

Samuel Courville

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SCIENTIFIC GOAL

Advance our understanding of how the solar system formed and help search for habitable extra-terrestrial environments.

EDUCATION

PH.D. ARIZONA STATE UNIVERSITY SCHOOL OF EARTH AND SPACE EXPLORATION
Tempe, Az | Exp May 2025

- Advisor: Dr. Joseph G. O'Rourke
- Thesis Topic: Thermal and compositional evolution of outer solar system asteroids, moons, and dwarf planets.
- GPA: 4.0 / 4.0

M.S. COLORADO SCHOOL OF MINES CENTER FOR WAVE PHENOMENA, GEOPHYSICS
Golden, CO | Dec 2019

- Advisor: Dr. Paul Sava
- Thesis Title: Toward Orbital Seismology: Theory for speckle noise reduction in laser Doppler vibrometer measurements on distant rough surfaces
- GPA: 4.0 / 4.0 – summa cum laude

B.S. COLORADO SCHOOL OF MINES GEOPHYSICAL ENGINEERING
Golden, CO | May 2017

- Senior Thesis: Autonomous roving exploration system, a Mars active source seismic acquisition concept
- Minor in Computer Science
- Dean's List (All Semesters)
GPA: 4.0 / 4.0 – summa cum laude

RESEARCH EXPERIENCE

NASA JET PROPULSION LABORATORY | INTERN
June 2022 - | Pasadena, CA

- Studying the composition and evolution of primordial oceans within icy bodies in the outer solar system.

PLANETARY SCIENCE INSTITUTE | RESEARCH ASSOCIATE
May 2019 - | Lakewood, CO

- Bayesian inversion group leader for the "SWIM" team, a project to globally map subsurface water ice on Mars. See <https://swim.psi.edu/>
- Assisting the MRO SHARAD operations team by using numerical modeling to link geologic models to data returned from MRO's SHARAD instrument. See <https://www.psi.edu/SHARAD>

- Designing instrumentation and methodology for active source seismic surveying on the Moon and Mars via a concept called ARES, the autonomous roving exploration system.

CENTER FOR WAVE PHENOMENA | RESEARCH ASSISTANT

August 2017 – Dec 2019 | Golden, CO

- Studying the application of laser Doppler vibrometry to detect seismic signals remotely on asteroid and planetary surfaces from orbit.
- Research assistant to Dr. Paul Sava at the Colorado School of Mines
- Funded by NASA PICASSO grant

LUNAR AND PLANETARY INSTITUTE | SUMMER INTERN

Summer 2017 | Houston, TX

- Determined the density of Schrodinger Basin's peak ring of mountains on the Moon using GRAIL gravity data
- Worked with planetary scientists at LPI and NASA's Johnson Space Center
- Selected as one of 14 summer interns from hundreds around the world

NASA'S PLANETARY GEOLOGY AND GEOPHYSICS UNDERGRADUATE RESEARCH PROGRAM | SUMMER INTERN

Summer 2016 | Golden, CO

- Studied the thermal properties of 171 dune fields on Mars in search of water ice using thermal emission spectrometer data from the Mars Odyssey Mission
- Worked with scientists from the Planetary Science Institute and Southwest Research Institute
- Funded by NASA grant

UNDERGRADUATE RESEARCH FELLOWSHIP | APP DEVELOPER

Spring 2016 - Spring 2017 | Golden, CO

- Began development on a virtual reality mobile app to aid in the viewing of 3D geophysical data
- Developed in Android Studio using Java and OpenGL
- Shared my knowledge with a junior undergraduate student who took over the project following my graduation

COLORADO SPACE GRANT CONSORTIUM DEMOSAT PROGRAM, PIKES PEAK COMMUNITY COLLEGE | TEAM MEMBER

Spring 2014 | Colorado Springs, CO

- Worked on a team to test the effect of high altitude radiation on skin cells using a high altitude weather balloon
- Required the construction of a size limited module and sensors programmed using Arduino
- Participated at age 17

TEACHING EXPERIENCE

TEACHING ASSISTANT | GEOPHYSICAL INVERSION – COLORADO SCHOOL OF MINES Spring 2019 & Fall 2019| Golden, CO

Teaching assistant to Dr. Paul Sava for a geophysical inversion course, GPGN409. Responsibilities include: teaching class when Dr. Sava is away, holding office hours, tutoring students, creating assignments, and grading.

