

## Erin J. Leonard, Ph.D.

Research Scientist

Planetary Geosciences Group (3223)

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### About

Dr. Erin Leonard is a research scientist in the Planetary Geoscience group at the Jet Propulsion Laboratory, California Institute of Technology. Her research focuses on geomorphologic mapping and structural analysis of solid planetary bodies, such as icy satellites and the Moon, with implications for the subsurface or evolution of the body. Dr. Leonard is the lead author on the first United States Geologic Survey (USGS) Science Investigation Map (SIM) of Europa. She is interested in the detection and characterization of Ocean Worlds in the outer solar system, and actively aids in formulating and advocating for missions to these targets. Dr. Leonard is also interested in the interface between science and engineering in mission operations and formulation.

### Education

June 2019 Ph.D., Planetary Geology, University of California Los Angeles

May 2014 B.S., Astrophysics and Planetary Science, University of California Berkeley

### Professional Experience

2022 – *pres.* Project Staff Scientist and Strategic Science Planning Lead, Europa Clipper

2025 – *pres.* Geology Working Group Co-Chair, Europa Clipper

2023 – *pres.* Deputy Project Scientist, New Frontiers 5 Mission Concept

2022 – 2024 Plumes Focus Group Facilitator, Europa Clipper

2021 – 2023 Science Sampling Task Lead, Europa Lander Pre-Project

2019 – 2022 JPL Postdoctoral Fellow

2019 – 2022 Europa Clipper Project Science Postdoctoral Affiliate

2017 – 2019 Europa Clipper Project Science Graduate Affiliate

2014 – 2019 Graduate Researcher & Teaching Assistant at UCLA in the Earth, Planetary, and Space Sciences (EPSS) Department

### Funded Activities

2024 NASA ROSES PDART– Uranian Moons Mapping (PI – D. Alex Patthoff, 3 years)

2024 NASA ROSES LMAP – Lunar Mapping Program (PI – self, 1 year)

2024 NASA ROSES NFDAP – JunoCam at Europa (PI – self, 3 years)

2023 NASA ROSES PDART– Europa Regional Geologic Mapping (PI – self, 3 years)

### Awards

2025 JPL Team Award – Uranus Mission Formulation

2025 JPL Voyager Award – Europa Clipper Non-nadir Strategic Science Planning Guide

2024 JPL Voyager Award – Europa Clipper Nadir Strategic Science Planning Guide

2023 JPL Team Award – Europa Clipper PSG 12

- 2021 JPL Voyager Award - Europa Clipper Rules of the Road
- 2019 NASA Group Achievement Award - Europa Global Geologic Map
- 2018 UCLA EPSS Excellence in Academic Performance and Research Potential
- 2018 Early Career Travel Award – Outer Planets Assessment Group (OPAG)
- 2017 Paul M. Furukawa Memorial Fellowship Award
- 2016, 2017 Excellence in Teaching Award Awarded by UCLA
- 2016 Planetary Interiors Short Course Scholar and Travel Awardee, International School of Space Science (ISSS)
- 2016 NSF Graduate Research Fellowship Honorable Mention

## Professional Activities

- 2025 – *pres.* MAPSIT Steering Committee Member
- 2023 – *pres.* Co-organizer, “The Ice Giants: Exploring the Planetary Systems of Uranus and Neptune”, American Geophysical Union (AGU) Fall Meeting
- 2023 Co-organizer and co-convenor, “Europa Clipper”, American Geophysical Union (AGU) Fall Meeting
- 2023 Co-organizer of the “Uranus Flagship 2023” Workshop at Caltech in July 2023
- 2023 Primary Convener, “Ice Giant System Science and Exploration” European Geophysical Union (EGU) Spring Meeting
- 2022 – 2023 Co-Convener, “The Ice Giants: Exploring the Planetary Systems of Uranus and Neptune”, American Geophysical Union (AGU) Fall Meeting
- 2022 – *pres.* Geologic Mapping Subcommittee (GEMS)
- 2022 – *pres.* Member of NASA RCN, Network for Ocean Worlds (NOW)
- 2021 – 2023 Co-Writer of Europa Lander Terrain Specification Document (TSD)
- 2021 Co-organizer and Primary Convener of “In Situ Science and Instrumentation for the Exploration of Europa and Ocean Worlds” Oral and Poster sessions at American Geophysical Union (AGU) Fall Meeting
- 2020 – *pres.* Lead Editor of the Europa Clipper Rules of the Road (RoTR) Document
- 2020 – *pres.* Co-Organizer and Chair of “Friends of Hoth: Geology of Icy Satellites and Small Bodies” at Geological Society of America Fall Meetings (annually)
- 2019 – 2023 Co-Organizer of ICE (Icy Collaboration and Exchange) seminar series
- 2019 – 2022 Member of NRSB (New Researchers Support Group)
- 2018 – *pres.* Review panelist for NASA Grant Proposals, ~1 per year.

