

# CHRISTOPHER R. GLEIN

July 12, 2024

## CONTACT INFORMATION

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## MAJOR CONTRIBUTIONS TO SCIENCE

Updated on May 6, 2024

- Pioneered diverse applications of geochemical approaches for understanding the origin, evolution, and habitability of outer solar system bodies
- Created a new field of extraterrestrial chemical oceanography (Glein et al., 2015; 2018)
- Co-discovered evidence of geothermal activity on the dwarf planets Eris and Makemake (Glein et al., 2024; Grundy et al., 2024)
- Came up with the first determination of the N<sub>2</sub> inventory on Pluto, shedding new light on the source of Pluto's glacial ice (Glein and Waite, 2018)
- Made the first assessment of energetic habitability on an exoplanet from observational data (Glein, 2024)
- Led the development of the leading model for the origin of Titan's atmosphere (Glein, 2015; Miller et al., 2019)
- Contributed to discoveries of a chemical energy source (Waite et al., 2017), organic compounds (Postberg et al., 2018), and phosphorus (Postberg et al., 2023) in materials erupted from Enceladus's subsurface ocean, establishing a strong case that Enceladus is a habitable world
- Helped to discover a carbon source on Europa's surface that most likely came from its subsurface ocean (Villanueva et al., 2023)

## RESEARCH INTERESTS

Exploration to assess habitability and search for life on ocean worlds

Compositions of subsurface oceans on icy bodies in the outer solar system

Origin and evolution of volatiles and planetary atmospheres in the solar system

Ocean chemistry of exoplanets and links to atmospheric composition

Thermodynamics of the liquid methane/ethane-driven geochemistry on Titan

Role of abiotic organic geochemistry in the search for life

Chemistry of relevance to the emergence of life on Earth and beyond

Thermodynamics, kinetics, and mechanisms of organic reactions in hydrothermal systems

Geochemical controls on the isotopic composition of organic compounds  
Organometallic chemistry of ore deposits and serpentinites

#### ACADEMIC QUALIFICATIONS

- Ph.D. Geological Sciences, Arizona State University, Tempe, AZ (2012); GPA: 4.0  
Area of Specialization: Planetary Geochemistry, Advisor: Everett Shock  
Dissertation Title: Theoretical and Experimental Studies of Cryogenic  
and Hydrothermal Organic Geochemistry
- B.S. Major in Chemistry, Minor in Earth and Space Sciences,  
University of Washington, Seattle, WA (2006); GPA: 3.93  
Areas of Specialization: Astrobiology and Planetary Science, Advisor: David Catling

#### WORK EXPERIENCE

- 2022-Present Lead Scientist, Space Science and Engineering Division, Southwest Research  
Institute, San Antonio, TX
- 2018-2022 Senior Research Scientist, Space Science and Engineering Division,  
Southwest Research Institute, San Antonio, TX
- 2015-2018 Research Scientist, Space Science and Engineering Division, Southwest  
Research Institute, San Antonio, TX
- 2014-2015 Deane Postdoctoral Fellow, Department of Earth Sciences, University of  
Toronto, Toronto, ON
- 2012-2014 McClintock Postdoctoral Fellow, Geophysical Laboratory, Carnegie  
Institution of Washington, Washington, DC
- 2006-2012 Graduate Research Assistant, Group Exploring Organic Processes in  
Geochemistry, School of Earth and Space Exploration, Arizona State  
University, Tempe, AZ
- 2003-2006 Undergraduate Research Assistant, Mars Research Group, Department of  
Earth and Space Sciences, University of Washington, Seattle, WA

#### TEACHING

- 2019-2023 Guest Instructor, Planetary Sciences course, Department of Physics and  
Astronomy, The University of Texas at San Antonio, San Antonio, TX
- 2021 Guest Instructor, Summer School in Planetary Sciences, Chinese Academy of  
Sciences Center for Excellence in Comparative Planetology and University of  
Science and Technology of China, online
- 2008-2011 Guest Instructor, Theoretical Geochemistry, and Thermodynamics of Natural  
Systems courses, School of Earth and Space Exploration, Arizona State  
University, Tempe, AZ
- 2007 Teaching Assistant, Introduction to Geology Laboratory, School of Earth and  
Space Exploration, Arizona State University, Tempe, AZ

#### TRAINING

- 2023 Participant, Proposal Mechanics two-day training course, Southwest Research Institute, San Antonio, TX
- 2021 Participant, Geochemical Reaction Modeling, The Geochemist's Workbench Virtual Workshop
- 2021 Participant, Introduction to Geochemical Modeling, The Geochemist's Workbench Virtual Workshop
- 2019 Participant, Project Management three-day training course, Southwest Research Institute, San Antonio, TX
- 2014 Participant, The Deep Carbon Observatory Early Career Scientist Workshop, San José, Costa Rica
- 2008 Participant, Josep Comas i Solà International Summer School in Astrobiology, Univeridad Internacional Meñendez Pelayo, Santander, Spain
- 2005 Research Associate, NASA Academy, Glenn Research Center, Cleveland, OH

#### PEER-REVIEWED PUBLICATIONS

Total number: 72

First-authored: 15

Single-authored: 4

Second-authored: 9

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Metrics as of May 18, 2024

*h*-index: Google Scholar, 29; Scopus, 24

Total citations: Google Scholar, 3956; Scopus, 2735

Papers with >100 citations: Google Scholar, 6; Scopus, 6

Papers in Nature/Science/PNAS: 7

Papers averaging >10 citations per year: Google Scholar, 20

Semantic Scholar 177 Highly Influential Citations

Papers are listed in reverse chronological order.

Students and postdoctoral advisees are underlined>.

Cartwright, R.J., et al. (incl. **Glein, C.R.**), JWST reveals CO ice, concentrated CO<sub>2</sub> deposits, and evidence for carbonates potentially sourced from Ariel's interior, *The Astrophysical Journal Letters*, in press.

Liu, C., et al. (incl. **Glein, C.R.**), The potential for organic synthesis in the ocean of Enceladus, *The Astrophysical Journal*, in press.

Blase, R.C., et al. (incl. **Glein, C.R.**), Biosignature detection from amino acid enantiomers with portable gas chromatography systems, *Advanced Devices & Instrumentation*, 5, 0049, <https://doi.org/10.34133/adi.0049>, 2024.

Becker, T.M., et al. (incl. **Glein, C.R.**), Exploring the composition of Europa with the upcoming Europa Clipper mission, *Space Science Reviews*, 220, 49, <https://doi.org/10.1007/s11214-024-01069-y>, 2024.

Pappalardo, R.T., et al. (incl. **Glein, C.R.**), Science overview of the Europa Clipper mission, *Space Science Reviews*, 220, 40, <https://doi.org/10.1007/s11214-024-01070-5>.

- Napoleoni, M., et al. (incl. **Glein, C.R.**), Probing the oxidation state of ocean worlds with SUDA: Fe (II) and Fe (III) in ice grains, *The Planetary Science Journal*, 5, 95, <https://doi.org/10.3847/PSJ/ad2462>, 2024.
- Waite, J.H., et al. (incl. **Glein, C.R.**), MASPEX-Europa: The Europa Clipper neutral gas mass spectrometer investigation, *Space Science Reviews*, 220, 30, <https://doi.org/10.1007/s11214-024-01061-6>.
- Higgins, P.M., Chen, W., **Glein, C.R.**, Cockell, C.S., Sherwood Lollar, B., Quantifying uncertainty in sustainable biomass and production of biotic carbon in Enceladus' notional methanogenic biosphere, *Journal of Geophysical Research: Planets*, 129, e2023JE008166, <https://doi.org/10.1029/2023JE008166>, 2024.
- Glein, C.R.**, The geochemical potential for metabolic processes on the sub-Neptune exoplanet K2-18b, *The Astrophysical Journal Letters*, 964, L19, <https://doi.org/10.3847/2041-8213/ad3079>, 2024.
- Cartwright, R.J., et al. (incl. **Glein, C.R.**), Revealing Callisto's carbon-rich surface and CO<sub>2</sub> atmosphere with JWST, *The Planetary Science Journal*, 5, 60, <https://doi.org/10.3847/PSJ/ad23e6>, 2024.
- Glein, C.R.**, et al., Moderate D/H ratios in methane ice on Eris and Makemake as evidence of hydrothermal or metamorphic processes in their interiors: Geochemical analysis, *Icarus*, 412, 115999, <https://doi.org/10.1016/j.icarus.2024.115999>, 2024.
- Genova, A., et al. (incl. **Glein, C.R.**), Gravity investigation to characterize Enceladus' ocean and interior, *The Planetary Science Journal*, 5, 40, <https://doi.org/10.3847/PSJ/ad16df>, 2024.
- Daubar, I.J., et al. (incl. **Glein, C.**), Planned geological investigations of the Europa Clipper mission, *Space Science Reviews*, 220, 18, <https://doi.org/10.1007/s11214-023-01036-z>, 2024.
- Neveu, M., et al. (incl. **Glein, C.**), Future of the search for life: Workshop report, *Astrobiology*, 24, 114-129, 2024.
- Grundy, W.M., Wong, I., **Glein, C.R.**, et al., D/H and <sup>13</sup>C/<sup>12</sup>C ratios in methane ice on dwarf planets Eris and Makemake: Evidence for internal activity, *Icarus*, 411, 115923, <https://doi.org/10.1016/j.icarus.2023.115923>, 2024.
- Tosi, F., et al. (incl. **Glein, C.R.**), Salts and organics on Ganymede's surface observed by the JIRAM spectrometer onboard Juno, *Nature Astronomy*, 8, 82-93, 2024.
- Vance, S.D., et al. (incl. **Glein, C.R.**), Investigating Europa's habitability with the Europa Clipper, *Space Science Reviews*, 219, 81, <https://doi.org/10.1007/s11214-023-01025-2>, 2023.
- Villanueva, G.L., et al. (incl. **Glein, C.R.**), Endogenous CO<sub>2</sub> ice mixture on the surface of Europa and no detection of plume activity, *Science*, 381, 1305-1308, 2023.
- Roberts, J.H., et al. (incl. **Glein, C.**), Exploring the interior of Europa with Europa Clipper, *Space Science Reviews*, 219, 46, <https://doi.org/10.1007/s11214-023-00990-y>, 2023.
- Villanueva, G.L., et al. (incl. **Glein, C.R.**), JWST molecular mapping and characterization of Enceladus' water plume feeding its torus, *Nature Astronomy*, 7, 1056-1062, 2023.
- Postberg, F., Sekine, Y., Klenner, F., **Glein, C.R.**, et al., Detection of phosphates originating from Enceladus' ocean, *Nature*, 618, 489-493, 2023.
- Glein, C.R.**, N<sub>2</sub> accretion, metamorphism of organic nitrogen, or both processes likely contributed to the origin of Pluto's N<sub>2</sub>, *Icarus*, 404, 115651, <https://doi.org/10.1016/j.icarus.2023.115651>, 2023.