CO-ADVISOR | JEFFCO EXECUTIVE INTERNSHIP PROGRAM – PLANETARY SCIENCE INSTITUTE

Summer 2019| Lakewood, CO

Co-advised Blake Maly and Daniel Havlat on Radar data analysis projects, which led to AGU abstract submissions.

TUTOR | PROGRAMMING CONCEPTS – COLORADO SCHOOL OF MINES

Spring 2016 | Golden, CO

Tutored students for an introduction to programming class (C++): CSCI261

RESEARCH PROPOSALS

2020-2021 Awarded SESE First Year Fellowship – Arizona State University
Journey to a magnetized metal-silicate world? Predicting the plausible magnetization of the asteroid 16 Psyche.

2016-2017 Awarded Undergraduate Research Fellowship – Colorado School of Mines
Virtual reality geophysical data viewer for mobile phones

INVITED TALKS

October 2022	JPL AMA science lecture	Magnetization of carbonaceous asteroids
June 2021	UCLA Meteorite Gallery Lecture	Of Magnets and Meteorites: What magnetized meteorites tell us about the formation of asteroids
Feb 2020	Joint HiRISE/SHARAD team meeting	1D n-layer SHARAD forward modelling program

AWARDS AND HONORS

2022	Ninninger Student Travel Award – Arizona State University
2019	Career Development Award - Lunar and Planetary Institute.
2017	Outstanding Graduating Senior – Colorado School of Mines Geophysics
2017	Presenter Travel Grant – Colorado School of Mines Graduate Student Government
2015	Chevron Petrotechnical Support Scholarship
2012	Mayor's 100 teens, for community service and academic achievement – Colorado Springs, CO

PROFESSIONAL SERVICE

2023	External Reviewer	NASA ROSES review panel
2024	Reviewer	IEEE, Icarus
2023	Reviewer	JGR Planets, Science Advances
2022	Reviewer	The leading edge, Geophysical Research Letters
2020	Executive Secretary	NASA ROSES review panel

SOCIETIES

2018	National	Geological Society of America
2017	National	Society of Exploration Geophysicists
2016	top 12%ile	Tau Beta Pi Engineering Honor Society
2016	National	American Geophysical Union
2016	National	European Association of Geochemistry
2012	3.5 GPA+	Phi Theta Kappa Honor Society

WORKSHOPS/SEMINARS/FIELD EXPERIENCE

NETWORK FOR OCEAN WORLDS, 1ST ANNUAL RETREAT | ATTENDEE

Oct 2022 | Wrigley Marine Science Center, Catalina Island, California

- Mixture of geologists, biologists, geophysicists, and geochemists gathered to assess the multidisciplinary challenge of how to identify and explore habitable environments on ocean worlds.
- Provided insight on the composition of icy world interiors.

OCEAN WORLD ANALOG FIELD SITE ASSESSMENT WORKSHOP | ATTENDEE

Oct 2022 | Denver, Colorado

- Developed guidelines to assess the similarity of a field site on Earth to ocean worlds in the solar system
- Made recommendations for future analog field studies
- Wrote a white paper summarizing findings

YELLOWSTONE NATIONAL PARK FIELD WORK | HOT SPRING WATER SAMPLING

July 2021 & July 2023 | Yellowstone National Park, Wyoming

- Collected water samples from hot springs as part of the Group Exploring Organic Processes in Geochemistry (GEOPIG) from Arizona State University.
- Worked with a team of 10 graduate students on a month-long expedition to sample hot springs throughout Yellowstone national park
- Used water samples combined with biological, soil, and gas samples to assess the chemical energy available for life in Yellowstone hot springs.

PLANETARY SCIENCE SUMMER SEMINAR | PROJECT MANAGER / CAPTURE LEAD

Aug 2019 | Jet Propulsion Laboratory in Pasadena, California

- Created a NASA New Frontiers class spacecraft mission concept for visiting the next interstellar object and answer the questions:
 - do other solar systems have the ingredients for life, and can they be transferred from one star system to another?
 - Do objects from other solar systems resemble objects in our solar system?
 - Can we determine what star system the object originated from?
- Voted to be the project-manager/capture-lead by the class of 18 students. Responsibilities included:
 - Presenting a 70 minute mock proposal pursuant to NASA's New Frontiers announcement of opportunity,
 - Managing and integrating each student's engineering subsystem task into a coherent spacecraft concept,
 - Working with the Principal Investigator to ensure our science payload answers our proposed science objectives.