## Outreach

- 2024 “Looking up” Cincinnati Radio interview – Europa Clipper
- 2024 e.l.f. presents “Women Taking Space” – Europa Clipper
- 2024 Invited speaker at Burbank “Space Night” – Europa Clipper
- 2024 “This Week in Space” podcast ([link](#)) on Europa Clipper
- 2024 Invited Speaker at the Burbank Public Library – Europa Clipper
- 2024 Invited Speaker at Los Angeles Valley Community College – Europa Clipper
- 2023 – *pres.* Mentoring students at Clovis Community College and Cal Poly Humboldt with Prof. Michelle Selvans
- 2021 Society for Science Regeneron High School Science Talent Search Evaluator

2021 Advisor for MIT 16.83 Enceladus Mission Class  
2019 Panelist for Long Beach Comic Con – Women in Planetary Science  
2018 Explore Your Universe (EYU) Booth Organizer – Cassini at Enceladus  
2017 UCLA Grad Slam Finalist <https://www.youtube.com/watch?v=nCg6QI2cyV8>

## Publications

- E. J. Leonard**, D. A. Senske, D. A. Patthoff (submitted). Analyzing the Recent Global Geologic History of Europa: Evidence for Clustered Resurfacing and a Lack of Recent Polar Wander. *Journal of Geophysical Research: Planets* (submitted).
- Denton, C.A., Scully, J.E.C., Castillo-Rogez, J.C., Sori, M.M., Elder, C.M., **Leonard, E.J.**, Cartwright, R., Nordheim, T.A. and Beddingfield, C., 2026. Assessing the plausibility of past cryovolcanism on Umbriel using the Wunda impact crater. *Journal of Geophysical Research: Planets*, 131(2), p.e2025JE009282.
- Mc Keown, L.E., Lesage, E., Scully, J.E., **Leonard, E.J.**, Pappalardo, R.T., Potter, M., Tsai, V., Choukroun, M., Gloesener, E., Diniega, S. and Hatcher, N., 2025. Lake Stars as an Earth Analog for Europa's Manannán Crater Spider Feature. *The Planetary Science Journal*, 6(12), p.279.
- Scully, J.E., Denton, C.A., Castillo-Rogez, J.C., Sori, M.M., **Leonard, E.J.**, Beddingfield, C., Cartwright, R., Elder, C.M., Mitchell, K.L. and Nordheim, T.A., 2025. Leveraging Ceres to gain insights into the candidate ocean worlds of Umbriel and Oberon that orbit Uranus. *The Planetary Science Journal*, 6(8), p.187.
- Roth, L., **Leonard, E. J.**, Miller, K., Hedman, M., Quick, L.C., Becker, T.M., Brooks, S., Cochrane, C., Davies, A.G., Ernst, C.M. and Grima, C., 2025. Plume Activity on Europa: Current Knowledge and Search Strategy for Europa Clipper. *The Planetary Science Journal*, 6(8), p.182.
- Scully, J.E., Malaska, M.J., **Leonard, E.J.**, Cameron, M.E., Lethcoe, H.A., Phillips, C.B., Cartwright, R.J., Lesage, E., Daswani, M.M. and McKeown, L.E., 2025. Small in number but mighty in significance: Impact craters as windows into Europa's subsurface. *Journal of Geophysical Research: Planets*, 130(7), p.e2024JE008670.
- Haslebacher, C., Tejero, J.G., Prockter, L.M., **Leonard, E.J.**, Rhoden, A.R. and Thomas, N., 2025. Length, width, and relative age analysis of lineaments in the Galileo regional maps with lineamapper. *The Planetary Science Journal*, 6(6), p.133.
- Scully, J.E., Belgacem, I., Parekh, R., Grima, C., Phillips, C.B., Craft, K.L., Collins, G.C., Detelich, C., **Leonard, E.J.**, Mishra, I. and Patterson, G.W., 2025. Potential landing sites: a comprehensive reconnaissance assessment of the Europa Clipper trajectory. *The Planetary Science Journal*, 6(6), p.142.
- Cartwright, R.J., Hibbitts, C.A., Holler, B.J., Raut, U., Nordheim, T.A., Neveu, M., Protopapa, S., Glein, C.R., **Leonard, E.J.**, Roth, L. and Beddingfield, C.B., 2025. JWST reveals spectral tracers of recent surface modification on Europa. *The Planetary Science Journal*, 6(5), p.125.
- Spiers, E., Weber, J., Dzurilla, K., **Leonard, E. J.**, Ferguson, S., Wolfenbarger, N., Chan, K., Johnson, P., Robinson, K. and Chivers, C., 2025. Cultivating Long-Term Planning, Collaboration, and Mission Continuity in Astrobiology Through Support of Early Career Researchers. White Paper for NASA DARES initiative, arXiv preprint arXiv:2504.09015.