- Mousis, O., et al. (incl. **Glein, C.R.**), Early stages of Galilean moon formation in a water-depleted environment, *The Astrophysical Journal Letters*, 944, L37, <https://doi.org/10.3847/2041-8213/acb5a4>, 2023.
- Hao, J.\*, **Glein, C.R.\***, et al., Abundant phosphorus expected for possible life in Enceladus's ocean, *Proceedings of the National Academy of Sciences of the United States of America*, 119, 2201388119, <https://doi.org/10.1073/pnas.2201388119>, 2022. \*corresponding authors
- Glass, J.B., Dierssen, H.M., **Glein, C.R.**, Schmidt, B.E., Winebrenner, D.P., Defining and characterizing habitable environments in ocean world systems, *Oceanography*, 35, 30-38, 2022.
- Castillo-Rogez, J.C., Melwani Daswani, M., **Glein, C.R.**, Vance, S.D., Cochrane, C.J., Contribution of non-water ices to salinity and electrical conductivity in ocean worlds, *Geophysical Research Letters*, 49, e2021GL097256, <https://doi.org/10.1029/2021GL097256>, 2022.
- MacKenzie, S.M., et al. (incl. **Glein, C.R.**), Science objectives for flagship-class mission concepts for the search for life at Enceladus, *Astrobiology*, 22, 685-712, 2022.
- National Academies of Sciences, Engineering, and Medicine (incl. **Glein, C.R.**), *Origins, Worlds, and Life: A Decadal Strategy for Planetary Science and Astrobiology 2023-2032*, The National Academies Press, Washington, DC, <https://doi.org/10.17226/26522>, 2022.
- Blase, R.C., et al. (incl. **Glein, C.R.**), MEMS GC column performance for analyzing organics and biological molecules for future landed planetary missions, *Frontiers in Astronomy and Space Sciences*, 9, 828103, <https://doi.org/10.3389/fspas.2022.828103>, 2022.
- Higgins, P.M., **Glein, C.R.**, Cockell, C.S., Instantaneous habitable windows in the parameter space of Enceladus' ocean, *Journal of Geophysical Research: Planets*, 126, e2021JE006951, <https://doi.org/10.1029/2021JE006951>, 2021.
- Melwani Daswani, M., Vance, S.D., Mayne, M.J., **Glein, C.R.**, A metamorphic origin for Europa's ocean, *Geophysical Research Letters*, 48, e2021GL094143, <https://doi.org/10.1029/2021GL094143>, 2021.
- Bouquet, A., Miller, K.E., **Glein, C.R.**, Mousis, O., Limits on the contribution of early endogenous radiolysis to oxidation in carbonaceous chondrites' parent bodies, *Astronomy & Astrophysics*, 653, A59, <https://doi.org/10.1051/0004-6361/202140798>, 2021.
- Cable, M.L., et al. (incl. **Glein, C.R.**), The science case for a return to Enceladus, *The Planetary Science Journal*, 2, 132, <https://doi.org/10.3847/PSJ/abfb7a>, 2021.
- McKinnon, W.B., **Glein, C.R.**, Bertrand, T., Rhoden, A.R., Formation, composition, and history of the Pluto system: A post-New-Horizons synthesis, In *The Pluto System after New Horizons* (S.A. Stern et al., eds.), pp. 507-543, Univ. of Arizona, Tucson, 2021.
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- MacKenzie, S.M., et al. (incl. **Glein, C.R.**), The Enceladus Orbilander mission concept: Balancing return and resources in the search for life, *The Planetary Science Journal*, 2, 77, <https://doi.org/10.3847/PSJ/abe4da>, 2021.
- Robinson, K.J., et al. (incl. **Glein, C.R.**), Quantifying the extent of amide and peptide bond synthesis across conditions relevant to geologic and planetary environments, *Geochimica et Cosmochimica Acta*, 300, 318-332, 2021.

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- Blase, R.C., et al. (incl. **Glein, C.R.**), Experimental coupling of a MEMS gas chromatograph and a mass spectrometer for organic analysis in space environments, *ACS Earth and Space Chemistry*, 4, 1718-1729, 2020.
- Klenner, F., et al. (incl. **Glein, C.R.**), Discriminating abiotic and biotic fingerprints of amino acids and fatty acids in ice grains relevant to ocean worlds, *Astrobiology*, 20, 1168-1184, 2020.
- Soderlund, K.M., et al. (incl. **Glein, C.R.**), Ice-ocean exchange processes in the Jovian and Saturnian satellites, *Space Science Reviews*, 216, 80, <https://doi.org/10.1007/s11214-020-00706-6>, 2020.
- Fu, X., et al. (incl. **Glein, C.R.**), Direct synthesis of amides from amines and carboxylic acids under hydrothermal conditions, *ACS Earth and Space Chemistry*, 4, 722-729, 2020.
- Fu, X., et al. (incl. **Glein, C.R.**), Effect of copper salts on hydrothermal oxidative decarboxylation: A study of phenylacetic acid, *Chemical Communications*, 56, 2791-2794, 2020.
- Glein, C.R.**, Zolotov, M.Y., Hydrogen, hydrocarbons, and habitability across the solar system, *Elements*, 16, 47-52, 2020.
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- Miller, K.E., et al. (incl. **Glein, C.R.**), Cassini INMS constraints on the composition and latitudinal fractionation of Saturn ring rain material, *Icarus*, 339, 113595, <https://doi.org/10.1016/j.icarus.2019.113595>, 2020.
- Glein, C.R.**, Gould, I.R., Lorange, E.D., Hartnett, H.E., Shock, E.L., Mechanisms of decarboxylation of phenylacetic acids and their sodium salts in water at high temperature and pressure, *Geochimica et Cosmochimica Acta*, 269, 597-621, 2020.
- Bouquet, A., Mousis, O., **Glein, C.R.**, Danger, G., Waite, J.H., The role of clathrate formation in Europa's ocean composition, *The Astrophysical Journal*, 885, 14, <https://doi.org/10.3847/1538-4357/ab40b0>, 2019.
- Truong, N., Monroe, A.A., **Glein, C.R.**, Anbar, A.D., Lunine, J.I., Decomposition of amino acids in water with application to in-situ measurements of Enceladus, Europa and other hydrothermally active icy ocean worlds, *Icarus*, 329, 140-147, 2019.
- Bouquet, A., **Glein, C.R.**, Waite, J.H., How adsorption affects the gas-ice partitioning of organics erupted from Enceladus, *The Astrophysical Journal*, 873, 28, <https://doi.org/10.3847/1538-4357/ab0100>, 2019.
- Fecteau, K.M., et al. (incl. **Glein, C.R.**), Production of carboxylic acids from aldehydes under hydrothermal conditions: A kinetics study of benzaldehyde, *ACS Earth and Space Chemistry*, 3, 170-191, 2019.
- Miller, K.E., **Glein, C.R.**, Waite, J.H., Contributions from organic nitrogen to Titan's N<sub>2</sub> atmosphere: New insights from cometary and chondritic data, *The Astrophysical Journal*, 871, 59, <https://doi.org/10.3847/1538-4357/aaf561>, 2019.
- Glein, C.R.**, Postberg, F., Vance, S.D., The geochemistry of Enceladus: Composition and controls, In *Enceladus and the Icy Moons of Saturn* (P.M. Schenk et al., eds.), pp. 39-56, Univ. of Arizona, Tucson, 2018.

- McKay, C.P., Davila, A., **Glein, C.R.**, Hand, K.P., Stockton, A., Enceladus astrobiology, habitability, and the origin of life, In *Enceladus and the Icy Moons of Saturn* (P.M. Schenk et al., eds.), pp. 437-452, Univ. of Arizona, Tucson, 2018.
- Waite, J.H., et al. (incl. **Glein, C.R.**), Chemical interactions between Saturn's atmosphere and its rings, *Science*, 362, eaat2382, DOI: 10.1126/science.aat2382, 2018.
- Perry, M.E., et al. (incl. **Glein, C.R.**), Material flux from the rings of Saturn into its atmosphere, *Geophysical Research Letters*, 45, <https://doi.org/10.1029/2018GL078575>, 2018.
- Postberg, F., et al. (incl. **Glein, C.R.**), Macromolecular organic compounds from the depths of Enceladus, *Nature*, 558, 564-568, 2018.
- Glein, C.R.**, Waite J.H., Primordial N<sub>2</sub> provides a cosmochemical explanation for the existence of Sputnik Planitia, Pluto, *Icarus*, 313, 79-92, 2018.
- Glein, C.R.**, A whiff of nebular gas in Titan's atmosphere – Potential implications for the conditions and timing of Titan's formation, *Icarus*, 293, 231-242, 2017.
- Bouquet, A., **Glein, C.R.**, Wyrick, D., Waite, J.H., Alternative energy: Production of H<sub>2</sub> by radiolysis of water in the rocky cores of icy bodies, *The Astrophysical Journal Letters*, 840, L8, <https://doi.org/10.3847/2041-8213/aa6d56>, 2017.
- Waite, J.H.\*, **Glein, C.R.**\*, et al., Cassini finds molecular hydrogen in the Enceladus plume: Evidence for hydrothermal processes, *Science*, 356, 155-159, 2017. \*corresponding authors
- Domagal-Goldman, S.D., Wright, K.E., et al. (incl. **Glein, C.R.**), The Astrobiology Primer v2.0, *Astrobiology*, 16, 561-653, 2016.
- Glein, C.R.**, Baross, J.A., Waite, J.H., The pH of Enceladus' ocean, *Geochimica et Cosmochimica Acta*, 162, 202-219, 2015.
- Glein, C.R.**, Noble gases, nitrogen, and methane from the deep interior to the atmosphere of Titan, *Icarus*, 250, 570-586, 2015.
- Neveu, M., Desch, S.J., Shock, E.L., **Glein, C.R.**, Prerequisites for explosive cryovolcanism on dwarf planet-class Kuiper belt objects, *Icarus*, 246, 48-64, 2015.
- Glein, C.R.**, Shock, E.L., A geochemical model of non-ideal solutions in the methane-ethane-propane-nitrogen-acetylene system on Titan, *Geochimica et Cosmochimica Acta*, 115, 217-240, 2013.
- Glein, C.R.**, Shock, E.L., Sodium chloride as a geophysical probe of a subsurface ocean on Enceladus, *Geophysical Research Letters*, 37, L09204, 2010.
- Williams, L.B., et al. (incl. **Glein, C.R.**), Birth of biomolecules from the warm wet sheets of clays near spreading centers, In *Earliest Life on Earth: Habitats, Environments and Methods of Detection* (eds. S.D. Golding, M. Glikson), Springer, New York, p. 79-114, 2010.
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- Waite, J.H., et al. (incl. **Glein, C.R.**), Liquid water on Enceladus from observations of ammonia and <sup>40</sup>Ar in the plume, *Nature*, 460, 487-490, 2009.
- Glein, C.R.**, Zolotov, M.Y., Shock, E.L., The oxidation state of hydrothermal systems on early Enceladus, *Icarus*, 197, 157-163, 2008.
- Catling, D.C., et al. (incl. **Glein, C.R.**), Light-toned layered deposits in Juventae Chasma, Mars, *Icarus*, 181, 26-51, 2006.

