

A photograph of an outdoor courtyard. On the left is a modern building with a vibrant red facade. In the center, a white bench sits on a bed of reddish-brown mulch. To the right, there are several large, leafy trees and a white building with a red-tiled roof. The sky is clear and blue. A white rectangular box with a black border is overlaid in the center of the image, containing the text.

W. M. KECK INSTITUTE FOR SPACE STUDIES

2025

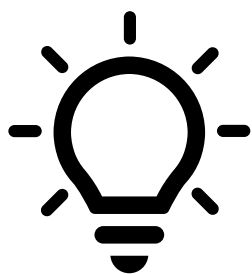
Annual Overview

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ABOUT KISS

The Keck Institute for Space Studies (KISS) was established at Caltech in January 2008 with an initial grant from the W. M. Keck Foundation. The Institute is a "think and do tank," that is shaping the future of space exploration, science, and technology via its three core objectives:



Develop ideas and concepts

that can revolutionize space science and engineering



Foster collaboration

Bridging Caltech and JPL, and integrating the world's space leaders into our community



Empower future leaders

of the space science and technology community

ABOUT KISS

This unique organization links the study elements of a think tank with the implementation elements of designing and developing prototypes. The Institute is centered on the intellectual, instrumentation, and research strengths of the Caltech Campus and JPL, and augments those strengths by inviting external experts from academia, government, and industry to engage in its programs.

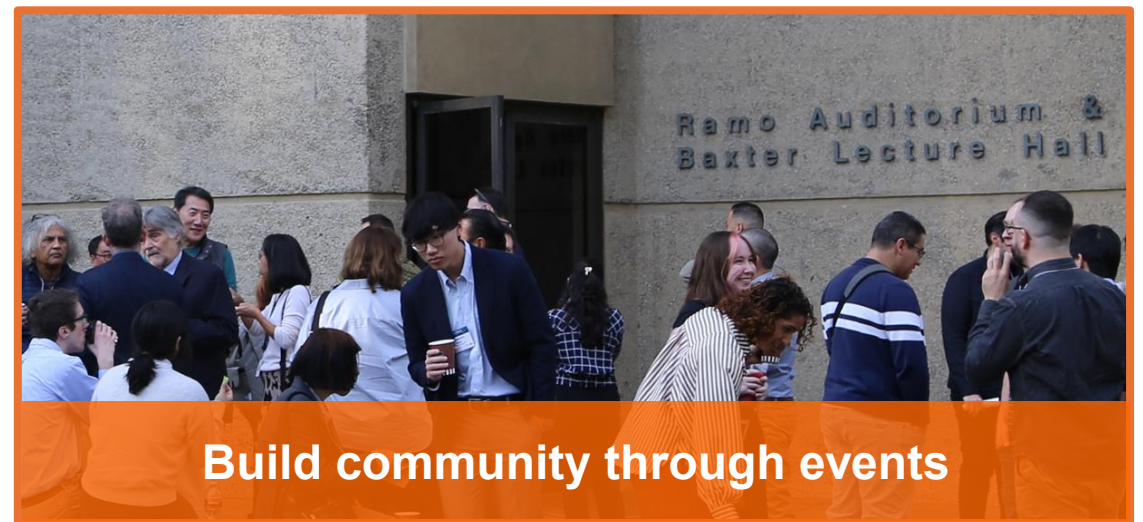
The Institute also provides opportunities for graduate students and postdoctoral fellows to actively participate in cutting edge space mission research and learning.

The Institute supports significant outreach to the public and the wider technical/scientific community via open lectures and other events.



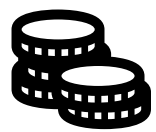
ABOUT KISS

At KISS we are dedicated to solving the most important and interesting space exploration problems of our time. We are at the forefront of new planetary, astrobiology, Earth, and astrophysics space mission concepts and technology. At KISS we:



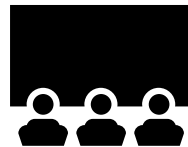
KISS IMPACT

KISS is recognized for its significant impact in many different areas:



