

Samantha K. Trumbo

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EDUCATION **Ph.D. Planetary Science**, California Institute of Technology **Spring 2021**
Dissertation: *Views of an Ocean World: The Signatures of Internal and External Processes on the Surface of Europa*
M.S. Oceanography, Scripps Institution of Oceanography, UCSD **Fall 2015**
Thesis: *Marine Export Productivity and the Demise of the Central American Seaway*
B.A. Astronomy, Biology (double major), Cornell University **Spring 2013**
Magna Cum Laude, Distinction in All Subjects

RESEARCH INTERESTS Surface processes and composition of outer-planet satellites and dwarf planets; Spacecraft exploration of ocean worlds and the outer Solar System; Feedback between remote-sensing observations and laboratory experiments

RESEARCH POSITIONS **51 Pegasi b Postdoctoral Fellow**, Cornell University **July 2021–present**
Postdoctoral Scholar, Caltech **Dec. 2020–June 2021**
NASA Earth and Space Science Graduate Fellow, Caltech **2017–2020**
Graduate Student Researcher, Caltech **2015–2017**
Graduate Student Researcher, Scripps Institution of Oceanography, UCSD **2013–2015**
Undergraduate Researcher, Cornell University **2011–2013**
NASA Airborne Science Intern, Student Airborne Research Program (SARP) **Summer 2012**

PUBLICATIONS

16. **Trumbo, S.K.**, Davis, M.R., Cassese, B., and Brown, M.E. (2022) Spectroscopic mapping of Io's surface with HST/STIS: SO₂ frost, sulfur allotropes, and large-scale compositional patterns. *PSJ*, 3, 272, doi:10.3847/PSJ/aca46d.
15. Becker, T.M., **Trumbo, S.K.**, Molyneux, P., Retherford, K.D., Hendrix, A., Roth, L., Raut, U., Alday, J., and McGrath, M.A. (2022) Mid-ultraviolet Hubble observations of Europa and the global distribution of SO₂. *PSJ*, 3, 129, doi:10.3847/PSJ/ac69eb.
14. **Trumbo, S.K.**, Becker, T.M., Brown, M.E., Denman, W.T.P., Molyneux, P., Hendrix, A., Retherford, K.D., Roth, L., and Alday, J. (2022) A new UV spectral feature on Europa: Confirmation of NaCl in leading-hemisphere chaos terrain. *PSJ*, 3, 27, doi:10.3847/PSJ/ac4580.
13. Denman, W.T.P., **Trumbo, S.K.**, and Brown, M.E. (2022) The influence of temperature and photobleaching on irradiated sodium chloride at Europa-like conditions. *PSJ*, 3, 26, doi:10.3847/PSJ/ac4581.
12. Brown, M.E., Denman, W.T.P., and **Trumbo, S.K.** (2022) The mid-UV spectrum of irradiated NaCl at Europa-like conditions. *PSJ*, 3, 28, doi:10.3847/PSJ/ac457f.
11. **Trumbo, S.K.**, Brown, M.E., Adams, D. (2021) The geographic distribution of dense-phase O₂ on Ganymede. *PSJ*, 2, 139, doi:10.3847/PSJ/ac0cee.
10. de Kleer, K., Butler, B.J., de Pater, I., Gurwell, M.A., Moullet, A., **Trumbo, S.K.**, and Spencer, J. (2021) Thermal properties of Ganymede's surface from millimeter and infrared emission. *PSJ*, 2, 5, doi:10.3847/PSJ/abcbf4.
9. **Trumbo, S.K.**, Brown, M.E., and Hand, K.P. (2020) Endogenic and exogenic contributions to visible-wavelength spectra of Europa's trailing hemisphere. *AJ*, 160, 282, doi:10.3847/1538-3881/abc34c.
8. Ingersoll, A.P., Ewald, S.P., and **Trumbo, S.K.** (2020) Time variability of the Enceladus plumes: Orbital periods, decadal periods, and aperiodic change. *Icarus*, 344, 113345, doi:10.1016/j.icarus.2019.06.006.
7. **Trumbo, S.K.**, Brown, M.E., and Hand, K.P. (2019) H₂O₂ within chaos terrain on Europa's leading hemisphere. *AJ*, 158, 127, doi:10.3847/1538-3881/ab380c.