Catling, D.C., **Glein, C.R.**, Zahnle, K.J., McKay, C.P., Why O<sub>2</sub> is required by complex life on habitable planets and the concept of planetary "oxygenation time", *Astrobiology*, 5, 415-438, 2005.

#### WORKS IN PROGRESS

Students and postdoctoral advisees are underlined.

Phillips, C.B., et al. (incl. **Glein, C.R.**), A reconnaissance strategy for landing on Europa, based on Europa Clipper data, *The Planetary Science Journal*, submitted.

Truong, N., **Glein, C.R.**, Lunine, J.I., A broad set of solar and cosmochemical data indicates high C-N-O abundances for the solar system, *The Astrophysical Journal*, submitted.

#### FUNDING HISTORY

Total funds received: \$4,815,117

PI grants: 7

Co-I grants: 11

#### *Awarded proposals:*

PI, SwRI Internal Research & Development, "Paleo-Metabolomics: Can We Use the Metabolome to Constrain Conditions Where Life Began?", Total Budget: \$75,000 (20 May 2024 to 20 September 2024)

PI, James Webb Space Telescope Cycle 2 General Observers Program, "Seeking New Clues to the Habitability and Plume Activity of the Ocean World Enceladus using JWST-NIRSpec", Total Budget: \$247,500 (10 June 2024 to 9 June 2026)

PI, Europa Inspiring Clipper: Opportunities for Next-generation Scientists (ICONS), Jet Propulsion Laboratory, "How do volatile and rock compositions affect the chemistry of Europa's ocean?", Total Budget: \$48,127 (3 June 2024 to 31 August 2024)

Co-I, SwRI Presidential Discretion Internal Research & Development, "Uranus Orbiter & Probes: Instrument Concept Preparations" (PI: Kurt Retherford, Southwest Research Institute), Total Budget: \$917,993 (1 February 2024 to 1 February 2025), Funds to Glein: \$45,807

Co-I, Signatures of Life in the Universe, Heising-Simons Foundation, "A close look at the habitability of water worlds" (PI: Jennifer Bergner, University of California, Berkeley), Total Budget: \$165,000 (1 October 2023 to 30 September 2025), Funds to Glein: \$55,000

Co-I, NASA Precursor Science Investigations for Europa, "Follow the Energy: Tracing from Europa Surface Chemistry Back to Subsurface Redox Conditions" (PI: Kelly Miller, Southwest Research Institute), Total Budget: \$1,915,259 (16 June 2023 to 15 June 2026), Funds to Glein: \$209,519

PI, SwRI Internal Research & Development, "Building SwRI expertise in Uranian system science for expected opportunities on a future Uranus Orbiter and Probe mission", Total Budget: \$285,055 (1 January 2023 to 31 December 2023)

Co-I, SwRI Internal Research & Development, "Enhancing the capability of MEMS GC columns for enantiomeric separations of biologically relevant compounds in future planetary



- landed missions (PI: Ryan Blase, Southwest Research Institute)”, Total Budget: \$74,982 (4 April 2022 to 4 August 2022), Funds to Glein: de minimis
- PI, Europa Clipper Composition Working Group, Jet Propulsion Laboratory, Total Budget: \$165,489 (31 March 2022 to 28 September 2025)
- PI, SwRI Internal Research & Development, “Dating on Enceladus: Taking Habitability to the Next Level for New Frontiers 5”, Total Budget: \$74,995 (14 March 2022 to 14 July 2022)
- Co-I, Cassini Data Analysis, “Further Examination of Hydrogen from the Enceladus Plume by Cassini INMS” (PI: Benjamin Teolis, Southwest Research Institute), Total Budget: \$631,687 (2 Jan 2021 to 1 Jan 2024), Funds to Glein: \$53,799
- Co-I, SwRI Presidential Discretion Internal Research & Development, “Demonstrating Future Mass Spectrometry for Enceladus” (PI: Kelly Miller, Southwest Research Institute), Total Budget: \$249,983 (2 March 2020 to 16 June 2020), Funds to Glein: \$6,602
- Co-I, Simons Collaboration on the Origins of Life, “Environmental Conditions for the Origin of Life and Early Life” (PI: David Catling, University of Washington), Total Budget: \$1,219,267 (1 Feb 2020 to 31 Jan 2023), Funds to Glein: \$105,000
- Co-I, NASA Planetary Mission Concept Studies, “Flagship Concepts for Astrobiology at Enceladus” (PI: Shannon MacKenzie, Johns Hopkins University Applied Physics Laboratory), Total Budget: \$146,588 (15 October 2019 to 30 June 2020), Funds to Glein: \$6,353
- Co-I, SwRI Presidential Discretion Internal Research & Development, “MASPEX-Orbitrap: Towards Detection of Extraterrestrial Life: Phase 1” (PI: Kelly Miller, Southwest Research Institute), Total Budget: \$225,573 (29 April 2019 to 29 January 2020), Funds to Glein: \$15,997
- PI, Instrument Concepts for Europa Exploration 2, “MASS Spectrometer for Planetary EXploration-ORganic Composition Analyzer (MASPEX-ORCA) for Europa Lander”, Total Budget: \$3,105,126 (4 March 2019 to 3 March 2021)
- Co-I, NASA Astrobiology Institute, Cooperative Agreement Notice 8, “Habitability of Hydrocarbon Worlds: Titan and Beyond” (PI: Rosaly Lopes, Jet Propulsion Laboratory), Total Budget: \$8,265,278 (1 January 2018 to 31 December 2022), Funds to Glein: \$235,653
- Co-I, SwRI Internal Research & Development, “Experimental Investigation of the Organic Solar System” (PI: Mark Libardoni, Southwest Research Institute), Total Budget: \$249,327 (1 April 2017 to 1 April 2018), Funds to Glein: \$48,049
- Co-I, Simons Collaboration on the Origins of Life, “Constraining the Environment for Life’s Origin and the Spread of Early Life” (PI: David Catling, University of Washington), Total Budget: \$899,999 (1 Feb 2017 to 31 Jan 2020), Funds to Glein: \$87,046

*Fellowships:*

- Roger Deane Fellowship (\$50k + benefits, 1 year), Department of Earth Sciences, University of Toronto, 2014
- Barbara McClintock Fellowship (\$120k + benefits, 2 years), Carnegie Institution for Science, 2012

## HONORS & AWARDS

Research accolades, January issue of Roadrunner, Southwest Research Institute, 2024  
Travel Grant to the Network for Ocean Worlds (NOW) 1st Annual Retreat: Exploring the  
Science and Technology of Ocean Worlds Across the Solar System, 2023  
Scialog Fellow, Signatures of Life in the Universe, Research Corporation for Science  
Advancement (RCSA) and the Heising-Simons Foundation, 2023  
Eos Editors' Highlight, "The Freshest Mineral Water in the Solar System", [https://eos.org/editor-  
highlights/the-freshest-mineral-water-in-the-solar-system](https://eos.org/editor-highlights/the-freshest-mineral-water-in-the-solar-system), 2020  
NASA Group Achievement Award to the Cassini Ion Neutral Mass Spectrometer Team, 2018  
Outstanding Contribution to the ESA Rosetta Mission, European Space Agency, 2017  
Bradley Prize for Best Talk of the Year, The Geological Society of Washington DC, 2013  
NASA Astrobiology Institute Scholarship for travel to the European Planetary Science Congress  
to give an invited talk, 2010  
Sherwood Chang Award for Student Excellence in the Origin of Life, Gordon Research  
Conference on the Origin of Life, 2010  
NASA Astrobiology Institute Scholarship for participation in the Comas i Solà International  
Summer School in Astrobiology, 2008  
Graduate Scholar Award, Arizona State University, 2006-2008  
Travel Grant to the Workshop on Ices, Oceans, and Fire: Satellites of the Outer Solar  
System, 2007  
Research Initiation Grant, Department of Geological Sciences, Arizona State University, 2006  
American Institute of Chemists Foundation Award for Outstanding Student Majoring in  
Chemistry at the University of Washington, 2006  
Hypercube Scholar Award in Computational Chemistry, Department of Chemistry, University of  
Washington, 2005  
P.C. Cross Award in Physical Chemistry, Department of Chemistry, University of Washington,  
2004

## SPACECRAFT MISSION INVOLVEMENT

### *Flown/selected missions:*

James Webb Space Telescope (JWST), 2022-Present  
Europa Clipper MAAss Spectrometer for Planetary EXploration (MASPEX) instrument, Co-  
Investigator, 2015-Present  
Juno, 2022-2023  
Cassini Ion and Neutral Mass Spectrometer (INMS) instrument, 2015-2019

### *Missions/instruments in the preflight stage:*

Enceladus Life Finder (ELF) mission concept, 2014-Present  
Deputy Principal Investigator, 2021-Present  
Proposed to Discovery 2015, New Frontiers 2017  
Study team for a Generic European Probe concept to giant planets, 2023-Present  
Enceladus Moonraker mission concept, 2022-Present

Europa Lander MASS Spectrometer for Planetary EXploration ORganic Composition Analyzer (MASPEX ORCA) instrument, 2018-2022  
Proteus main belt comet mission concept, 2019-2020  
Proposed to Discovery 2019  
Titan Oceanus mission concept, 2016-2017  
Proposed to New Frontiers 2017  
Life Investigation For Enceladus (LIFE) mission concept, 2013-2016  
Europa Sylph SmallSat concept, 2016  
Mass Analyzer for Real-time Investigation of Neutrals at Europa (MARINE) instrument, 2014-2015