**Leonard, E. J.**, M. Hofstadter, N. Rowe-Gurney, J. M. Jasinski, and D. Atkinson (2024), A mission to Uranus requires a community-building effort on Earth, *Eos*, 105. Published 23 July 2024.

Weber, J.M. and **Leonard, E. J. (co-first author)** (2024). The Astrobiological Potential of the Uranian Moon System. *Astrobiology*, 24(8), pp.839-844.

**E. J. Leonard**, D. A. Patthoff, and D. A. Senske (2024). The Europa Global Geologic Map. *United States Geologic Survey*.

Becker, T.M., et al. (incl. **E. J. Leonard**) (2024). Exploring the Composition of Europa with the Upcoming Europa Clipper Mission. *Space Sci Rev* 220, 49. <https://doi.org/10.1007/s11214-024-01069-y>

Pappalardo, R.T., (incl. **Leonard, E. J.**) et al. (2024). Science overview of the Europa clipper mission. *Space Science Reviews*, 220(4), p.40.

Berne, A., Simons, M., Keane, J.T., **Leonard, E. J.** and Park, R.S. (2024). Jet activity on Enceladus linked to tidally driven strike-slip motion along tiger stripes. *Nature Geoscience*, 17(5), pp.385-391.

Hansen, C.J., Ravine, M.A., Schenk, P.M., Collins, G.C., **Leonard, E.J.**, Phillips, C.B., Caplinger, M.A., Tosi, F., Bolton, S.J. and Jónsson, B. (2024). Juno's JunoCam Images of Europa. *The Planetary Science Journal*, 5(3), p.76.

Daubar, I.J., (incl. **Leonard, E. J.**) et al. (2024). Planned geological investigations of the Europa Clipper Mission. *Space Science Reviews*, 220(1), p.18.

Howell, S.M., Bierson, C.J., Kalousová, K., **Leonard, E. J.**, Steinbrügge, G. and Wolfenbarger, N., (2024). Jupiter's ocean worlds: Dynamic ices and the search for life. In *Ices in the Solar-System* (pp. 283-314). Elsevier.

Park, R.S., Mastrodemos, N., Jacobson, R.A., Berne, A., Vaughan, A.T., Hemingway, D.J., **Leonard, E. J.**, Castillo-Rogez, J.C., Cockell, C.S., Keane, J.T. and Konopliv, A.S., 2024. The global shape, gravity field, and libration of Enceladus. *Journal of Geophysical Research: Planets*, 129(1), p.e2023JE008054.

Cockell, C.S., Simons, M., Castillo-Rogez, J., Higgins, P.M., Kaltenegger, L., Keane, J.T., **Leonard, E. J.**, Mitchell, K.L., Park, R.S., Perl, S.M. and Vance, S.D., 2023. Sustained and comparative habitability beyond Earth. *Nature Astronomy*, pp.1-9.

**Leonard, E. J.**, Beddingfield, C.B., Elder, C.M. and Nordheim, T.A., 2023. Unraveling the Geologic History of Miranda's Inverness Corona. *The Planetary Science Journal*, 4(12), p.235.

Vance, S.D., et al. (incl. **Leonard, E. J.**) 2023. Investigating Europa's Habitability with the Europa Clipper. *Space Science Reviews*, 219(8), p.81.

Beddingfield, C.B., **Leonard, E. J.**, Nordheim, T.A., Cartwright, R.J. and Castillo-Rogez, J.C., 2023. Titania's Heat Fluxes Revealed by Messina Chasmata. *The Planetary Science Journal*, 4(11), p.211.

Roberts, J.H., et al. (incl. **Leonard, E. J.**) 2023. Exploring the interior of Europa with the Europa Clipper. *Space Science Reviews*, 219(6), p.46.

