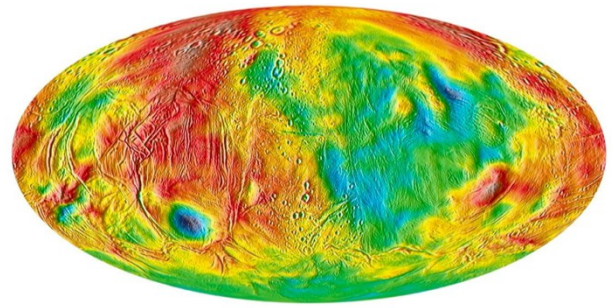


# Alexander Berne

Ph.D. Candidate, NASA FINESST Fellow  
California Institute of Technology  
Seismological Laboratory, Pasadena, CA 91125 USA

[alexberne.com](https://alexberne.com) | [aberne@caltech.edu](mailto:aberne@caltech.edu) | [tel:+1 772 480 7495](tel:+17724807495)



Topographic map of Enceladus  
derived from Cassini stereo-imagery  
(see my publications)

## RESEARCH INTERESTS

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Numerical modelling of planetary interior processes, including tidal dynamics, fault deformation, and thermal evolution. Space geodesy and associated applications, particularly using SAR and gravimetry. Bayesian methods for geophysical inverse problems.

## I. EMPLOYMENT

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**2022 - present** Affiliate for Science, Research, and Technology Development Initiative, NASA Jet Propulsion Laboratory.

*Host:* Ryan Park

**2022 - present** Graduate Research Associate: Division of Geological and Planetary Sciences, California Institute of Technology.

**2020 - 2022** Graduate Research/Teaching Assistant: Division of Geological and Planetary Sciences, California Institute of Technology.

**2016 - 2019** Undergraduate Research/Teaching Assistant: Department of Mechanical Engineering, University of Miami.

**2017- 2017** Electrical Engineering Intern, Florida Power and Light.

## II. EDUCATION

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**2020 - 2025** PhD (Geophysics) at **California Institute of Technology**

*Thesis:* Exploring Different Scales of Crustal Deformation on Enceladus

*Advisor:* Associate Professor Mark Simons

**2019 - 2020** MSc (Physics) at **Oxford University**

*Thesis:* Characterising the Behaviour of an Energy Monitor Device for FLASH Radiation for Cancer Radiotherapy

*Advisor:* Associate Professor Boris Vojnovic

**2015 - 2019** BS (Mechanical Engineering) at **University of Miami** (Valedictorian)

*Thesis:* An automatic control system for a thermo-electric ice coring drill to recover samples from Greenland's ice sheet.

*Advisor:* Assistant Professor Mason Klein

### III. RESEARCH GRANTS AND FELLOWSHIPS AWARDED

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Total Amount Awarded: \$220,000

**2022 - 2025** Future Investigators in NASA Earth and Space Sciences (FINNEST), *Exploring Different Scales of Crustal Deformation on Enceladus*

PI: Alexander Berne

Total Award: \$150,000

**2022 - 2024** Geomechanics and Mitigation of Geologic Hazards, *Structural Controls on Degassing Dynamics in Volcanic Systems*

PI: Joann Stock

**2020 - 2021** Resnick Sustainability Institute, *Understanding Feedback between the Biosphere and Volcanic CO<sub>2</sub> Emissions*

PI: Joann Stock

### IV. PROFESSIONAL DEVELOPMENT

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Activities directly related to research including workshops, mission formulation work, etc.

**2021 - Present** *Nightingale Enceladus Geophysical Orbiter*, PI: Mark Simons.

Nightingale is a NASA mission concept currently under development at JPL to study Enceladus's geodynamics and habitability using radar interferometry (InSAR) and other geophysical measurements.

Role: Graduate Student Member of the Science Team.

**2021** *Keck Institute for Space Studies (KISS) "Next Generation Planetary Geodesy"*.

An invitation-only, week-long "think-tank" program aimed at developing new, innovative, and revolutionary mission concepts for using modern geodetic techniques to constrain processes in the interior of planetary bodies. Team leads: James Tuttle Keane (JPL), Michael Sori (Purdue), Anton Ermakov (Berkeley).

Role: Co-author of proposal and program participant.

**2021 - 2024** *Computational Infrastructure for Geodynamics, Pylith Hackathon and Workshop* .

An invitation-only, week-long workshop aimed at presenting work in computational geodynamics using Pylith. An attached hackathon involves adding functionality to the finite-element code Pylith.

Team leads: Brad Aagaard (UC Davis), Matthew Knepley (SUNY), Charles Williams.

Role: Participant and Presenter

**2021 - Present** *Pylith: a Finite-Element Code for Simulations of Crustal Deformation*

Development work for a finite element code capable of simulating frictional mechanics, viscoelastic rheology, and complex geometries. Pylith is principally designed to model terrestrial dynamics, but is being adapted (by me) to model crustal dynamics for bodies beyond Earth.

Team leads: Brad Aagaard (UC Davis), Matthew Knepley (SUNY), Charles Williams.