#### SEMINAR PRESENTATIONS

Unjournal Club, Southwest Research Institute, May 2024  
Geodynamics Seminar Series, Woods Hole Oceanographic Institution, April 2024  
Center for Planetary Systems Habitability Seminar Series, The University of Texas at Austin, February 2024  
Institut Origines Seminar, Laboratoire d'Astrophysique de Marseille, October 2023  
Department of Chemistry and Chemical Biology Seminar Series, Rensselaer Polytechnic Institute, September 2023  
Earth and Planets Laboratory General Seminar Series, Carnegie Institution for Science, June 2023  
Institute of Geological Sciences Colloquium, Freie Universität Berlin, June 2023  
Planetary Science Directorate Colloquium, Southwest Research Institute Boulder, April 2023  
Europa Clipper Composition Working Group Townhall, November 2022  
Online Invited Talk, Paleontological Society of China – Geobiology Section, August 2022  
Earth and Space Sciences Seminar, University of Washington, June 2021  
Institute for Geophysics Seminar, University of Texas, October 2019  
Geophysical Laboratory Seminar, Carnegie Institution for Science, April 2018  
Planetary Science Seminar, Science Visitor and Colloquium Program, Jet Propulsion Laboratory, June 2017  
Department of Astronomy Colloquium, Cornell University, April 2016  
Enceladus Seminar Lecture, Center for Integrative Planetary Science, Department of Astronomy, University of California, Berkeley, April 2016  
Speaker Series, Department of Geological Sciences, Michigan State University, February 2016  
Geological Sciences Seminar, School of Earth, Energy & Environmental Sciences, Stanford University, January 2016  
Department of Space Science Seminar, Southwest Research Institute, July 2015  
Geophysical Laboratory Seminar, Carnegie Institution of Washington, April 2015  
Department of Earth Sciences Seminar, University of Toronto, March 2015  
Centre for Planetary Sciences Planet Day, University of Toronto, February 2015  
Department of Earth & Environmental Sciences and Lamont-Doherty Earth Observatory Seminar, Columbia University, April 2014  
Department of Geosciences Colloquium, Stony Brook University, April 2014  
Astrobiology Program Colloquium, University of Washington, November 2013  
October Meeting, The Geological Society of Washington DC, October 2013

Deep Carbon Forum, Geophysical Laboratory, Carnegie Institution of Washington, July 2013  
Deep Carbon Forum, Geophysical Laboratory, Carnegie Institution of Washington, December 2012

Geophysical Laboratory Seminar, Carnegie Institution of Washington, September 2012

#### SOCIETY MEMBERSHIPS

American Association for the Advancement of Science  
American Astronomical Society  
AAS Division for Planetary Sciences  
American Chemical Society  
American Geophysical Union  
Geochemical Society  
International Society for the Study of the Origin of Life  
Outer Planets Assessment Group  
Planetary Society  
Scientific Society for Astrobiology

#### PROFESSIONAL SERVICE

##### *Leadership:*

Co-Chair, Composition Working Group, Europa Clipper mission, 2022-Present  
Chair, Enceladus: The Storyteller, American Geophysical Union, Fall Meeting, 2024  
Scientific Organizing Committee, Second Texas Area Planetary Science (TAPS) Meeting, 2024  
Scientific Organizing Committee, Breakthrough Discuss, 2024  
Chair, Enceladus: From Inner Workings to the Potential for Life, American Geophysical Union, Fall Meeting, 2023  
Scientific Organizing Committee, Workshop on the Origins and Habitability of the Galilean Moons, 2023  
Scientific Organizing Committee, First Texas Area Planetary Science (TAPS) Meeting, 2023  
Chair, Extraordinary Enceladus, American Geophysical Union, Fall Meeting, 2022  
Organizing Committee, Future of the Search for Life (FoSL) workshop, 2022  
Chair, Enceladus: Beacon of Ocean Worlds, American Geophysical Union, Fall Meeting, 2021  
Member, Ocean Worlds and Dwarf Planets Panel, Planetary Science and Astrobiology Decadal Survey 2023-2032, 2020-2021  
Chair, Enceladus: A Habitable World Beckons, American Geophysical Union, Fall Meeting, 2020  
Chair, Deep Dive Enceladus, American Geophysical Union, Fall Meeting, 2019  
Convener, The Many Layers of Titan, Astrobiology Science Conference, 2019  
Convener, Beyond CHNOPS: Exploring Habitability on Icy Ocean Worlds, Astrobiology Science Conference, 2019  
Convener, Geochemists Infiltrate the Solar System: The Geological Evolution of Small Bodies, Moons, and Planets, Goldschmidt Conference, 2018  
Scientific Organizing Committee, Ocean Worlds: Europa, Enceladus, Titan, and Beyond, Committee on Space Research Scientific Assembly, 2018

Chair, Inside out of Icy Satellites, Lunar and Planetary Science Conference, 2016  
Chair, Outer Planetary Bodies, Lunar and Planetary Science Conference, 2015  
Postdoctoral Representative, Library Committee, Geophysical Laboratory, 2013-2014

*Support of early career scientists:*

Mentor to graduate researcher Cindy Luu, University of Texas at San Antonio, 2024-Present  
Mentor to postdoctoral researcher Elizabeth Spiers, University of Texas at Austin, 2024-Present  
Supervisor of postdoctoral researcher Ngoc Truong, Southwest Research Institute, 2023-Present  
Mentor to undergraduate summer intern Jared Bouck, Northern Arizona University, 2024  
Mentor to undergraduate summer intern Carly Davis, McNeese State University, 2024  
Mentor to graduate researcher Ngoc Truong, Cornell University, 2021-2022  
Co-supervisor of undergraduate summer intern Nadia Gonzales, University of Texas at Austin, 2022  
Co-advisor (unofficial) of graduate researcher Christine Ray, “The Habitability of Ocean Worlds: A Chemical Systems Perspective”, University of Texas at San Antonio, 2016-2021  
Mentor to high school student William Eisen, Nyack High School, 2019-2021  
Mentor to postdoctoral researcher Jihua Hao, Rutgers University, 2019-2020  
Mentor to graduate researcher Alexis Bouquet, University of Texas at San Antonio, 2015-2018  
Supervisor of postdoctoral researcher Kelly Miller, Southwest Research Institute, 2016-2018  
Mentor to undergraduate researcher Alice Zhu, University of Toronto, 2014-2015  
Mentor to high school intern Robert Martin (semifinalist in the 2013 Siemens Competition in Math:Science:Technology), Carnegie Institution of Washington, 2013-2014  
Mentor to undergraduate researcher Mark Reineke, Arizona State University, 2009

*Peer review:*

Manuscript Reviewer for The Astrophysical Journal Letters, Earth and Planetary Science Letters, ACS Earth and Space Chemistry, Geochimica et Cosmochimica Acta, Geophysical Research Letters, Icarus, Journal of Geophysical Research: Planets, Monthly Notices of the Royal Astronomical Society, Nature Communications, Origins of Life and Evolution of Biospheres, Proceedings of the National Academy of Sciences of the United States of America, The Planetary Science Journal  
Book Chapter Reviewer for Planetary Astrobiology, The University of Arizona Press  
External Reviewer, National Academies Report – Biosignatures Standards of Evidence Workshop, 2022  
Application Reviewer, Astrobiology Mission Ideation Factory: The Search for Life on Mars, 2023  
Grant Review Panelist, NASA Habitable Worlds Program, 2018  
Grant Review Panelist, NASA Cosmochemistry Program, 2013  
External Grant Reviewer, NASA Habitable Worlds Program, 2019  
External Grant Reviewer, NASA Astrobiology Institute, 2017  
External Grant Reviewer, NASA Exobiology Program, 2016, 2024  
External Grant Reviewer, NASA Outer Planets Research Program, 2012

### *Public outreach:*

Presenter of a talk on trans-Neptunian objects, New Jersey Astronomical Association, 2024  
Featured scientist in The James Webb Telescope: Are We Alone, The Whole Story with Anderson Cooper, Season 2, CNN, <https://www.cnn.com/videos/title-2429410>, 2024  
Guest interviewee on Planetary Radio, <https://www.planetary.org/planetary-radio/2024-eris-and-makemake>, 2024  
Advocate at The Planetary Society's Day of Action, United States Capitol, 2023  
Guest interviewee on Planetary Radio, <https://www.planetary.org/planetary-radio/2023-phosphorus-in-enceladus>, 2023  
Presenter of a talk on Diving into the Alien Ocean of Enceladus, South Texas Mensa group, 2022  
Presenter of a talk in Season 2: Motivations for Ocean Worlds Exploration, Episode 3: Geochemistry & Habitability, Network for Ocean Worlds (NOW) Lecture Series, 2021  
Exhibitor in the SwRI Space Science & Engineering booth, Alamo City Comic Con, 2018  
Presenter of an Astronomy on Tap talk, Blue Star Brewing Company, San Antonio, 2018  
Presenter of a talk on an Introduction to Enceladus, Morningside Ministries, 2018  
Presenter of a talk on the past, present, and future of Ocean Worlds exploration, Seventieth Annual Meeting, Southwest Research Institute, 2018  
Presenter of a Tom Talk (a "TED-style" talk), Southwest Research Institute, 2017  
Panelist for a discussion on the implications for life on Earth and elsewhere from the 40<sup>th</sup> anniversary of the discovery of deep-sea hot springs, 6<sup>th</sup> International Symposium on Chemosynthesis-based Ecosystems, Woods Hole Oceanographic Institution, 2017  
Presenter of a Cassini-Huygens Analysis and Results from the Mission (CHARM) telecon on Enceladus, <https://saturn.jpl.nasa.gov/cassinicharm>, 2017  
Presenter at Professional Development Day for secondary school teachers, Department of Earth Sciences, University of Toronto, 2015  
Education and Public Outreach Exhibitor for the Carnegie Institution at the USA Science and Engineering Festival, Washington DC, 2014

### SOFTWARE EXPERTISE

Geochemical/planetary data analysis, modeling, and visualization: Geochemist's Workbench, EQ3/6, PyGCC, SUPCRT92, FREZCHEM, HSC Chemistry, GEM-Selektor, MELTS, NIST-REFPROP, MATLAB, Mathematica, IDL, Fortran, OriginLab, Excel, Photoshop, Illustrator

### LABORATORY EXPERTISE

Organic geochemistry experiments and analysis: 1-atm furnace, Cold-seal vessel, Wet chemistry, Gas chromatography (FID, TCD), Gas chromatography-mass spectrometry (GC-MS), Pyrolysis-GC-MS, Isotope-ratio mass spectrometry, Ion chromatography

### WHITE PAPERS

Neveu, M., et al. (incl. **Glein, C.**), Future of the Search for Life: Workshop Report, 2022.