WORKSHOP IN GEOLOGY AND GEOPHYSICS OF THE SOLAR SYSTEM |

ATTENDEE

Summer 2018 | Petnica, Serbia

- A multi-disciplinary workshop covering a wide range of topics related to the formation, structure and dynamics of the Solar System bodies
- Designed for PhD students
- Lectures conducted by planetary scientists from around the world

GEOPHYSICS FIELD CAMP – COLORADO SCHOOL OF MINES | ASSISTANT

STUDENT PROJECT MANAGER

Summer 2016 | Pagosa Springs, CO

- A four week field program designed to give hands on experience with all geophysical methods, focused on studying the geothermal system at Pagosa Springs, CO
- Was voted to be one of two project managers out of the class of 50+ students
- Oversaw the completion of a 200+ page report detailing the camps findings:
<https://geophysics.mines.edu/field-camp/>

NOTABLE COURSEWORK

ARIZONA STATE UNIVERSITY

Special topics: Life on icy moons - SES598

- Final Project: Estimating the oxidant flux in Europa's ocean to quantify available energy for life

Special topics: Astrostatistics - SES598

- Final Project: Planetary geochemical inverse problem using MCMC

Space Business and Entrepreneurship - SES598

- Final Project: HELM, the Human Equivalent Lunar Mapper, a commercial off the shelf camera and navigation computer for autonomous lunar rovers

Special topics: Origins of solar systems - AST598

- Final Project: Magnetization of carbonaceous meteorites

COLORADO SCHOOL OF MINES

GRADUATE

Space Resource Fundamentals - EGGN598

- Final Project: Asteroid Prospecting Explorer (APEX) concept

Seismic Wavefield Imaging - GPGN658

- Final Project: Wavefield imaging with moving receivers

Laser Physics - PHGN480

- Final Project: Designing a long range laser vibrometer

Sparse Signal Processing - EENG509

- Final Project: Compressive sensing of seismic data

Parallel Computing - CSCI563

- Final Project: Parallelized wave equation solver

UNDERGRADUATE

Overview of Martian Geology and Rock Properties

- Self designed course, independent study

Advanced Electromagnetic Methods - GPGN420

- Projects: Numerical modeling of EM surveys

Advanced Gravity and Magnetic methods - GPGN411

- Projects: Numerical modeling of gravity and magnetism

Cryptography - CSCI474

- Final Project: Quantum cryptography

Digital Signal Processing - GPGN404

Algorithms - CSCI406

Geodynamics and Geology - GPGN471

SKILLS

PROGRAMMING & SOFTWARE

- Java
- Matlab
- Python
- L^AT_EX
- C and C++
- Android Studio
- OpenGL
- MySQL
- ArcGIS
- Linux (command line / bash)

EQUIPMENT COMPETENCIES

- EM sounding instruments
- Ground penetrating radar
- Seismometers and geophones
- Gravimeters
- Magnetometers
- Laser optics
- Laser Doppler vibrometer
- Differential GPS (DGPS)
- Oscilloscopes
- Standard chemistry lab equipment