Howell, S., and **E. J. Leonard** (2023). Ocean Worlds: Interior Processes and Physical Environments, *NASA Handbook of Space Resources*, Springer Publishing.

Beddingfield, C.B., Cartwright, R.J., Ferguson, S.N. and **Leonard, E.J.**, 2023. Tethys's Heat Fluxes Varied with Time in the Ithaca Chasma and Telemus Basin Region. *The Planetary Science Journal*, 4(3), p.57.

- Mills, M.M., Pappalardo, R.T., Panning, M.P., **Leonard, E.J.** and Howell, S.M., 2023. Moonquake-triggered mass wasting processes on icy satellites. *Icarus*, p.115534.
- Schoenfeld, A.M., Hawkins, E.K., Soderlund, K.M., Vance, S.D., **Leonard, E.** and Yin, A., 2023. Particle entrainment and rotating convection in Enceladus' ocean. *Communications Earth & Environment*, 4(1), p.28.
- Wynne, J.J., Mylroie, J.E., Titus, T.N., Malaska, M.J., Buczkowski, D.L., Buhler, P.B., Byrne, P.K., Cushing, G.E., Davies, A.G., Frumkin, A. and Hansen-Koharcheck, C., (incl. **Leonard, E. J.**). 2022. Planetary caves: A solar system view of processes and products. *Journal of Geophysical Research: Planets*, 127(11), p.e2022JE007303.
- Beddingfield, C.B., **E. J. Leonard**, Cartwright, R.J., Elder, C. and Nordheim, T.A. (2022). High Heat Flux near Miranda's Inverness Corona Consistent with a Geologically Recent Heating Event. *The Planetary Science Journal*, 3(7), p.174.
- Beddingfield, C.B., Cartwright, R.J., **E. J. Leonard**, Nordheim, T. and Scipioni, F. (2022). Ariel's Elastic Thicknesses and Heat Fluxes. *The Planetary Science Journal*, 3(5), p.106.
- Zheng, W., **et al.**, 2022. The Lick Observatory Supernova Search follow-up program: photometry data release of 70 SESNe. *Monthly Notices of the Royal Astronomical Society*, 512(3), pp.3195-3214.
- E. J. Leonard**, Howell, S., Mills, A., Senske, D.A., Patthoff, D.A., Hay, H.C.F.C. and Pappalardo, R.T., 2022. Finding order in chaos: Quantitative predictors of chaos terrain morphology on Europa. *Geophysical Research Letters*, p.e2021GL097309.
- Cartwright, Richard J., **et al.**, 2022. A CO<sub>2</sub> Cycle on Ariel? Radiolytic Production and Migration to Low-latitude Cold Traps. *The Planetary Science Journal*, 3(1), p.8.
- Howell, S., and **E. J. Leonard** (2021, in press). Ocean Worlds: Interior Processes and Physical Environments, Handbook of Space Resources, Springer Publishing.
- E. J. Leonard**, et al., 2021. UMaMI: A New Frontiers-style Mission Concept to Explore the Uranian System. *The Planetary Science Journal*, 2(5), p.174.
- Cartwright, Richard J., **et al.**, 2021. The science case for spacecraft exploration of the Uranian satellites: Candidate ocean worlds in an ice giant system. *The Planetary Science Journal*, 2(3), p.120.
- Titus, T.N., **et al.** 2021. A roadmap for planetary caves science and exploration. *Nature Astronomy*, 5(6), pp.524-525.
- E. J. Leonard**, A. Yin, and R. T. Pappalardo (2021). Forming Relic Cratered Blocks: Left-Lateral Shear on Enceladus Inferred From Ice-Shell Deformation in the Leading Hemisphere. *Journal of Geophysical Research: Planets*, 126(2), e2020JE006499.
- E. J. Leonard**, C. Elder, T. Nordheim, R. Cartwright, D. A. Patthoff, C. Beddingfield, M. Tiscareno, N. Strange, and T. Balint, and 98 cosigners (2020). A New Frontiers Class Mission for the Uranian System that Focuses on Moon, Magnetosphere, and Ring Science. *White Paper submitted in Response to the Planetary Science and Astrobiology Decadal Survey 2023–2032*.
- E. J. Leonard**, Yin, A., and Pappalardo, R. T. (2020). Ridged Plains on Europa Reveal a Compressive Past. *Icarus*. p.113709.
- S. Jarmak, **E. J. Leonard**, et al. (2020). QUEST: A Mission Concept for a New Frontiers Style Uranus Orbiter. *Acta Astronautica*, 170, pp.6-26.