- MacKenzie, S.M., et al. (incl. **Glein, C.R.**), Enceladus Orbilander: A flagship mission concept for astrobiology, Planetary Mission Concept Study for the 2023-2032 Decadal Survey, <https://lib.jhuapl.edu/papers/the-enceladus-orbilander>, 2020.
- Glass, J.B., Dierssen, H.M., **Glein, C.R.**, Schmidt, B.E., Winebrenner, D.P., Defining and characterizing habitable environments in ocean world systems, solicited by NASA's Earth Science Division, <https://oceanworlds.space/whitepaper>, 2020.
- Cable, M.L., et al. (incl. **Glein, C.R.**), The case for a return to Enceladus, Planetary Science and Astrobiology Decadal Survey 2023-2032, [http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/623127/5489366/172-35a411bf1d6d47e724a23368a5f8d1a8\\_CableMorganL.pdf](http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/623127/5489366/172-35a411bf1d6d47e724a23368a5f8d1a8_CableMorganL.pdf), 2020.
- Miller, K.E., et al. (incl. **Glein, C.R.**), The value of CHONS isotopic measurements of major compounds as probes of planetary origin, evolution, and habitability, Planetary Science and Astrobiology Decadal Survey 2023-2032, [http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/623127/5489366/132-fc29b1e9c3c2a009bfe60bf9ab8d4249\\_MillerKellyE.docx](http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/623127/5489366/132-fc29b1e9c3c2a009bfe60bf9ab8d4249_MillerKellyE.docx), 2020.
- Cable, M.L., et al. (incl. **Glein, C.R.**), Enceladus: A review of recent discoveries, National Academies of Sciences, Engineering, and Medicine, Astrobiology Science Strategy for the Search for Life in the Universe, [http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/201-4519228baf5c69b327d13ad21f761c17\\_CableMorganL.pdf](http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/201-4519228baf5c69b327d13ad21f761c17_CableMorganL.pdf), 2018.
- Cable, M.L., et al. (incl. **Glein, C.R.**), Seeking the origins of aqueous life on Titan, National Academies of Sciences, Engineering, and Medicine, Astrobiology Science Strategy for the Search for Life in the Universe, [http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/48-15e05a32a99f2f13062aaae15ab7a52b\\_CableMorganL.pdf](http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/48-15e05a32a99f2f13062aaae15ab7a52b_CableMorganL.pdf), 2018.
- Malaska, M.J., et al. (incl. **Glein, C.R.**), Seeking non-aqueous life on a hydrocarbon world, National Academies of Sciences, Engineering, and Medicine, Astrobiology Science Strategy for the Search for Life in the Universe, [http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/254-8d793c365f8b0bbb2a699c1c71ba29b9\\_MalaskaMichaelJ.docx](http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/254-8d793c365f8b0bbb2a699c1c71ba29b9_MalaskaMichaelJ.docx), 2018.
- Hendrix, A.R., et al. (incl. **Glein, C.**), Roadmaps to ocean worlds (ROW): Priorities, National Academies of Sciences, Engineering, and Medicine, Astrobiology Science Strategy for the Search for Life in the Universe, [http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/41-919f56adf2fe8e43ec3854e818ad8db0\\_HendrixAmanda.pdf](http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/41-919f56adf2fe8e43ec3854e818ad8db0_HendrixAmanda.pdf), 2018.
- Hendrix, A.R., et al. (incl. **Glein, C.**), Roadmaps to ocean worlds (ROW): Goals, objectives, investigations, National Academies of Sciences, Engineering, and Medicine, Astrobiology Science Strategy for the Search for Life in the Universe, [http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/201-c212c816d649a38ad5874f3d98f93268\\_HendrixAmandaR.pdf](http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/201-c212c816d649a38ad5874f3d98f93268_HendrixAmandaR.pdf), 2018.
- Pappalardo, R., et al. (incl. **Glein, C.**), Addressing the habitability of Europa with the Europa Clipper Mission, National Academies of Sciences, Engineering, and Medicine, Astrobiology Science Strategy for the Search for Life in the Universe, [http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/64-2f109e174ee7cca5f8270e689bf23ce0\\_PappalardoRobertT.pdf](http://surveygizmoreponseuploads.s3.amazonaws.com/fileuploads/15647/3949545/64-2f109e174ee7cca5f8270e689bf23ce0_PappalardoRobertT.pdf), 2018.

## CONFERENCE PRESENTATIONS

Total number: 255

Invited talks: 8

–2024–

- Cartwright, R.J., et al. (incl. **Glein, C.R.**), Ariel, a Carbon Dioxide Wonderland Observed by JWST, 56th Division for Planetary Sciences Meeting, held 6-10 October in Boise, ID, 2024.
- Camarca, M., et al. (incl. **Glein, C.**), The surface ices of Callisto's primordial landscape: New JWST NIRSpec results, 56th Division for Planetary Sciences Meeting, held 6-10 October in Boise, ID, 2024.
- Mousis, O., et al. (incl. **Glein, C.**), Generic Entry Probe Program (GEPP) – An international initiative promoting the development of European descent modules dedicated to the in situ exploration of giant planets, EuroPlanet Science Congress, held 8-13 September in Berlin, Germany, 2024.
- Napoleoni, M., et al. (incl. **Glein, C.**), Detecting Fe (II) and Fe (III) in ice grains: Implications for the geochemistry and habitability of Europa and Enceladus, EuroPlanet Science Congress, held 8-13 September in Berlin, Germany, 2024.
- Hao, J., **Glein, C.**, Availability of nutrients in the Enceladus ocean, Goldschmidt Conference, held 18-23 August in Chicago, IL, 2024.
- Liu, C., et al. (incl. **Glein, C.R.**), The potential for organic synthesis in the ocean of Enceladus, Goldschmidt Conference, held 18-23 August in Chicago, IL, 2024.
- Blase, R.C., et al. (incl. **Glein, C.R.**), Next-generation separation science for landed planetary science missions, Second Texas Area Planetary Science Meeting, held 15-16 August in San Antonio, TX, 2024.
- Glein, C.R.**, Large trans-Neptunian objects as evolved worlds shaped by internally driven processes, Second Texas Area Planetary Science Meeting, held 15-16 August in San Antonio, TX, 2024.
- Luu, C., et al. (incl. **Glein, C.**), Can the presence of a supercritical water ocean explain the atmospheric composition of exoplanet K2-18b? Second Texas Area Planetary Science Meeting, held 15-16 August in San Antonio, TX, 2024.
- Glein, C.R.**, Enceladus as the best bet for finding life, Breakthrough Discuss, A Cosmic Tapestry for Exploration: Weaving Novel Strands in Artificial Intelligence, Astrobiology and Space Missions, held 18-19 July in Oxford, UK, 2024.
- Mousis, O., et al. (incl. **Glein, C.**), Generic Entry Probe Program (GEPP) – An international initiative promoting the development of European descent modules dedicated to the in situ exploration of giant planets, Committee on Space Research Scientific Assembly, held 13-21 July in Busan, Korea, 2024.
- Protopapa, S., et al. (incl. **Glein, C.**), Discoveries in the field of trans-Neptunian objects by the James Webb Space Telescope, Committee on Space Research Scientific Assembly, held 13-21 July in Busan, Korea, 2024.
- Glein, C.R.**, et al., Hot times in cool places: JWST measurements of D/H ratios indicate endogenic production of methane on Eris and Makemake (Invited), TNO2024, held 24-28 June in Taipei, Taiwan, 2024.



- Vance, S.D., et al. (incl. **Glein, C.R.**), Europa Clipper's investigation of Europa's habitability, Asia Oceania Geosciences Society Meeting, held 23-28 June in Pyeongchang, Gangwon-do, South Korea, 2024.
- Truong, N., **Glein, C.**, Improved constraints on the solar abundances from neutrino and solar winds: Implications to giant planet compositions, Exoplanets 5, held 16-21 June in Leiden, The Netherlands, 2024.
- Cartwright, R.J., et al. (incl. **Glein, C.R.**), The surface compositions of the large moons of Uranus: Tracers of exogenic processing and possible internal oceans, The Uranus Flagship: Investigating New Paradigms for Outer Planet Exploration, held 21-23 May in Greenbelt, MD, 2024.
- Grava, C., et al. (incl. **Glein, C.**), The exospheres of the five major satellites of Uranus and their connection with surface and magnetosphere, The Uranus Flagship: Investigating New Paradigms for Outer Planet Exploration, held 21-23 May in Greenbelt, MD, 2024.
- Mousis, O., et al. (incl. **Glein, C.**), Generic Entry Probe Program (GEPP) – Promoting European descent modules for in situ exploration of giant planets, The Uranus Flagship: Investigating New Paradigms for Outer Planet Exploration, held 21-23 May in Greenbelt, MD, 2024.
- Blase, R., et al. (incl. **Glein, C.R.**), Biosignature detection with MASPEX at ocean worlds, Astrobiology Science Conference, held 5-10 May in Providence, RI, 2024.
- Higgins, P.M., et al. (incl. **Glein, C.**), Ratios of abiotic to biotic carbon inform on the scale, productivity, behavior, and detectability of notional ocean world biospheres, Astrobiology Science Conference, held 5-10 May in Providence, RI, 2024.
- Luu, C., et al. (incl. **Glein, C.**), Can the presence of a supercritical water ocean explain the atmospheric composition of exoplanet K2-18b? Astrobiology Science Conference, held 5-10 May in Providence, RI, 2024.
- Napoleoni, M., et al. (incl. **Glein, C.**), Detecting Fe (II) and Fe (III) in ice grains: Implications for the geochemistry and habitability of Europa and Enceladus, Astrobiology Science Conference, held 5-10 May in Providence, RI, 2024.
- Vance, S., et al. (incl. **Glein, C.**), Europa Clipper's investigation of Europa's habitability, Astrobiology Science Conference, held 5-10 May in Providence, RI, 2024.
- Mousis, O., et al. (incl. **Glein, C.**), Generic Entry Probe Program (GEPP) – An international initiative promoting the development of European descent modules dedicated to the in situ exploration of giant planets, European Geosciences Union, General Assembly, held 14-19 April in Vienna, Austria, 2024.
- Waite, J.H., et al. (incl. **Glein, C.R.**), The Europa Clipper MASPEX investigation, European Geosciences Union, General Assembly, held 14-19 April in Vienna, Austria, 2024.
- Glein, C.**, Hot times in cool places: JWST measurements of D/H ratios indicate endogenic production of methane on Eris and Makemake, Network for Ocean Worlds Steering Committee Meeting, held 3 April online, 2024.
- Blase, R.C., et al. (incl. **Glein, C.R.**), MASPEX for biosignature detection, 55<sup>th</sup> Lunar and Planetary Science Conference, p. 2720, 2024.
- Pappalardo, R., et al. (incl. **Glein, C.**), Europa Clipper: Seven months to launch! 55<sup>th</sup> Lunar and Planetary Science Conference, p. 1293, 2024.
- Truong, N., **Glein, C.R.**, Potential revision to the solar abundances and implications to the formation of Jupiter and Uranus, 243<sup>rd</sup> Meeting of the American Astronomical Society, held 7-11 January in New Orleans, LA, 2024.