PUBLICATIONS

- Courville S. W., Castillo-Rogez J. C., Melwani Daswani M., Gloesener E, Choukroun M, O'Rourke J. G. (2023) Timing and abundance of clathrate formation control ocean evolution in outer solar system bodies: Challenges of maintaining a thick ocean within Pluto Planetary Science Journal, in press.
- Domingue D., Weirich J., Chuang F., Sickafoose A., HsiaYeo L., Courville S. W., Palmer E., Gaskell R. (2023) Spectrophotometric and Topographic Correlations within the Mare Ingenii Swirl Region: Evidence for a Highly Mobile Lunar Regolith Planetary Science Journal, in press.
- Courville S. W., O'Rourke J. G., Castillo-Rogez J. C., Oran R., Weiss B. P., Fu R. R., Elkins-Tanton L. T. (2022) Acquisition and Preservation of Remanent Magnetization in Carbonaceous Asteroids. Nature Astronomy, Volume 6, pages 1387–1397
- Elkins-Tanton L. T., Asphaug E., Bell J. F., Bierson C. J., Bills B. G., Bottke W. F., Courville S. W., et. al. (2022) Distinguishing the Origin of Asteroid (16) Psyche. Space Science Reviews. Volume 218(3), Pages 1-38.
- Putzig N.E., Morgan G.A., Sizemore H.G., Baker D.M.H., Petersen E.I., Pathare A.V., Dundas C.M., Bramson A.M., Courville S.W., Perry M.R., Nerozzi S., Bain Z.M., Hoover R.H., Campbell B.A., Mastrogiuseppe M., Mellon M.T., Seu R., Smith I.B. (2023) Ice Resource Mapping on Mars. Ch. 16 in Badescu V., Zacny K., Bar-Cohen Y. (Eds.), Handbook of Space Resources, Springer Nature Switzerland AG. pp. 583–616
- Bierson C. J., Tulaczyk S., Courville S. W., Putzig N. E. (2021) Strong MARSIS radar reflections from the base of Martian south polar cap may be due to conductive ice or minerals. Geophysical Research Letters. Volume 48(13), <https://doi.org/10.1029/2021GL093880>
- Courville S. W., Perry M. R., and Putzig N. E. (2021) Lower bounds on the thickness and dielectric constant of dust layers within the North Polar Layered Deposits of Mars from radar forward modeling. Planetary Science Journal. Volume 2(1), Page 28, <https://doi.org/10.3847/psj/abda50>
- Moore K., Courville S. W., et. al. (2021) Bridge to the stars: A mission concept to an interstellar object. Planetary and Space Science. Volume 197, 105137, <https://doi.org/10.1016/j.pss.2020.105137>
- Courville S. W., and Sava P. C. (2020) Speckle noise attenuation in orbital laser vibrometer seismology. Acta Astronautica. Volume 172, Pages 16-32, <https://doi.org/10.1016/j.actaastro.2020.03.016>.
- Courville S. W. (2019). Toward Orbital Seismology: Theory for speckle noise reduction in laser Doppler vibrometer measurements on distant rough surfaces (Master's thesis). Colorado School of Mines, Golden, CO. Available here: <http://newton.mines.edu/paul/theses/SamCourvilleMSc.pdf>

CONFERENCE ABSTRACTS

LPSC 2023

Courville S. W., Castillo-Rogez J. C., Melwani Daswani M., Gloesener E., et al. (2023) Timing and abundance of clathrate formation within outer solar system bodies. In Lunar and Planetary Science 54, Abstract #1867. (poster)

Castillo-Rogez J. C., Courville S. W., Melwani Daswani M., Diab J., Weber J. M. (2023) Geophysical Implications of Carbon Cycling in Ocean Worlds. In Lunar and Planetary Science 54, Abstract #1779. (poster)

Putzig N. E., Morgan G. A., Perry M. R., Courville S. W., Russell A. T., Russell M. B., et al. (2023) Lunar Investigation Using Selenophysics (LINUS) to Assess the Age of the Ina Irregular Mare Patch. In Lunar and Planetary Science 54, Abstract #2946. (poster)

URANUS FLAGSHIP 2023

Courville S. W., Castillo-Rogez J. C. Weiss B. P. Oran R. O'Rourke J. G., Melwani Daswani M., Fu R. R. (2023) Chemical Remanent Magnetization in the Uranian Satellites from Differentiation within the Uranian Magnetosphere. In Uranus Flagship Conference, Abstract #8043 (poster).

AGU 2022

Courville S. W., Castillo-Rogez J. C., Melwani Daswani M., Choukroun M., Gloesener E., and O'Rourke J. (2022) Did Clathrate Layers Insulate Primordial Oceans in the Outer Solar System? In American Geophysical Union's Fall Meeting, Abstract P55G-1655 (poster)

LPSC 2022

Courville S. W., O'Rourke J. G., Castillo-Rogez J. C., Oran R., Weiss B. P., Fu R. R., Elkins-Tanton L. T. (2022) Magnetic Field Measurements at 10 Hygiea and 24 Themis Could Constrain Models of Their Formation and Evolution In Lunar and Planetary Science 53, Abstract #2678. (talk)

AGU 2021

Courville S. W., O'Rourke J. G., Castillo-Rogez J. C., Oran R., Weiss B. P., Fu R. R. (2021) Magnetization of carbonaceous asteroids by nebular fields and the origin of CM chondrites In American Geophysical Union's Fall Meeting, Abstract GP45E-0449 (poster)
Eposter Link: <https://agu2021fallmeeting-agu.ipostersessions.com/Default.aspx?s=7D-62-0F-D9-44-6D-9D-A3-65-6B-ED-C1-92-EA-84-EE>

Bierson C., Tulaczyk S., Courville S. W., Putzig N. (2021) Conductivity Contrasts as the Cause for Strong Radar Reflections from the Base of Martian South Polar Cap. In American Geophysical Union's Fall Meeting, Abstract P32D-07.