\$310M+

Funding generated for KISS study participants to date



130+

workshops held to date

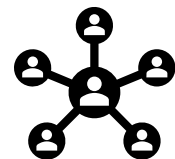


Creating new space missions and instruments



500+

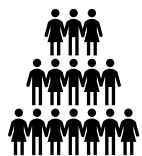
Research papers published



400+ organizations represented at KISS events



New technologies for space exploration



2,100+

participants in KISS studies, with many repeat attendees



25+ countries represented by workshop participants



Study recommendations influence national policy

2025 HIGHLIGHTS



4 Study Programs



5 Workshops



3 Short Courses



3 Symposia

2025 HIGHLIGHTS



**8 Final
Reports
published**



**4 Public
Lectures**



**7 Affiliates
selected**



**Many
co-hosted
events**

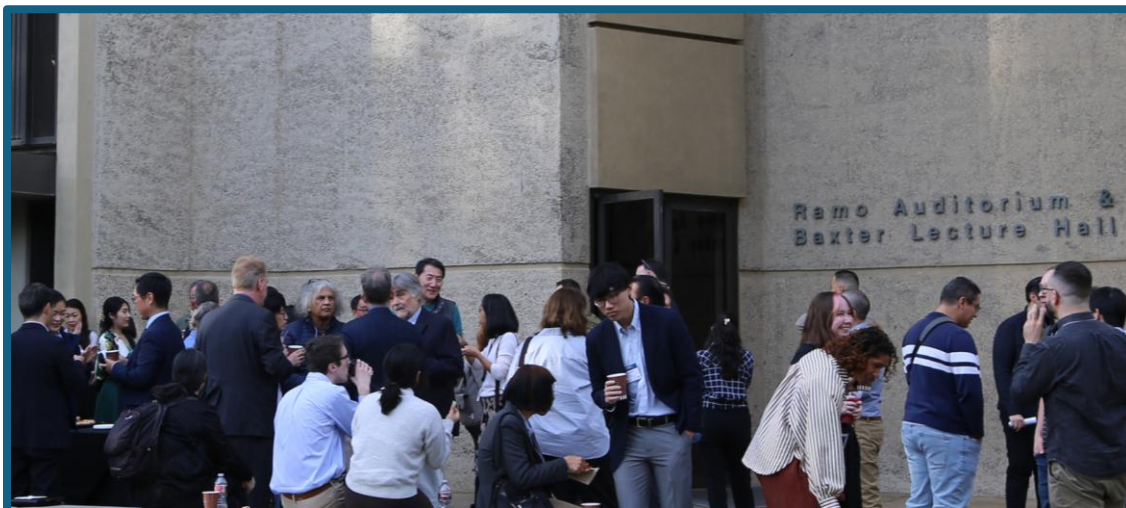
2025 HIGHLIGHTS



Ongoing
Impact



15+ Research
Papers
published



Follow on
funding
awarded to
multiple KISS
studies in 2025



2025 HIGHLIGHTS

Numerous KISS studies represented at LPSC 2025



KISS continues to act as a springboard fostering further career development

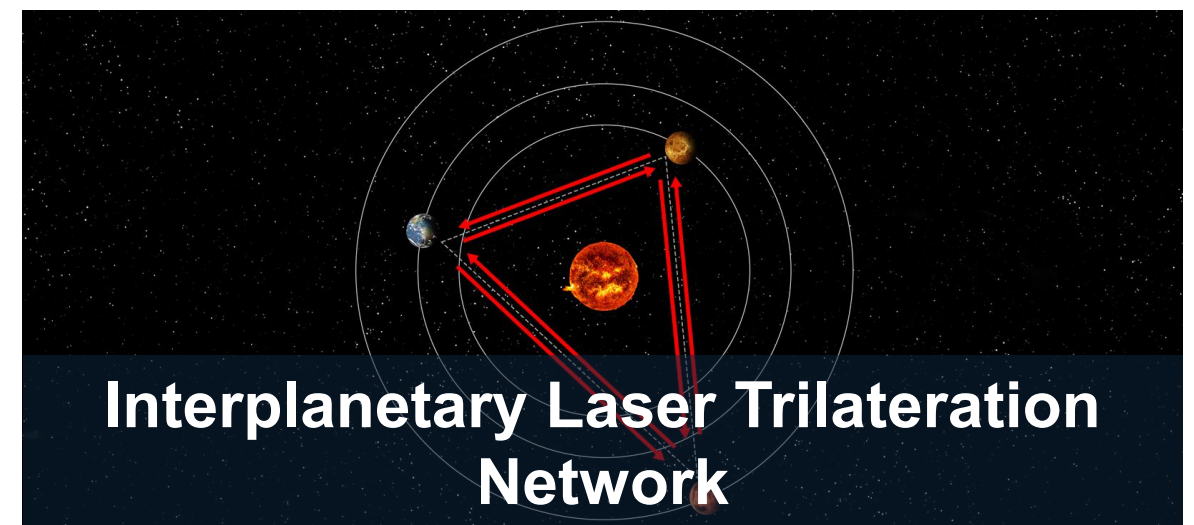
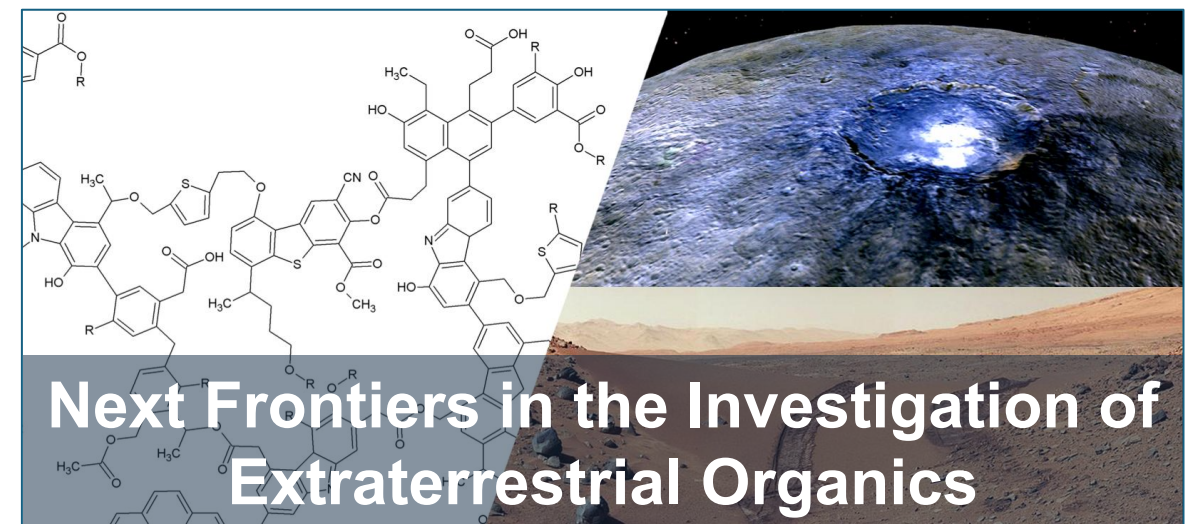
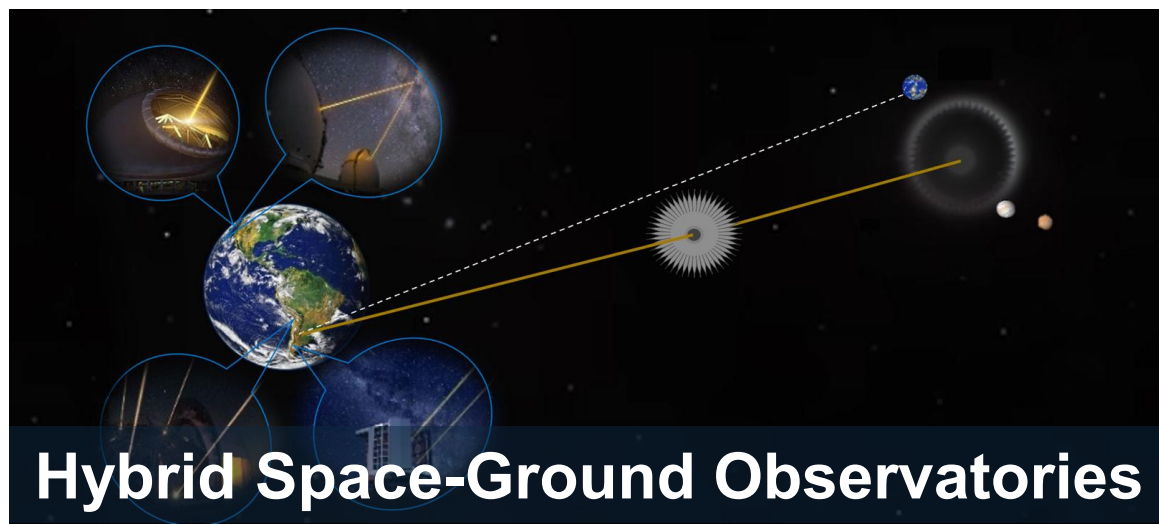


Multiple research papers acknowledge KISS studies in 2025.