–2023–

- Glein, C.**, et al., Deuterium decoded: How the D/H ratio can clarify the origin of methane in the Kuiper belt, New Horizons Science Plenary meeting, held 14 December online, 2023.
- Burch, J.L., et al. (incl. **Glein, C.R.**), MASPEX: The Europa Clipper neutral gas mass spectrometer, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Castillo, J.C., et al. (incl. **Glein, C.R.**), Internal evolution and current state of Enceladus accreted from cometary material, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Daubar, I., et al. (incl. **Glein, C.R.**), Planned geological investigations of the Europa Clipper mission, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Genova, A., et al. (incl. **Glein, C.R.**), Gravity investigation of a mission concept to constrain Enceladus' internal structure, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Glein, C.R.**, et al., The tastes, smells, and colors of Europa: How Europa Clipper will reveal Europa's composition as never before, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Higgins, P.M., et al. (incl. **Glein, C.R.**), Uncertainty in habitability and sustainable biomass for a hypothetical methanogenic biosphere on Enceladus, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Pappalardo, R., et al. (incl. **Glein, C.R.**), Europa Clipper: 10 months to launch, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Tosi, F., et al. (incl. **Glein, C.R.**), A close look at Ganymede's surface composition with Juno/JIRAM, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Truong, N.T., et al. (incl. **Glein, C.R.**), Revealing the outgassing history and hydrothermal circulation processes of Enceladus, Europa and icy ocean worlds with noble gases, American Geophysical Union, Fall Meeting, held 11-15 December in San Francisco, CA, 2023.
- Glein, C.**, Deuterium decoded: How the D/H ratio can clarify the origin of methane in the Kuiper belt (and Europa too), Europa MAAss Spectrometer for Planetary EXploration Team Meeting, held 6 November in San Juan, Puerto Rico, 2023.
- Glein, C.R.**, What does Europa's ocean taste like? Workshop on the Origins and Habitability of the Galilean Moons, held 24-26 October in Marseille, France, 2023.
- Cartwright, R.J., et al. (incl. **Glein, C.R.**), Investigating carbon-bearing species on Europa and Callisto with JWST, Workshop on the Origins and Habitability of the Galilean Moons, held 24-26 October in Marseille, France, 2023.
- Castillo-Rogez, J.C., et al. (incl. **Glein, C.R.**), Relationships between the origin, internal evolution, and current state of the Galilean moons, Workshop on the Origins and Habitability of the Galilean Moons, held 24-26 October in Marseille, France, 2023.
- Miller, K.E., et al. (incl. **Glein, C.**), MASPEX performance for measuring Europa habitability, Workshop on the Origins and Habitability of the Galilean Moons, held 24-26 October in Marseille, France, 2023.

- Mousis, O., et al. (incl. **Glein, C.**), Galilean moon formation in a water-depleted environment, Workshop on the Origins and Habitability of the Galilean Moons, held 24-26 October in Marseille, France, 2023.
- Pappalardo, R.T., et al. (incl. **Glein, C.R.**), Europa Clipper: A mission to explore Europa's habitability, Workshop on the Origins and Habitability of the Galilean Moons, held 24-26 October in Marseille, France, 2023.
- Tosi, F., et al. (incl. **Glein, C.R.**), Ganymede's surface composition with Juno JIRAM data, Workshop on the Origins and Habitability of the Galilean Moons, held 24-26 October in Marseille, France, 2023.
- Truong, N., et al. (incl. **Glein, C.R.**), Revealing the outgassing history and hydrothermal circulation processes of Enceladus, Europa and icy ocean worlds with noble gases, Workshop on the Origins and Habitability of the Galilean Moons, held 24-26 October in Marseille, France, 2023.
- Cartwright, R., et al. (incl. **Glein, C.**), Unraveling Callisto's carbon-rich surface with JWST/NIRSpec, 55<sup>th</sup> Division for Planetary Sciences Meeting, held 1-6 October in San Antonio, TX, 2023.
- Glein, C.**, et al., Deuterium decoded: How the D/H ratio can clarify the origin of methane in the Kuiper belt, 55<sup>th</sup> Division for Planetary Sciences Meeting, held 1-6 October in San Antonio, TX, 2023.
- Postberg, F., et al. (incl. **Glein, C.**), Detection of phosphate in ice grains from Enceladus' ocean and implications for Europa, 55<sup>th</sup> Division for Planetary Sciences Meeting, held 1-6 October in San Antonio, TX, 2023.
- Tosi, F., et al. (incl. **Glein, C.**), Infrared observations by Juno/JIRAM reveal local surface composition on Ganymede, 55<sup>th</sup> Division for Planetary Sciences Meeting, held 1-6 October in San Antonio, TX, 2023.
- Truong, N., et al. (incl. **Glein, C.**), Low-temperature aqueous alteration of cometary rocks: Applications to potential ocean worlds of the Uranian system, 55<sup>th</sup> Division for Planetary Sciences Meeting, held 1-6 October in San Antonio, TX, 2023.
- Villanueva, G., et al. (incl. **Glein, C.**), Comprehensive spectroscopy of Enceladus and Europa with JWST, 55<sup>th</sup> Division for Planetary Sciences Meeting, held 1-6 October in San Antonio, TX, 2023.
- Glein, C.**, New insights into the origin of methane on hydrocarbon worlds, Titan NAI Team Meeting, held 6-8 September in Seattle, WA, 2023.
- Mousis, O., et al. (incl. **Glein, C.**), An entry probe contributed by ESA to Uranus Orbiter and Probe, 20th International Planetary Probe Workshop, held August 28 to September 1 in Marseille, France, 2023.
- Glein, C.R.**, Enceladus as the most habitable world we know of beyond Earth, First Texas Area Planetary Science Meeting, held 17-18 August in San Antonio, TX, 2023.
- Glein, C.R.**, et al., Uranus's bulk atmospheric composition from mixing of solar nebula gas with comet-like core material, Uranus Flagship 2023: Investigations and Instruments for Cross-Discipline Science, held 25-27 July in Pasadena, CA, 2023.
- Miller, G.P., et al. (incl. **Glein, C.R.**), Mass spectrometry as a tool for exploration of the Uranian system, Uranus Flagship 2023: Investigations and Instruments for Cross-Discipline Science, held 25-27 July in Pasadena, CA, 2023.
- Truong, N. (incl. **Glein, C.R.**), Low-temperature aqueous alteration of cometary rocks: Applications to potential ocean worlds of the Uranian system, Uranus Flagship 2023:

- Investigations and Instruments for Cross-Discipline Science, held 25-27 July in Pasadena, CA, 2023.
- Teolis, B.D., et al. (incl. **Glein, C.R.**), Seasonally pulsating sputtered exospheres at the Uranian icy moons, Uranus Flagship 2023: Investigations and Instruments for Cross-Discipline Science, held 25-27 July in Pasadena, CA, 2023.
- Grundy, W.M., et al. (incl. **Glein, C.R.**), JWST NIRSpec spectrum of Eris: Methane, deuterated methane, and nitrogen, Asteroids, Comets, Meteors Conference, held 18-23 June in Flagstaff, AZ, 2023.
- Faggi, S., et al. (incl. **Glein, C.R.**), Mapping Enceladus' immense water plume with NIRSpec/JWST, Planetary Systems and the Origins of Life in the Era of JWST, held 16-19 May in Baltimore, MD, 2023.
- Mousis, O., et al. (incl. **Glein, C.R.**), Dehydration of phyllosilicates at the origin of the Galilean moons' density gradient, Biennial European Astrobiology Conference, held 8-12 May on La Palma Island, Spain, 2023.
- Phillips-Lander, C.M., et al. (incl. **Glein, C.**), Role of polyols in creating microhabitable environments during ice formation on Enceladus, Biennial European Astrobiology Conference, held 8-12 May on La Palma Island, Spain, 2023.
- Postberg, F., et al. (incl. **Glein, C.R.**), Detection of phosphate in Enceladus' ocean with implications for geochemistry and habitability in the outer solar system, European Geosciences Union, General Assembly, held 23-28 April in Vienna, Austria, 2023.
- Glein, C.**, Does Enceladus host a hidden organic factory? International Conference of Deep Space Sciences, held 22-30 April in Hefei, China, 2023.
- Glein, C.**, New geochemical findings on Enceladus, Enceladus Focus Group Workshop, held 29-30 March in Los Angeles, CA, 2023.
- Glein, C.**, Enceladus: A factory of organic molecules, Enceladus Focus Group Workshop, held 29-30 March in Los Angeles, CA, 2023.
- Cartwright, R.J., et al. (incl. **Glein, C.R.**), Investigating the nature and origin of hydrated salts on Europa, 54<sup>th</sup> Lunar and Planetary Science Conference, p. 2215, 2023.

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- Glein, C.R.**, Enceladus as the most habitable world we know of beyond Earth, American Geophysical Union, Fall Meeting, held 12-16 December in Chicago, IL, 2022.
- Sekine, Y., et al. (incl. **Glein, C.R.**), Detection of phosphate in Enceladus' ocean: Its implications for geochemistry and habitability, American Geophysical Union, Fall Meeting, held 12-16 December in Chicago, IL, 2022.
- Miller, K., et al. (incl. **Glein, C.**), Onwards to Europa: Results from the final ground calibration of the MASPEX-Europa flight instrument, EuroPlanet Science Congress, held 18-23 September in Granada, Spain, 2022.
- Mousis, O., et al. (incl. **Glein, C.**), The role of phyllosilicates in shaping the Galilean moons' density gradient, EuroPlanet Science Congress, held 18-23 September in Granada, Spain, 2022.
- Glein, C.R.**, Geochemical perspectives on habitability and the origin of life in the outer solar system (Invited), Japan Geoscience Union Meeting, held 22-27 May in Chiba, Japan, 2022.
- Blase, R., et al. (incl. **Glein, C.R.**), Gas chromatography (GC): The next generation micro-electro-mechanical systems (MEMS) GC columns for future spaceflight missions, Astrobiology Science Conference, held 15-20 May in Atlanta, GA, 2022.

**Glein, C.R.**, et al., How much P is in Enceladus's ocean? Astrobiology Science Conference, held 15-20 May in Atlanta, GA, 2022.

Miller, G.P., et al. (incl. **Glein, C.R.**), MASPEX Europa: A high-resolution mass spectrometer for planetary exploration of ocean worlds, Astrobiology Science Conference, held 15-20 May in Atlanta, GA, 2022.