Morgan G., Putzig N., Baker D., Pathare A., Hoover R., Dundas C., Sizemore H., Petersen E., Bramson A., Courville S. W., et. al. (2021) Defining the Equatorial Extent of Subsurface Ice on Mars through Global Geomorphic Mapping. In American Geophysical Union's Fall Meeting, Abstract EP23C-04.

Putzig N., Morgan G., Sizemore H., Baker D., Petersen E., Pathare A., Dundas C., Bramson A., Courville S. W. (2021) Mapping Ice Resources on Mars. In American Geophysical Union's Fall Meeting, Abstract P23B-07.

Bramson A., ..., Courville S. W., et. al. (2021) Underground Ice on Mars: Characterization Activities, Potential as an In Situ Resource, and Possible Destination for Human Explorers. In American Geophysical Union's Fall Meeting, Abstract P23B-06.

Bierson C., Tulaczyk S., Courville S. W., Putzig N. (2021) Conductivity Contrasts as the Cause for Strong Radar Reflections from the Base of Martian South Polar Cap. In American Geophysical Union's Fall Meeting, Abstract P32D-07.

LPSC 2021

Courville S. W., O'Rourke J. G., Castillo-Rogez J. C., Oran R., Weiss B. P., Fu R. R. (2021) Magnetization of Large C-Type Asteroids: A Detectable Consequence of Pebble Accretion? In Lunar and Planetary Science 52, Abstract #2355. (talk)

LUNAR SURFACE SCIENCE WORKSHOP 2020

Courville S. W., Putzig N. E., Sava P. c., Perry M. R., Mikesell T. D. (2020) ARES and Artemis: The Autonomous Roving Exploration System for Active Source Seismology on the Moon. In Lunar Surface Science Workshop, Abstract #5055.

AGU 2020

Putzig N. E., ... Courville S. W., et. al. (2020) Subsurface Water Ice Mapping (SWIM) on Mars to Characterize In Situ Resources. In American Geophysical Union's Fall Meeting, Abstract P057-06.

Morgan G. A., ... Courville S. W., et. al. (2020) Subsurface Water Ice Mapping (Swim) Project: Characterizing the Inventory of Nonpolar Ice on Mars. In American Geophysical Union's Fall Meeting, Abstract P055-0005.

Sizemore H. G., ... Courville S. W., et. al. (2020) Shallow Ice Detection on Mars: Integration of Thermal and Neutron Datasets into the Mars Subsurface Water Ice Mapping (SWIM) Project. In American Geophysical Union's Fall Meeting, Abstract P055-0004.

LPSC 2020

Courville S. W., Putzig N. E., Sava P. c., Perry M. R., Mikesell T. D. (2020) ARES: the autonomous roving exploration system for active source seismology on the Moon and Mars. In Lunar and Planetary Science 51, Abstract #2623.
Eposter link: <https://www.hou.usra.edu/meetings/lpsc2020/eposter/2623.pdf>

Courville S. W. and the 31st PSSS team (2020) Bridge to the stars: a mission concept to an interstellar object. In Lunar and Planetary Science 51, Abstract #1766.
Eposter link: <https://www.hou.usra.edu/meetings/lpsc2020/eposter/1766.pdf>

Perry M., Courville S. W., Putzig N., Morgan G., Bain Z., Baker D., Bramson A., Dundas C., Hoover R., Hornisher D., Nelson G., Nerozzi S., Pathare A., Petersen E., Sizemore H., Campbell B., Mastrogiuseppe M., Mellon M., Smith I. (2020) Subsurface Water Ice Mapping (SWIM) on Mars: Overview and Methods In Lunar and Planetary Science 51, Abstract #2645.

Putzig N., Morgan G., Bain Z., Baker D., Bramson A., Courville S. W., Dundas C., Hoover R., Hornisher D., Nelson G., Nerozzi S., Pathare A., Perry M., Petersen E., Sizemore H., Campbell B., Mastrogiuseppe M., Mellon M., Smith I. (2020) Subsurface Water Ice Mapping (SWIM) on Mars to Support In Situ Resource Utilization In Lunar and Planetary Science 51, Abstract #2648.

Bain Z., Putzig N., Morgan G., Baker D., Bramson A., Courville S. W., Dundas C., Hoover R., Hornisher D., Nelson G., Nerozzi S., Pathare A., Perry M., Petersen E., Sizemore H., Campbell B., Mastrogiuseppe M., Mellon M., Smith I. (2020) Subsurface Water Ice Mapping (SWIM) on Mars: Focused Study Regions In Lunar and Planetary Science 51, Abstract #2679.