2025 STUDY PROGRAMS

2025 was another competitive year, with 26 study concepts followed by 11 full proposals received. 4 study programs were selected for the 2025 program.



2025 STUDY PROGRAMS

4 Study Programs



6 Workshops



including



110+ Participants

representing



50+ Organizations



6 Countries

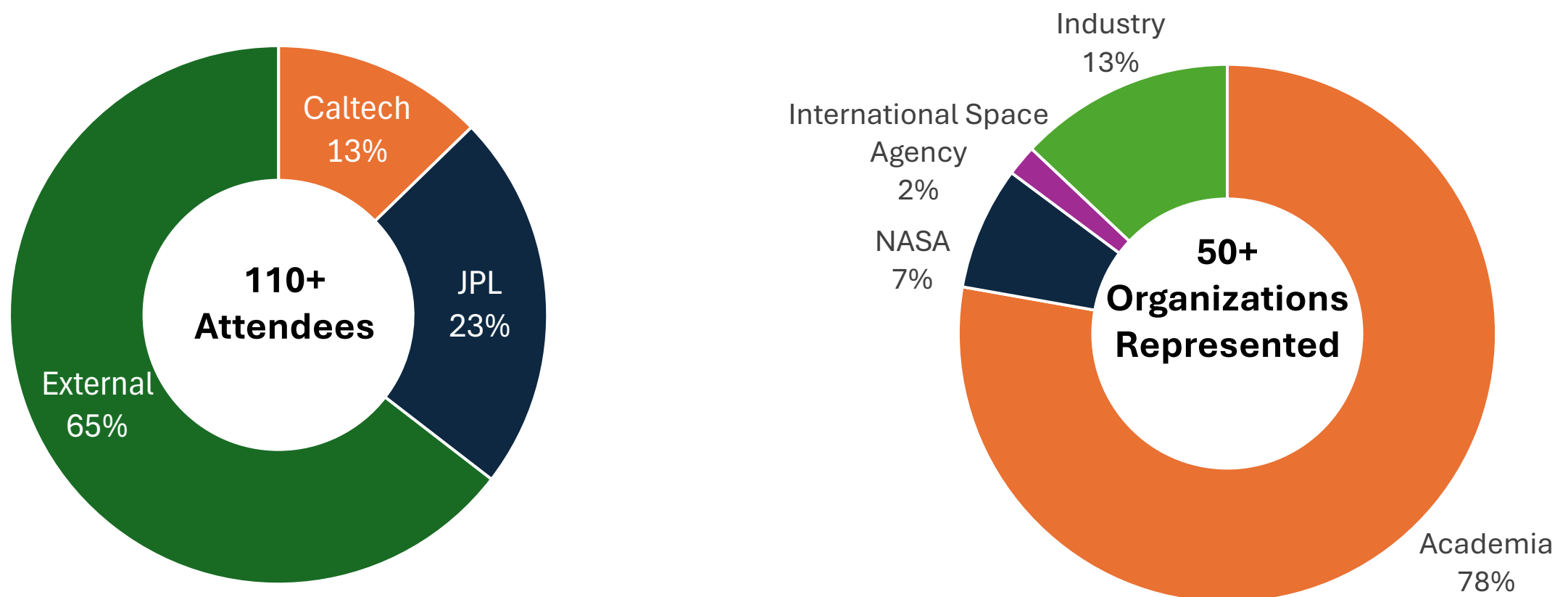
KISS Highlight: “interactions with people from very different perspectives and background - super enriching!”

– workshop participant

** Denotes workshop to be held in 2026*

2025 STUDY PROGRAM ATTENDEES

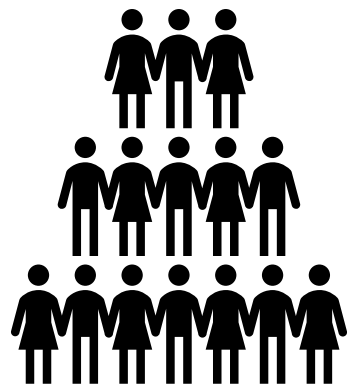
The Keck Institute for Space Studies brings together scientists and engineers from all over the world to participate in our study programs.