MacKenzie, S., et al. (incl. **Glein, C.R.**), Enceladus Orbilander: Searching for signs of life in orbit and on the surface, Astrobiology Science Conference, held 15-20 May in Atlanta, GA, 2022.

Truong, N., **Glein, C.R.**, Lunine, J.I., Constraining the age of Enceladus's ocean and the evolution of other icy ocean worlds from the outgassing history of noble gases, Astrobiology Science Conference, held 15-20 May in Atlanta, GA, 2022.

**Glein, C.**, Could Titan's methane be biotic? Titan NAI Team Meeting, held 2-4 May in Honolulu, HI, 2022.

**Glein, C.**, Subsurface oceans, Future of the Search for Life (FoSL) workshop, held 21-25 March online, 2022.

Castillo-Rogez, J.C., et al. (incl. **Glein, C.R.**), Europa's interior structure and salinity based on the origin of its volatiles, 53<sup>rd</sup> Lunar and Planetary Science Conference, p. 2747, 2022.

Cody, G.D., Alexander, C.M.O'D., Foustoukos, D., **Glein, C.R.**, Aqueous carbonate isotopic (<sup>13</sup>C) exchange with chondritic organic solids, 53<sup>rd</sup> Lunar and Planetary Science Conference, p. 1216, 2022.

Miller, K.E., et al. (incl. **Glein, C.R.**), An update on the MASPEX instrument: New capabilities for planetary chemistry and habitability, 53<sup>rd</sup> Lunar and Planetary Science Conference, p. 2664, 2022.

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Melwani Daswani, M., Vance, S., **Glein, C.R.**, Clathrate blankets as (in)surmountable barriers for hydrothermal systems in Europa, American Geophysical Union, Fall Meeting, held 13-17 December in New Orleans, LA, 2021.

Ray, C., **Glein, C.R.**, Waite, H., Can abiotic synthesis generate complex organic matter on Enceladus? American Geophysical Union, Fall Meeting, held 13-17 December in New Orleans, LA, 2021.

Spilker, L.J., et al. (incl. **Glein, C.R.**), The science case for a return to Enceladus, American Geophysical Union, Fall Meeting, held 13-17 December in New Orleans, LA, 2021.

Truong, N.T., **Glein, C.R.**, Lunine, J.I., Age estimates of Enceladus's ocean and other outer solar system icy ocean worlds inferred from the evolution of noble gases, American Geophysical Union, Fall Meeting, held 13-17 December in New Orleans, LA, 2021.

Vance, S., et al. (incl. **Glein, C.R.**), Ocean detection and characterization at Enceladus and Mimas using magnetic induction, American Geophysical Union, Fall Meeting, held 13-17 December in New Orleans, LA, 2021.

Waite, H., et al. (incl. **Glein, C.**), The ocean worlds of Enceladus and Europa, The European Astrobiology Institute (EAI) Academy, presented 27 October online, 2021.

Castillo-Rogez, J.C., et al. (incl. **Glein, C.R.**), Role of non-water ices in driving salinity and electrical conductivity in ocean worlds, Outer Planets Assessment Group Meeting, held August 30 to September 1 online, 2021.

MacKenzie, S.M., et al. (incl. **Glein, C.**), Enceladus Orbilander: A mission concept study to search for signs of life, Outer Planets Assessment Group Meeting, held August 30 to September 1 online, 2021.

- Glein, C.**, An update on the origin of Pluto's N<sub>2</sub>, Pluto System and Arrokoth Workshops, held 12-16 July in Laurel, MD, 2021.
- Ray, C., et al. (incl. **Glein, C.**), What's for lunch on Enceladus? How oxidant production generates a rich metabolic menu, Goldschmidt Conference, held 4-9 July online, 2021.
- Glein, C.R.**, et al., MASPEX-ORCA: A new GC-MS instrument for Europa Lander, In Situ Science and Instrumentation Workshop for the Exploration of Europa and Ocean Worlds, held 20 May online, 2021.
- Glein, C.**, Discussion on Europa ocean geochemistry models, Europa Clipper Composition Working Group Monthly Townhall, held 23 February online, 2021.
- Glein, C.**, Miller, K., Hao, J., Robinson, K., Progress on organic and phosphorus geochemistry inside Titan, Titan NAI Team Meeting, held 11 February online, 2021.
- Craft, K.L., et al. (incl. **Glein, C.R.**), On-chip sample purification and biosignature detection instrumentation at ocean worlds, Committee on Space Research Scientific Assembly, held January 28 to February 4 online, 2021.
- McKinnon, W., et al. (incl. **Glein, C.**), The Pluto system: New results from the New Horizons flyby, Committee on Space Research Scientific Assembly, held January 28 to February 4 online, 2021.
- Miller, K.E., et al. (incl. **Glein, C.R.**), Towards the future of mass spectrometry for biosignature detection, Committee on Space Research Scientific Assembly, held January 28 to February 4 online, 2021.
- Mousis, O., Bouquet, A., **Glein, C.**, Danger, G., Waite, J.H., The role of clathrate formation in Europa's ocean composition, Committee on Space Research Scientific Assembly, held January 28 to February 4 online, 2021.

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- Blase, R., et al. (incl. **Glein, C.R.**), Experimental coupling of a MEMS gas chromatograph and a mass spectrometer for organic analysis on icy ocean world landers, American Geophysical Union, Fall Meeting, held 1-17 December online, 2020.
- Glein, C.R.**, A new model for the origin of chlorine on Enceladus, American Geophysical Union, Fall Meeting, held 1-17 December online, 2020.
- Hao, J., et al. (incl. **Glein, C.R.**), Abundant phosphorus for life in the Enceladus ocean, American Geophysical Union, Fall Meeting, held 1-17 December online, 2020.
- MacKenzie, S.M., et al. (incl. **Glein, C.R.**), Enceladus Orbilander: A Flagship Mission Concept for the Planetary Decadal Survey, American Geophysical Union, Fall Meeting, held 1-17 December online, 2020.
- McKinnon, W.B., et al. (incl. **Glein, C.R.**), A Kuiper belt carol (in prose), being an origin story of Pluto and Charon, American Geophysical Union, Fall Meeting, held 1-17 December online, 2020.
- Miller, K.E., et al. (incl. **Glein, C.R.**), Organic content of Titan's sub-surface ocean: Constraints from chondrites, American Geophysical Union, Fall Meeting, held 1-17 December online, 2020.
- Ray, C., **Glein, C.R.**, Waite, H., Abiotic synthesis as a new source of organic matter on Enceladus, American Geophysical Union, Fall Meeting, held 1-17 December online, 2020.

- Miller, K.E., et al. (incl. **Glein, C.R.**), Organic content of Titan's interior ocean from accreted insoluble organic matter, 52<sup>nd</sup> Division for Planetary Sciences Meeting, held 26-30 October online, 2020.
- Phillips-Lander, C., et al. (incl. **Glein, C.**), Flagship concepts for astrobiology at Enceladus, JpGU-AGU Joint Meeting, held 12-16 July online, 2020.
- Waite, J.H., et al. (incl. **Glein, C.**), Important Grand Finale results from the Cassini Ion Neutral Mass Spectrometer (INMS), Asia Oceania Geosciences Society Meeting, held June 28 to July 4 in Sono Belle Vivaldi Park, Hongcheon, 2020 (canceled due to coronavirus).
- Blase, R.C., et al. (incl. **Glein, C.**), MASS Spectrometer for Planetary EXploration-ORganic Composition Analyzer (MASPEX-ORCA) for Europa Lander, American Society for Mass Spectrometry Conference, held May 31 to June 4 in Houston, TX, 2020 (canceled due to coronavirus).
- Klenner, F., et al. (incl. **Glein, C.R.**), A method to discriminate between abiotic and biotic processes on cryovolcanically active ocean worlds, European Geosciences Union, General Assembly, held 3-8 May in Vienna, Austria, 2020 (canceled due to coronavirus).
- Blase, R.C., Libardoni, M., Miller, K.E., Waite, J.H., **Glein, C.R.**, Chemical derivatization of amino acids and fatty acids for Gas Chromatography-Mass Spectrometry (GC-MS) analysis with MASPEX-ORCA, In Situ Science and Instrumentation Workshop for the Exploration of Europa and Ocean Worlds, held 28-30 April in Pasadena, CA, 2020 (canceled due to coronavirus).
- Glein, C.R.**, et al., MASPEX-ORCA: A new GC-MS instrument for Europa Lander, In Situ Science and Instrumentation Workshop for the Exploration of Europa and Ocean Worlds, held 28-30 April in Pasadena, CA, 2020 (canceled due to coronavirus).
- Libardoni, M., Blase, R., Miller, K.E., Kurabayashi, K., Fan, X., **Glein, C.**, Advanced separation science technology for the identification of complex organic samples on the surface of Europa with MASPEX-ORCA, In Situ Science and Instrumentation Workshop for the Exploration of Europa and Ocean Worlds, held 28-30 April in Pasadena, CA, 2020 (canceled due to coronavirus).
- Miller, K.E., Franke, K., Miller, G., Waite, J.H., Blase, R.C., Libardoni, M., **Glein, C.R.**, MASPEX-ORCA isotopic measurements for biosignature detection, In Situ Science and Instrumentation Workshop for the Exploration of Europa and Ocean Worlds, held 28-30 April in Pasadena, CA, 2020 (canceled due to coronavirus).
- Perry, M.E., et al. (incl. **Glein, C.R.**), Sample handling and processing for the MASPEX-ORCA, In Situ Science and Instrumentation Workshop for the Exploration of Europa and Ocean Worlds, held 28-30 April in Pasadena, CA, 2020 (canceled due to coronavirus).
- Ray, C., **Glein, C.R.**, Waite, J.H., Miller, K.E., The volatile composition of Europa's ocean, 51<sup>st</sup> Lunar and Planetary Science Conference, p. 2953, 2020 (canceled due to coronavirus).
- Craft, K.L., et al. (incl. **Glein, C.R.**), On-chip purification of amino acids for ocean world in situ biosignature analyses, 51<sup>st</sup> Lunar and Planetary Science Conference, p. 2560, 2020 (canceled due to coronavirus).
- Glein, C.**, The science case for exploring the subsurfaces of Enceladus and Titan (Invited), Microsymposium 61 Planets Underground: The Next Frontier in Planetary Exploration, held 14-15 March in The Woodlands, TX, 2020 (canceled due to coronavirus).
- Glein, C.**, Europa's habitability gold mine, Europa Clipper Project Science Group Meeting #8, held 11-13 February in Pasadena, CA, 2020.