6. **Trumbo, S.K.**, Brown, M.E., and Hand, K.P. (2019) Sodium chloride on the surface of Europa. *Science Advances*, 5, 6, doi: 10.1126/sciadv.aaw7123.
5. **Trumbo, S.K.**, Brown, M.E., and Butler, B.J. (2018) ALMA thermal observations of Europa. *AJ*, 156, 161, doi:10.3847/1538-3881/aada87.
4. **Trumbo, S.K.**, Brown, M.E., and Butler, B.J. (2017) ALMA thermal observations of a proposed plume source region on Europa. *AJ*, 154, 148, doi:10.3847/1538-3881/aa8769.
3. **Trumbo, S.K.**, Brown, M.E., Fischer, P.D., and Hand, K.P. (2017) A new spectral feature on the trailing hemisphere of Europa at 3.78 μm . *AJ*, 153, 250, doi:10.3847/1538-3881/aa6d80.
2. Corrales, L.R., Yi, T.D., **Trumbo, S.K.**, Shalloway, D., Lunine, J.I., and Usher, D.A. (2017) Acetonitrile cluster solvation in a cryogenic ethane-methane-propane liquid: Implications for Titan lake chemistry. *The Journal of Chemical Physics*, 146, 104308, doi:10.1063/1.4978395.
1. Fischer, P.D., Brown, M.E., **Trumbo, S.K.**, and Hand, K.P. (2016) Spatially resolved spectroscopy of Europa's large-scale compositional units at 3-4 μm with Keck NIRSPEC. *AJ*, 153, 13, doi:10.3847/1538-3881/153/1/13.

GRANT FUNDING

Space Telescope Science Institute (PI), *Targeted observations of Ceres' Occator crater with HST/STIS*, \$74,748 (awarded 2022, 3-year period).
Space Telescope Science Institute (PI), *Europa's UV absorptions: oceanic or exogenic origins?* \$154,020 (awarded 2022, 3-year period).
Heising-Simons Foundation (51 Pegasi b Fellowship), *The surfaces of icy worlds: Windows to the oceans below*, \$375,000 (awarded 2021, 3-year period).
Space Telescope Science Institute (Co-I, GO), *Complete spectral maps of the Galilean satellites from 200-1000 nm: salts, radiolytic cycles, and O₂ production*, \$175,842 (awarded 2019).
Space Telescope Science Institute (Co-I, AR), *Complete spectral maps of the Galilean satellites from 200-1000 nm: salts, radiolytic cycles, and O₂ production*, \$76,677 (awarded 2019).
NASA (Earth and Space Science Graduate Fellowship), *The Signatures of Exogenous and Endogenous Processes on the Surface of Europa*, \$135,000 (awarded 2017).

PI & SCIENCE- PI OBSERVING PROGRAMS

Hubble Space Telescope (HST): 2 programs as PI, Cycle 30 (2022–2023), STIS, 9 total orbits.
Gemini Observatory: 2 programs as PI (2019–2021), GMOS-S, 6.6 total hours.
W.M. Keck Observatory: 3 programs as Science PI (2018–2021), NIRSPEC, 9 total half nights.
The Atacama Large Millimeter Array (ALMA): 1 program as PI, Cycle 6 (2018–2019), 2.5 hours.
NASA Infrared Telescope Facility (IRTF): 2 programs as PI (2018–2019), SpeX, 28.5 total hours.

CO-I OBSERVING PROGRAMS

James Webb Space Telescope (JWST): 1 program, Cycle 2 GTO (2023), NIRSPEC/MIRI, 13.8 hours.
Hubble Space Telescope (HST): 2 programs, Cycles 24 & 27 (2016–2020), STIS, 29 total orbits.
The Atacama Large Millimeter Array (ALMA): 1 program, Cycle 5 (2017–2018), 4 hours.