“The multi-disciplinary nature of the participants generated a broad and creative set of ideas.”

– workshop participant

2025 STUDY PROGRAM ATTENDEES



20%

Of participants were graduate students and postdocs

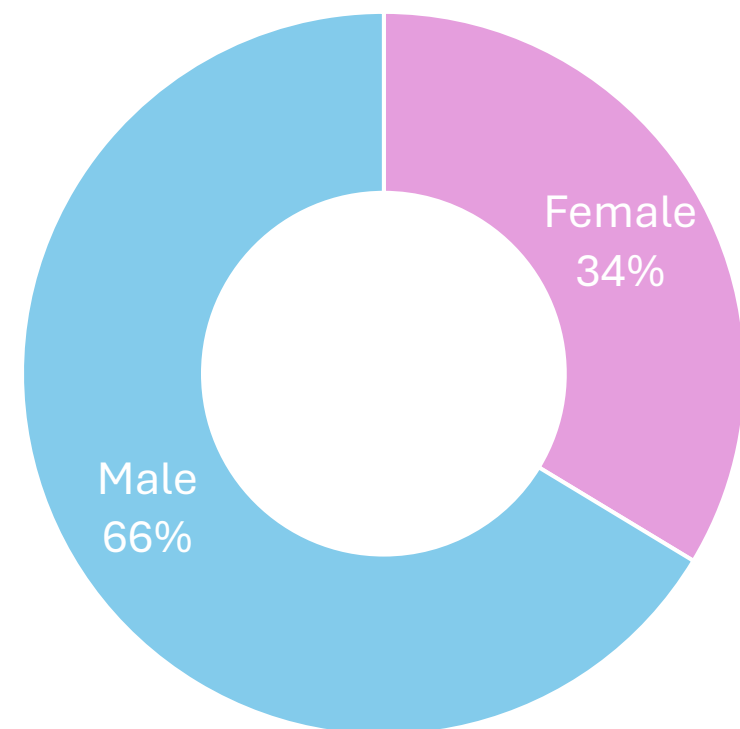
KISS Highlights: *“As a grad student, definitely the opportunity to connect with more senior scientists both in my direct field and in adjacent space science fields. I also really appreciated the interdisciplinary aspects of the workshop.”*

– workshop participant

“The interdisciplinary ideation on a single topic allowing us to gather ideas from a broad community of influential people.”

– workshop participant

Gender Diversity



INTERPLANETARY LASER TRILATERATION NETWORK



1
Workshop



25
participants



13
organizations

Study Leads: Bruce Bills (JPL), Marshall Eubanks (Space Initiatives Inc.), Krzysztof M. Gorski (JPL)

Participants: Amirhossein Bagheri (Caltech), Konstantin Batygin (Caltech), Bruce Bills (JPL), Abhijit Biswas (JPL), Mariana Blanco-Rojas (Purdue University), Lluc Ramon Busquets Soler (University of Colorado Boulder), Alex Davis (JPL), Andrea Donnellan (Purdue University), Brynna Downey (Southwest Research Institute), Anton Ermakov (Stanford University), Thomas Eubanks (Space Initiatives Inc.), Krzysztof Gorski (JPL), Carl Gwinn (University of California, Santa Barbara), Evan Hoffman (NASA Goddard Space Flight Center), Sergei Kopeikin (University of Missouri-Columbia), Shri Kulkarni (Caltech), David Leibrandt (University of California, Los Angeles), Kirk McKenzie (Australian National University), R. Steven Nerem (University of Colorado Boulder), Eitan Rapaport Bruck (University of California, San Diego), Callum Sambridge (JPL), Michael Sori (Purdue University), Riley Tam (Stanford University), Slava Turyshev (JPL), Michael Watkins (Caltech)



2 countries

INTERPLANETARY LASER TRILATERATION NETWORK

Study Objectives

While the use of microwave links from Earth-based microwave antennas within the Deep Space Network (DSN), have well served planetary geodesy, navigation, and exploration for more than 50 years, changes associated with an interplanetary laser trilateration network (ILTIN) show promise for revolutionary advances in those fields.