Blase, R., et al. (incl. **Glein, C.**), MASS Spectrometer for Planetary EXploration-ORganic Composition Analyzer (MASPEX-ORCA) for Europa Lander, Outer Planets Assessment Group Meeting, held 3-4 February in Houston, TX, 2020.

Miller, K., **Glein, C.**, Further insights into deep carbon and nitrogen geochemistry on Titan and beyond, Titan NAI Team Meeting, held 9-10 January in Pasadena, CA, 2020.

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**Glein, C.R.**, et al., What does Europa smell like? American Geophysical Union, Fall Meeting, held 9-13 December in San Francisco, CA, 2019.

Miller, K.E., **Glein, C.R.**, Foustoukos, D., Alexander, C., Experimental and theoretical exploration of Titan's ocean chemistry, American Geophysical Union, Fall Meeting, held 9-13 December in San Francisco, CA, 2019.

Fu, X., et al. (incl. **Glein, C.R.**), Does copper control the fate of organic acids in hydrothermal systems? American Geophysical Union, Fall Meeting, held 9-13 December in San Francisco, CA, 2019.

**Glein, C.**, Alien oceans as an opportunity for the deep carbon community (Invited), Deep Carbon 2019: Launching the Next Decade of Deep Carbon Science, held 24-26 October in Washington, DC, 2019.

Vance, S., et al. (incl. **Glein, C.**), Titan's bulk interior structure and inferred composition: Perspective from radial structure models, Titan after Cassini-Huygens Scientific Workshop, held 23-25 September in Madrid, Spain, 2019.

Bouquet, A., Mousis, O., Danger, G., **Glein, C.R.**, Waite, J.H., Clathrate formation and the volatile evolution of Europa's ocean, EPSC-DPS Joint Meeting, held 15-20 September in Geneva, Switzerland, 2019.

Ray, C., **Glein, C.**, Miller, K., Waite, J.H., Modeling the volatile speciation of high temperature fluids on Europa, EPSC-DPS Joint Meeting, held 15-20 September in Geneva, Switzerland, 2019.

Postberg, F., et al. (incl. **Glein, C.R.**), The long journey of organic material from Enceladus hydrothermal core into the plume, EPSC-DPS Joint Meeting, held 15-20 September in Geneva, Switzerland, 2019.

Waite, J.H., et al. (incl. **Glein, C.**), MASPEX-Europa aboard Clipper: A mass spectrometer for investigating the habitability of Europa, EPSC-DPS Joint Meeting, held 15-20 September in Geneva, Switzerland, 2019.

Waite, H., Bolton, S., Miller, K., **Glein, C.**, Miller, G., The importance of mass spectrometry in the Horizon 2061 program, Planetary Exploration 2061, Step 3: Synthesis Workshop, held 11-13 September in Toulouse, France, 2019.

**Glein, C.R.**, Alien oceans as a new frontier for geochemistry (Invited), Goldschmidt Conference, held 18-23 August in Barcelona, Spain, 2019.

McKinnon, W., **Glein, C.**, More about Pluto's surface ice composition, New Horizons Science Plenary meeting, held 8 August online, 2019.

Waite, J.H., Miller, K., **Glein, C.**, The D/H ratio of water throughout the solar system, Asia Oceania Geosciences Society Meeting, held July 28 to August 2 in Singapore, 2019.

Waite, J.H., et al. (incl. **Glein, C.**), The determination of the He/H<sub>2</sub> ratio in the atmospheres of Saturn and Jupiter and implications for giant planet formation and evolution, Asia Oceania Geosciences Society Meeting, held July 28 to August 2 in Singapore, 2019.



- McKinnon, W.B., **Glein, C.R.**, Rhoden, A.R., Formation, composition, and history of the Pluto system: A post-New Horizons synthesis, Pluto System after New Horizons Conference, held 14-18 July in Laurel, MD, 2019.
- Glein, C.**, et al., MAss Spectrometer for Planetary EXploration-ORganic Composition Analyzer (MASPEX-ORCA) for Europa Lander and other missions to icy ocean worlds, Astrobiology Science Conference, held 24-28 June in Bellevue, WA, 2019.
- Catling, D.C., **Glein, C.R.**, Cody, G.D., Toner, J.D., Are metal carbonyls prebiotically plausible? Astrobiology Science Conference, held 24-28 June in Bellevue, WA, 2019.
- Malaska, M., Vance, S., **Glein, C.R.**, A depth transect of potential Titan environments, Astrobiology Science Conference, held 24-28 June in Bellevue, WA, 2019.
- Miller, K.E., **Glein, C.R.**, Waite, J.H., Zahnle, K.J., The evolution of Titan's accreted organics: From refractory to volatile, Astrobiology Science Conference, held 24-28 June in Bellevue, WA, 2019.
- Postberg, F., et al. (incl. **Glein, C.R.**), Origins of organic matter in Enceladus' plume, Astrobiology Science Conference, held 24-28 June in Bellevue, WA, 2019.
- Ray, C., **Glein, C.**, Waite, J.H., Modeling the volatile composition of hydrothermal fluids on Europa, Astrobiology Science Conference, held 24-28 June in Bellevue, WA, 2019.
- Toner, J.D., Catling, D.C., **Glein, C.R.**, Alkaline lake settings for concentrated prebiotic cyanide and the origin of life, Astrobiology Science Conference, held 24-28 June in Bellevue, WA, 2019.
- Waite, H., et al. (incl. **Glein, C.**), Results from the Cassini Grand Finale at Saturn using Cassini INMS, UVIS, CIRS, and RSS, Revealing Saturn's deep interior for the first time with Cassini, Royal Society Meeting, held 17-18 June in Newport Pagnell, UK, 2019.
- Glein, C.**, Overview on the geochemistry of Europa's ocean, Europa Clipper Project Science Group Meeting #7, held 11-14 June in Ithaca, NY, 2019.
- Glein, C.**, Update on new ocean models for Europa, Europa Clipper MAss Spectrometer for Planetary EXploration Team Meeting, held 10 June in Ithaca, NY, 2019.
- Glein, C.R.**, Catling, D.C., Cody, G.D., Toner, J.D., Are metal carbonyls prebiotically plausible? Simons Collaboration on the Origins of Life Annual Symposium, held 22-24 April in New York, NY, 2019.
- Waite, J.H., Bell, J., Miller, K., **Glein, C.**, He/H<sub>2</sub> ratio in the atmosphere of Saturn, European Geosciences Union, General Assembly, held 7-12 April in Vienna, Austria, 2019.
- Waite, J.H., et al. (incl. **Glein, C.**), The Europa Clipper MASPEX Europa investigation, European Geosciences Union, General Assembly, held 7-12 April in Vienna, Austria, 2019.
- Glein, C.**, The hydrothermal solar system: Enceladus as an example of Everett Shock's legacy, American Chemical Society National Meeting & Exposition, Spring Meeting, held March 31 to April 4 in Orlando, FL, 2019.
- Waite, J.H., Perryman, R., **Glein, C.**, Miller, K., The legacy of Cassini-Huygens mass spectrometry at Saturn, American Chemical Society National Meeting & Exposition, Spring Meeting, held March 31 to April 4 in Orlando, FL, 2019.
- Miller, K.E., **Glein, C.R.**, Waite, J.H., Bolton, S.J., Using D/H ratio of water and volatile organics to constrain thermogenic processes inside ice-rock bodies, 50<sup>th</sup> Lunar and Planetary Science Conference, p. 3013, 2019.
- Waite, J.H., **Glein, C.**, Postberg, F., Lunine, J., Enceladus as revealed by the Cassini-Huygens mission, 50<sup>th</sup> Lunar and Planetary Science Conference, p. 1290, 2019.

Waite, J.H., et al. (incl. **Glein, C.**), Sampling systems that support atmospheric probe mass spectrometry objectives, Workshop on In Situ Exploration of the Ice Giants, held 25-27 February in Marseille, France, 2019.

**Glein, C.**, Miller, K., Waite, H., Contributions from accreted organics to Titan's atmosphere: New insights from cometary and chondritic data, Titan NAI Team Meeting, held 23-24 January in Pasadena, CA, 2019.

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Waite, J.H., et al. (incl. **Glein, C.R.**), Implications from Cassini Ion Neutral Mass Spectrometer (INMS) Grand Finale measurements on atmospheric and interior processes at Saturn, American Geophysical Union, Fall Meeting, held 10-14 December in Washington, DC, 2018.

Miller, K.E., et al. (incl. **Glein, C.R.**), Cassini Ion Neutral Mass Spectrometer measurements of D Ring influx to Saturn's atmosphere, American Geophysical Union, Fall Meeting, held 10-14 December in Washington, DC, 2018.

Ray, C., **Glein, C.R.**, Waite, J.H., Teolis, B.D., Hoehler, T.M., Huber, J.A., Exploring oxidation chemistry and energy availability in Enceladus' ocean, American Geophysical Union, Fall Meeting, held 10-14 December in Washington, DC, 2018.

Truong, N.T., **Glein, C.R.**, Monroe, A., Anbar, A.D., Lunine, J.I., Decomposition of amino acids in water with application to Enceladus and other ocean worlds, American Geophysical Union, Fall Meeting, held 10-14 December in Washington, DC, 2018.

Lopes, R.M.C., et al. (incl. **Glein, C.**), Habitability of hydrocarbon worlds: Titan and beyond, American Geophysical Union, Fall Meeting, held 10-14 December in Washington, DC, 2018.

Miller, K.E., et al. (incl. **Glein, C.**), Constraints on Saturn D ring composition from Cassini Ion Neutral Mass Spectrometer, 50<sup>th</sup> Division for Planetary Sciences Meeting, held 21-26 October in Knoxville, TN, 2018.

McKinnon, W.B., **Glein, C.**, Lunine, J., Mousis, O., Shock, E.L., Vance, S.D., Waite, J.H., Interpreting Enceladus' D/H ratio in light of the 'Jovian Gap', 50<sup>th</sup> Division for Planetary Sciences Meeting, held 21-26 October in Knoxville, TN, 2018.

Postberg, F., et al. (incl. **Glein, C.R.**), Macromolecular organic compounds emerging from the Enceladus ocean, European Planetary Science Congress, held 16-21 September in Berlin, Germany, 2018.

Ray, C., **Glein, C.**, Waite, J.H., Teolis, B., Huber, J., Exploring oxidative chemistry and metabolic pathways in Enceladus' ocean, European Planetary Science Congress, held 16-21 September in Berlin, Germany, 2018.

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- Glein, C.**, Enceladus' ocean chemistry, Enceladus Focus Group Workshop, held 8-9 June in Berkeley, CA, 2016.
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