- T. deJaeger, **et al.** (2019). The Berkeley sample of Type II supernovae: BVRI light curves and spectroscopy of 55 SNe II. *MNRAS*, 490(2).
- B. E. Stahl, **et al.** (2019). Lick Observatory Supernova Search Follow-Up Program: Photometry Data Release of 83 Type Ia Supernovae. *MNRAS*, 490(3), pp.3882-3907.
- E. J. Leonard**, R. T. Pappalardo, and A. Yin (2018). Structural analysis of very-high-resolution Galileo images of Europa: Implications for surface evolution. *Icarus*, 312, pp.100-120.

### **Manuscripts in prep.**

- E. J. Leonard** and the LMAP Alpha Team (*in prep*). The Global Geologic Map of Europa: An analysis of global surface features. *Planetary Science Journal* (planned).

### **Invited Talks**

- E. J. Leonard** (2026). Cal Poly Humboldt
- E. J. Leonard** (2025). SwRI
- E. J. Leonard** (2025). Planetary Tectonics. Guest lecturer for Caltech Planetary Surface Processes Graduate-level Class, January 2025.
- E. J. Leonard** (2024). Europa Clipper: The journey to explore and ocean world begins. Caltech Seismology Seminar, November 2024
- E. J. Leonard** (2023). Europa's Geology: The Cover Art of an Enigmatic Moon. Making Space: A Workshop on Space, SciArt, and Society. July, 2023.
- E. J. Leonard** (2023). Inferring Europa's resurfacing history through potential impurity layers within the ice shell. Japan Geosciences Union (JpGU). May, 2023.
- E. J. Leonard** (2023). Bringing Order to Chaos: Insights on the Formation of Chaos Terrain and Implications for Ice Shell Evolution. Brown University, Earth, Environmental, and Planetary Science Department Seminar. March, 2023.
- E. J. Leonard** (2023). Bringing Order to Chaos: Insights on the Formation of Chaos Terrain from Geologic Mapping of Europa and Implications for Ice Shell Evolution. California Institute of Technology, DIX Planetary Science Seminar. January, 2023.
- E. J. Leonard** (2022). Mapping Everything Europa: Clipper Team Policies to Geology. Group Meeting for 398P. January 10<sup>th</sup>, 2022.
- E. J. Leonard** (2021). Bringing Order to Chaos: Insights on the Formation of Chaos Terrain from Geologic Mapping of Europa at the Global and Regional Scale. University of Chicago, September 30<sup>th</sup>, 2021
- E. J. Leonard** (2021). Bringing Order to Chaos: Insights on the Formation of Chaos Terrain from Geologic Mapping of Europa at the Global and Regional Scale. University of North Carolina Wilmington, February 26<sup>th</sup>, 2021
- E. J. Leonard** (2019). Compositional Variations within Europa's Ice Shell: Implications for Surface Geology. Europa Clipper Science Series at JPL, April 19<sup>th</sup>, 2019
- E. J. Leonard**, Pappalardo, R.T. and Yin, A., (2018). Forming Ridges on Icy Satellites: Insights from Physical Analogue Modeling. *GSA Fall Meeting, 2018*, pp.P42B-08.
- E. J. Leonard** (2018). Europa at all Scales: Analyzing Global to High-Resolution Images to Constrain Surface Evolution. Planetary Science Seminar at CalTech, Oct. 2<sup>nd</sup> 2018.

- E. J. Leonard** (2018). Europa's Geology: Insights from Geologic Mapping at the Global to Local Scale. Europa Clipper Science Series at JPL, July 13<sup>th</sup> 2018.
- E. J. Leonard** (2018). "Europa at all Scales: Analyzing Global to High-Resolution Images to Constrain Surface Evolution". Planetary Science Seminar at UCLA, April 12<sup>th</sup> 2018.
- E. J. Leonard**, D. A. Patthoff, and D. A. Senske (2017). "The First USGS Global Geologic Map of Europa." Hyperwall Presentation at AGU Fall Meeting in New Orleans, LA, December 2017. (<https://www.youtube.com/watch?v=jd7rHQOxRiM>)
- E. J. Leonard**, D. A. Patthoff, and D. A. Senske (2017). "The First USGS Global Geologic Map of Europa." Hyperwall Presentation at GSA Fall Meeting in Seattle, WA, October 2017.