shoulders
Standing on Apollo's Shoulders: a Microseismometer for the Moon - Electronic Supplement

Outreach Activities:

Aug 2020: Moonquakes and marsquakes: How we peer inside other worlds, by Horizon Magazine

Nov 2018: Old Lunar Data Gets New Life, With Help From Seismologists, by Michael Durmiak, Spectrum

June 2016: How to make a mountain (for pupils aged 10-11 years)
The Moon (for pupils aged 9-10 years)
Talks at Cherry Hinton Primary School, Cambridge, UK

8 June 2015: Darwin: the great geologist behind the Origin of Species
The Conversation
http://theconversation.com/revealed-the-great-geologist-behind-the-origin-of-species-42783

October 2015: The structure of Mount Etna
Talk for the North Eastern Geological Society
http://www.northern-england-geology.co.uk/negs-newsletter-dec-2015.pdf

Fieldwork:

2007: Mapping of the Loch Ba Ring Dyke, Isle of Mull, Scotland (35 days fieldwork).

IT Skills

ObsPy, SAC
Programming in Python, Fortran, Java, VB; scripting in Bash and AWK
Environments: Mac, Linux, UNIX and Windows
Cluster computing
High quality figures and animations in Python (matplotlib, cartopy, basemap), GMT, IDL, Inkscape
SQL databases (Oracle, MySQL, SQL Server)
Sun Certified Java Programmer (2002)
Oracle Certified Professional, Oracle Forms Developer (1999)

Teaching:

LMU, Munich
Spring 2016, Spring 2017: Geophysical Data Acquisition (for MSc course - lectures, practicals, developing practicals, writing exam material)
Nov 2016: Contributor to SeismoLive (https://krischer.github.io/seismo_live_build/)
July 2016: Oral Examiner - Seismology (for MSc in Geophysics)

University of Cambridge
2010 – 2011: Teaching Assistant - Continental Tectonics and Mountains (3rd year Geology BA or 4th year Geology MSci)
2009 – 2010 Teaching Assistant - Physics of the Earth as a Planet (4th year Physics MSci)
2010 Teaching Assistant in revision classes for Geology (1st year Natural Sciences BA)

Career Breaks

Jul 2014 - Jan 2015: Career break with my youngest daughter.
Jan 2012 - Jul 2012: Maternity Leave, 3 months full-time, 3 months part-time.

Early Career (highlights)

2003 - 2005: Corelogic, London

Project Team Leader

1997 - 2003: Iteba, London

Team Leader and Software Developer

1992 - 1995: University of Sussex
Social Psychology (B.A. Hons)