AGU 2019

Courville S. W., Putzig N. E., Sava P. C., and Perry R. M. (2018) Preparing to image the Martian subsurface: planetary active-source seismology vs. radar, and the ARES concept. In American Geophysical Union's Fall Meeting, Abstract P44B-05. (talk)

Havlat D., Maly B. I., Courville S. W., Perry M. R., Bain Z. M., and Putzig N. E. (2018) Martian Dust Cover May Permit More Detailed Subsurface Discovery. In American Geophysical Union's Fall Meeting, Abstract P41C-3459.

Maly B. I., Havlat D., Bain Z. M., Perry M. R., Putzig N. E., and Courville S. W. (2018) The Northern

Terminus of Ground-Ice Detections in Arcadia Planitia on Mars May Be Attributable to Surface Effects. In American Geophysical Union's Fall Meeting, Abstract P41C-3465.

LPSC 2019

Courville S. W. and Sava P. (2019) Speckle Noise in Orbital Laser Doppler Vibrometry. In Lunar and Planetary Science 50, Abstract #1720.
Eposter link: <https://www.hou.usra.edu/meetings/lpsc2019/eposter/1720.pdf>

Amos C., Putzig N., Perry R., Paulsson B., Thornburg J., Wylie M., Hardiman H., He R., Sava P., Courville S. W., Zacny K., Paulsen G., Mikesell T. (2019) Fiber Optic Geophones for Use in Planetary Subsurface Exploration. In Lunar and Planetary Science 50, Abstract #2623.

AGU 2018

Courville S. W., Putzig N. E., Sava P. C., Perry R. M., and Mikesell D. (2018) ARES: An Autonomous Roving Exploration System for Planetary Active-Source Seismic Data Acquisition. In American Geophysical Union's Fall Meeting, Abstract P54D-02. (eLightning)

LPSC 2018

Courville S. W., James P. B., and Kramer G. Y. (2018) Shallow Subsurface Investigations of Schrodinger Basin's Peak Ring Using Grail Gravity Field. In Lunar and Planetary Science 49, Abstract #1567. (oral)

Dwornik Award feedback from judges:

"A very dynamic speaker that kept the attention of the audience throughout the presentation."

"Good talk, you were very clear about what you were doing, why and how, and were to-the-point in answering questions."

"I really enjoyed reading your abstract. I think this is a great study. The implications were clear."

Hoover R. H., Robbins S. J., Putzig N. E., Fenton L. K., Hayward R., Courville S. W., et. al. (2018) Examining Thermal Inertia of Layered Ejecta Craters and Southern Hemisphere Dunes on Mars. In Lunar and Planetary Science 49, Abstract #1811. (poster)

LPSC 2017

Hoover R. H., Robbins S. J., Putzig N. E., Fenton L. K., Hayward R., and Courville S. W. (2017) Analysis of Thermal Inertia to Understand the Near-Surface Properties of Layered Ejecta Craters and Southern Hemisphere Dunes on Mars. In Lunar and Planetary Science 48, Abstract #1062. (poster)

AGU 2016

Courville S. W., Putzig N. E., Hoover R. H., and Fenton L. K. (2016) Thermophysical Variation within Dune Fields in the Southern Hemisphere of Mars. In American Geophysical Union's Fall Meeting, Abstract P21A-2073. (poster)

WHITE PAPERS

Courville S. W. et. al. (2021). Developing Active Source Seismology for Planetary Science. Bulletin of the American Astronomical Society, Vol. 53, Issue 4, e-id. 398.
DOI: 10.3847/25c2cfef.ef2d617d

Bramson A., ... Courville S. W. et. al. (2021). Mid-Latitude Ice on Mars: A Science Target for Planetary Climate Histories and an Exploration Target for In Situ Resources. Bulletin of the American Astronomical Society, Vol. 53, Issue 4, e-id. 115. DOI: 10.3847/25c2cfef.cc90422d

Moore K., ... Courville S. W. et. al. (2021). Rapid Response Missions to Explore Fast, High-Value Targets such as Interstellar Objects and Long Period Comets. Bulletin of the American Astronomical Society, Vol. 53, Issue 4, e-id. 481. DOI: 10.3847/25c2cfef.1d58e5af

Donitz B., ... Courville S. W. et. al. (2021). New Frontiers Mission Concept Study to Explore Oort Cloud Comets. Bulletin of the American Astronomical Society, Vol. 53, Issue 4, e-id. 344.
DOI: 10.3847/25c2cfed.d7cfcc43