The goal of this study program is to develop plans for a future planetary geodesy measurement protocol that would improve the state of the art for planetary ranging by up to three orders of magnitude, using a triad of spacecraft with laser communications deployed in orbit around Venus, Earth, and Mars.

- Bring together a group of scientists and engineers with expertise spanning a wide range of topics in the relevant fields.
- Describe and quantify the potential for achieving revolutionary new science, including the possibility of measuring mean galactic rotation rate, gravitational waves, and other applications, which will be enabled by an interplanetary laser trilateration network.
- Identify (and start to solve) the practical challenges associated with the design, development, and implementation of an interplanetary laser trilateration network.

ONE-SHOT OUTER SOLAR SYSTEM EXPLORATION WITH ADAPTIVE SPACE SYSTEMS



2
Workshops



26
participants



17
organizations

Study Leads: Morgan Cable (JPL), Hiro Ono (JPL), Dani Selva (Texas A&M University)

Participants: Morgan Cable (JPL), Shane Campbell-Staton (Princeton University), Mathieu Choukroun (JPL), Soon-Jo Chung (Caltech), John Day (Blue Origin), Alexander Demagall (Texas A&M University), Marie Ethvignot (JPL), Maggie Hansen (Carnegie Mellon University), Andreas Hein (University of Luxembourg), Michel Ingham (JPL), Sorina Lupu (Openmind Research Institute), Zac Manchester (Carnegie Mellon University), David Murrow (Retired JPL/Lockheed Martin), Masahiro Ono (JPL), Charity Phillips-Lander (Southwest Research Institute), Chad Pozarycki (Deleon), Richard Rieber (JPL), Maria Sakovsky (Stanford University), Alejandro Salado (University of Arizona), Daniel Selva (Texas A&M University), Lori Shiraishi (JPL), Pascal Spino (MIT), Amanda Stockton (Georgia Institute of Technology), Yisong Yue (Caltech), Kris Zacny (Honeybee Robotics, a Blue Origin Company)



2 countries

ONE-SHOT OUTER SOLAR SYSTEM EXPLORATION WITH ADAPTIVE SPACE SYSTEMS

Study Objectives

The surface and subsurface of any worlds beyond Mars still remain unexplored or underexplored. Yet it is these worlds that hold the key to some of the greatest questions in planetary science - for example, the icy moons of gas giants that conceal potentially habitable subsurface oceans, Kuiper belt objects that preserve ancient records of the Solar System, or interstellar objects on which we can sample and analyze rocks from other star systems. While NASA has been tremendously successful in robotic Mars exploration, it hinged on incrementalism through 15 progressively sophisticated missions spanning over four decades. It started with orbiters, followed by simple robotic missions, and then resulted in the highly complex Curiosity and Perseverance rovers. As we set our sights on exploring a multitude of unvisited worlds beyond Mars, we must face a subtle but profound problem: We will not enjoy the luxury of sending many missions to each of the destinations due to the extensive cruise time to the Outer Solar System and beyond (e.g., ~10 years to Saturn's moons) unless we are willing to wait for many centuries.

We envision a new planetary exploration paradigm, which we call Robotic Space Exploration 3.0 (RSE 3.0), that explores unvisited worlds in one-shot with a radically adaptive space system. The incremental sophistication over many missions in the conventional paradigm will be replaced by the adaptation of the functional behaviors of a single robotic system in RSE 3.0. Since hardware cannot be upgraded once in space, the system must be software-defined.

This KISS Study will aim to establish the concept of software-defined space systems (SDSS) that can adapt their functions at all levels, from science instruments to robotic capabilities, after launch through software updates, and formulate a one-shot multifaceted mission, which performs orbiting, landing, surface/subsurface exploration, and potentially sample return in a single unified mission. The Study will also produce a technology roadmap for SDSS and recommend technology development programs for maturing key SDSS technologies.