RESEARCH ADVISING

Research Advisor & Thesis Committee Member, Peiyu Wu, Ph.D. student, Cornell **2021–present**
Research Advisor, Sherry Liang, undergraduate student, Caltech **Fall 2019**
Research Advisor, Yiluo Li, Visiting undergraduate student, Caltech **Summer 2018**

UNIVERSITY TEACHING

Teaching Assistant, Caltech **2017–2019**
 Ge 108: Applications of Physics to the Earth Sciences (graduate-level course; guest lectured)
 Ge 157c: Remote Sensing (senior undergraduate/graduate-level course with lab and field component)
 Ge 131: Planetary Interiors (senior undergraduate/graduate-level course)
Teaching Assistant, Scripps Institution of Oceanography, UCSD **2014–2015**
 SIO 1: The Planets (large undergraduate course; designed and led discussion sections)
 SIO 104/255: Paleobiology and the History of Life (undergraduate course with lab component)
Undergraduate Teaching Assistant, Physics Learning Center, Cornell University **2011**
 PHYS 1102: General Physics II (large undergraduate course with lab component)

ADDITIONAL TEACHING & ADVISING

Career Mentor, Pasadena City College Natural Sciences Mentoring Program **2021**
Math Tutor, Caltech Rise Program for the Pasadena Unified School District **2020–2021**
Physics Tutor, Volunteer Physics Tutoring Pilot Program, Pasadena City College **2020–2021**

PROFESSIONAL DEVELOPMENT	GET-SET Course Design Institute , series of workshops through the Cornell Center for Teaching Innovation on the development of learning outcomes and student-centered courses. March 2023. Teaching and Learning in the Diverse Classroom , month-long course through the Cornell Center for Teaching Innovation on inclusive teaching strategies and best practices. June 2022.	
PROFESSIONAL AFFILIATIONS & SERVICE	NASA Europa Clipper Science Team , Postdoctoral Affiliate (MISE) NASA Europa Clipper Science Team , Graduate-student Affiliate (Europa-UVS) AAS Division of Planetary Sciences (DPS) , session co-chair (2020, 2021) American Geophysical Union (AGU) Referee for <i>Geophysical Research Letters</i> , <i>AAS Journals</i> , <i>Icarus</i>	2021–present 2019–2021 2016–present 2012–present
PUBLIC OUTREACH	Cornell Friends of Astronomy Lecture , March 2022 Cornell Astronomical Society Lecture , March 2022 W.M. Keck Observatory Donor Talk , Dec. 2020 Science Magazine Podcast Guest Appearance , June 2019 L.A. Public Radio Guest Appearance , June 2019 NASA SARP Guest Lecture , July 2017 Public Education Volunteer , The Birth Aquarium at Scripps Institution of Oceanography, 2008	
SELECTED AWARDS	Heising-Simons Foundation 51 Pegasi b Fellowship in Planetary Astronomy NASA Earth and Space Sciences Fellowship E.W. Scripps Fellowship , Scripps Institution of Oceanography Outstanding Student Paper Award (OSPA) , AGU Fall Meeting	2021 2017 2013 2012
SELECTED PRESS	The Atlantic , “There’s Hope for Life on Europa, a Distant Moon”, Oct. 2022 Scientific American , “Water on Europa—with a Pinch of Salt”, June 2019 Caltech/JPL Press Release , “Table Salt Compound Spotted on Europa”, June 2019 NRAO Press Release , “ALMA Maps Europa’s Temperature”, Oct. 2018 EOS , “How Hot is Europa? There’s a Map for That”, Sep. 2018 New Scientist , “One of Europa’s Plumes May Not Exist, Making Hunt for Life Hard”, Aug. 2017	
INVITED SEMINARS & COLLOQUIA	UC Santa Cruz , EPS/IGPP Seminar, May 13, 2022 Cornell University , Planetary Lunch Seminar, Oct. 19, 2020 UC Berkeley and UCLA , Joint CIPS and EPSS Seminar, Sep. 30, 2020 CU Boulder , Laboratory for Atmospheric and Space Physics Seminar, Sep. 3, 2020 JPL , Europa Clipper Lecture Series, Jan. 10, 2020 JPL , Icy Worlds Seminar, April 18, 2019 University of Copenhagen , Centre for Star and Planet Formation Seminar, Sep. 24, 2018	
CONFERENCE TALKS	Trumbo, S.K. , Davis, M.R., Cassese, B., and Brown, M.E. (2022) Volcanic Sulfur Products and Large-scale Compositional Patterns on Io from HST/STIS. London, Ontario, Canada, 112.02. (Invited) Trumbo, S.K. (2022) Surface chemistry of the icy Galilean satellites: Observations, laboratory perspectives, and future directions. Japan Geoscience Union Meeting (Hybrid), Chiba, Japan, PPS01-04. (Invited) Trumbo, S.K. (2022) The surface of Europa: A window to the ocean below? Ice-Ocean Interactions on Icy Moons in the Solar System. Princeton Center for Theoretical Science, Princeton, NJ. (Invited) Trumbo, S.K. , Becker, T.M., Brown, M.E., Denman, W.T.P., Molyneux, P., Hendrix, A., Retherford, K.D., Roth, L., and Alday, J. (2022) A new UV absorption on Europa’s surface: Confirmation of NaCl in leading-hemisphere chaos terrain. AGU Fall Meeting, New Orleans, LA, P24C-05. Trumbo, S.K. , Brown, M.E., and Adams, D. (2021) The geographic distribution of dense-phase O ₂ on Ganymede. 53 rd AAS DPS Meeting (Virtual), 103.02. Trumbo, S.K. , Brown, M.E., and Hand, K.P. (2020) Endogenic and exogenic contributions to visible-wavelength spectra of Europa's trailing hemisphere. 52 nd AAS DPS Meeting (Virtual), 106.03. Trumbo, S.K. , Brown, M.E., and Hand, K.P. (2020) H ₂ O ₂ within chaos terrain on Europa. Keck Science Meeting (Virtual). Trumbo, S.K. , Brown, M.E., and Hand, K.P. (2019) H ₂ O ₂ within chaos terrain on Europa’s leading hemisphere, 51 st AAS DPS Meeting/EPSC Meeting, Geneva, Switzerland, EPSC-DPS2019-825.	