Role: Participant and Presenter

## V. HONORS AND AWARDS

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Total amount awarded: \$12700

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| 2024 Travel Stipend Award: <i>Adapting Pylith for Machine Learning Applications</i>              | Award: \$700  |
| 2023 CUBIT Development Award <i>Using CUBIT to study the geodynamics of planetary satellites</i> | Award: \$4000 |
| 2023 Travel Stipend Award: <i>Adapting Pylith for Multi-Physics Applications in Geophysics</i>   | Award: \$1100 |
| 2022 Travel Stipend Award: <i>Adapting Pylith for Planetary Geophysics Beyond Earth</i>          | Award: \$700  |
| 2020 Distinction (for Master's Thesis), Oxford University  |               |
| 2019 <a href="#">Best Senior Design Project in Mechanical Engineering</a>                        |               |
| 2019 Best Student Presentation, Undergraduate Student Research Day, University of Miami          |               |
| 2019 Einspruch Scholarship Department of Mechanical Engineering, University of Miami             | Award: \$3000 |
| 2019 Engineering School Valedictorian, University of Miami                                       |               |
| 2015 STEM Career Development Award   | Award: \$700  |
| 2015 High School Salutatorian  |               |
| 2014 National Merit Scholarship  | Award: \$2500 |

## VI. PEER-REVIEWED PUBLICATIONS

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5 first author publications, and 2 in preparation  
2 co-author publications, and 1 in review, and 2 in preparation

**Berne, A.**, Simons, M., Keane, J., and Park, R., Constraints on Ice Shell Structure from the Spectral Localization of Surface Topography at Enceladus (in prep)

**Berne, A.**, Nelson, K., Chung, N., and Stock, J., An Inverse Approach to Monitor Volcanic CO<sub>2</sub> Flux using Unmanned Aerial Vehicles at Rincon de la Vieja Volcano, Costa Rica (in prep)

Bhageri, A., Simons, M., **Berne, A.**, Vance, S., On the Detectability of the Interior Properties of Enceladus using Tidal Measurements (in prep)

Spitale, J., Tigges, M., **Berne, A.**, Rhoden, A., Hurford, T., and Webster, K., Curtain-Based Maps of Eruptive Activity in Enceladus' South-Polar Terrain at Fifteen Cassini Epochs. (in prep)

Rovira-Navarro, M., Matsuyama, I., and **Berne, A.** "A Spectral Method to Compute the Tides of Laterally-Heterogeneous Bodies." *arXiv preprint* (2023). Preprint DOI: [10.48550/arXiv.2311.15710](https://doi.org/10.48550/arXiv.2311.15710) (accepted at PSJ)

**Berne, A.**, Simons, M., Keane, J. T., Park, R. S., and Leonard, E. J. (2024). Jet Activity at Enceladus linked to tidally-driven strike slip motion along tiger stripes. *Nature Geoscience*, vol. , pp. DOI: [10.1038/s41561-024-01418-0](https://doi.org/10.1038/s41561-024-01418-0)

Nelson, K.M., Jiménez, C., Deering, C.D., de Moor, M.J., Blackstock, J.M., Broccardo, S.P., Schwandner, F.M., Fisher, J.B., Chatterjee, S., Induni, G.A. and Rodriguez, A., ... **Berne, A.**, ... (2024). Total CO<sub>2</sub> budget estimate and degassing dynamics for an active stratovolcano: Turrialba Volcano, Costa Rica. *Journal of Volcanology and Geothermal Research*, p.108075. DOI: <https://doi.org/10.1016/j.jvolgeores.2024.108075>

Park, R. S., Mastrodemos, N., Jacobson, R. A., **Berne, A.**, Vaughan, A. T., Hemingway, D. J., ... and Vance, S. (2024). The global shape, gravity field, and libration of Enceladus. *Journal of Geophysical Research: Planets*, 129(1), e2023JE008054. DOI: <https://doi.org/10.1029/2023JE008054>

**Berne, A.**, Simons, M., Keane, J. T., and Park, R. S. (2023). Using Tidally-Driven Elastic Strains to Infer Regional Variations in Crustal Thickness at Enceladus. *Geophysical Research Letters*, 50(22), e2023GL106656. DOI: <https://doi.org/10.1029/2023GL106656>

**Berne, A.**, Simons, M., Keane, J. T., and Park, R. S. (2023). Inferring the mean thickness of the outer ice shell of Enceladus from diurnal crustal deformation. *Journal of Geophysical Research: Planets*, 128(6), e2022JE007712. DOI: [10.1029/2022JE007712](https://doi.org/10.1029/2022JE007712)

**Berne, A.**, Zhang, T., Shomar, J., Ferrer, A. J., Valdes, A., Ohyama, T., and Klein, M. (2023). Mechanical vibration patterns elicit behavioral transitions and habituation in crawling *Drosophila* larvae. *Elife*, 12, e69205.

DOI: <https://doi.org/10.7554/eLife.69205>

**Berne, A.**, Petersson, K., Tullis, I. D., Newman, R. G., and Vojnovic, B. (2021). Monitoring electron energies during FLASH irradiations. *Physics in Medicine and Biology*, 66(4), 045015. DOI: [10.1088/1361-6560/abd672](https://doi.org/10.1088/1361-6560/abd672)

## VII. TECHNICAL REPORTS AND OTHER PUBLICATIONS

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Sori, M., Keane, J.T. and Ermakov, A. and **Berne, A.**, and Bierson, C., and Bills, B., and Boening, C., and Bramson, A., and D'Amico, S., and Denton, C.A. and Evans, A., and Hemingway, D., and Hernandez, s., and Hostrom, K., and Izquierdo, K., and James, P. and Johnson, B., and Lau, H., and Navarro, T. 2023. Next Generation Planetary Geodesy. *Keck Institute for Space Studies*. <https://doi.org/10.7907/y1m4-ek67>.

## VIII. SELECTED PRESS RELEASES

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**2019** University of Miami News: *"Student Profile: Alexander Berne"*

**2019** University of Miami News: *"In search of hidden worlds"*

*Topic:* Highlight of my work in the Astronomy Club at the University of Miami