Trumbo, S.K., Brown, M.E., and Hand, K.P. (2018) A Search for signatures of irradiated chloride salts on the surface of Europa. 50th AAS DPS Meeting, Knoxville, TN, 407.02.

Trumbo, S.K., Brown, M.E., de Kleer, K., and Hand, K.P. (2018) Observational constraints on the distribution and temperature dependence of H₂O₂ on the surface of Europa. Europa Deep Dive 2: Composition, Houston, TX, 3020.

Trumbo, S.K., Brown, M.E., de Kleer, K., and Hand, K.P. (2018) Observational constraints on the distribution and temperature dependence of H₂O₂ on the surface of Europa. European Planetary Science Congress (EPSC), Berlin, Germany, EPSC2018-203.

Trumbo, S.K., Brown, M.E., and Butler, B.J. (2017) ALMA thermal observations of Europa. 49th AAS DPS Meeting, Provo, UT, 203.05.

Trumbo, S.K., Ewald, S.P., and Ingersoll, A.P. (2016) The time variability of individual geysers in the plume of Enceladus. AGU Fall Meeting, San Francisco, CA, P32A-04.

Trumbo, S.K., Fischer, P.D., Hand, K.P., and Brown, M.E. (2016) A new spectral feature on the trailing hemisphere of Europa at 3.78 μ m. 48th AAS DPS Meeting, Pasadena, CA, 517.01.

Trumbo, S.K., Palacios, S.L., Zimmerman, R.C., and Kudela, R.M. (2012) A mathematical model for estimation of kelp bed productivity: Age dependence and contributions of subsurface kelp. AGU Fall Meeting, San Francisco, CA, B34D-06.