NEXT FRONTIERS IN THE INVESTIGATION OF EXTRATERRESTRIAL ORGANICS



2
Workshops



30
participants



18
organizations

Study Leads: Maitrayee Bose (Arizona State University), Julia Tejada (Caltech), Jessica Weber (JPL)

Participants: Laurie Barge (JPL), Jennifer Bergner (University of California, Berkeley), Maitrayee Bose (Arizona State University), Eloi Camprubi (University of Texas Rio Grande Valley), Julie Castillo (JPL), Samuel Courville (Arizona State University), Ellen Czaplinski (Honeybee Robotics), Dionysis Foustoukos (Carnegie Institution for Science), Kate Freeman (Pennsylvania State University), Yuanyuan He (Caltech), Bryana Henderson (JPL), Amy Hofmann (JPL), Yongsong Huang (Brown University), Kristin Johnson-Finn (Rensselaer Polytechnic Institute), Christopher Junium (Syracuse University), Susan Lang (Woods Hole Oceanographic Institution), Shawn McGlynn (Institute of Science Tokyo), Ophélie McIntosh (Pennsylvania State University), Alexander Meshoulam (Caltech), Haruka Nakagawa (Institute of Science Tokyo), Marc Neveu (University of Maryland/NASA Goddard Space Flight Center), Nathan Reed (University of Colorado Boulder/Rensselaer Polytechnic Institute), Lucas Reynoso (Arizona State University), Kirtland Robinson (Arizona State University), Laura Rodriguez (Lunar and Planetary Institute), Alex Sessions (Caltech), Julia Tejada (Caltech), Jessica Weber (JPL), Xinting Yu (University of Texas at San Antonio)



3 countries



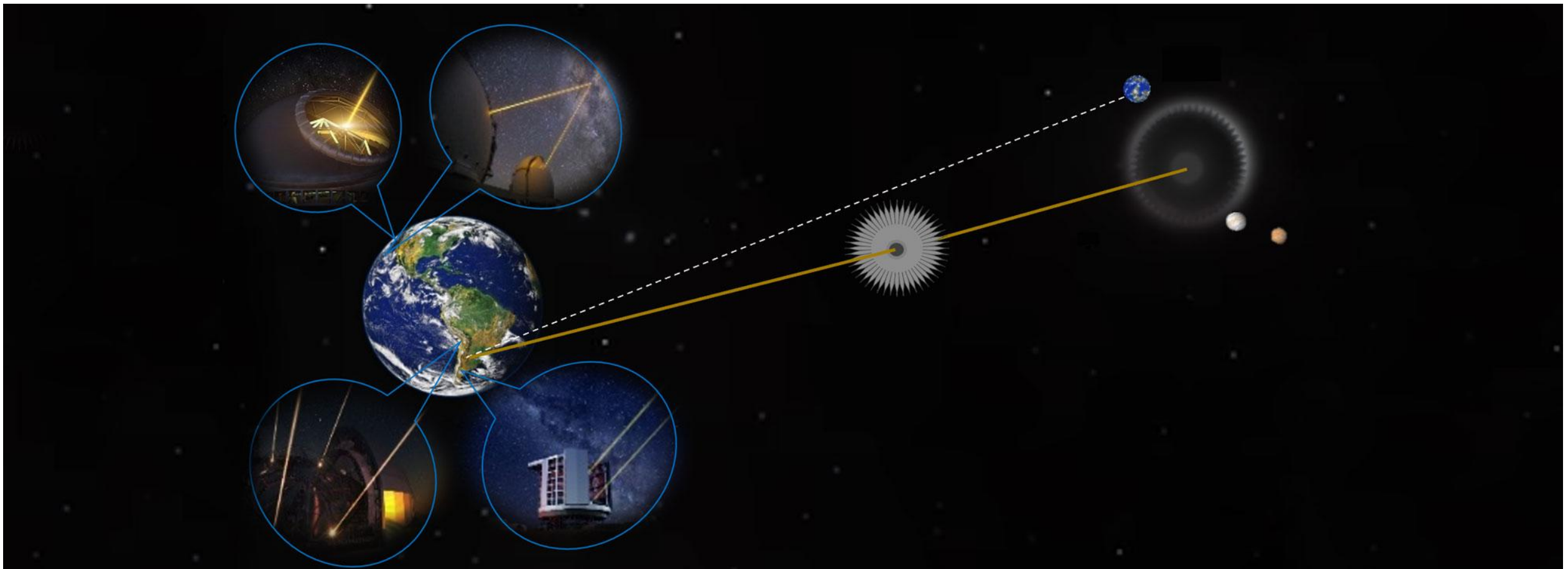
NEXT FRONTIERS IN THE INVESTIGATION OF EXTRATERRESTRIAL ORGANICS

Study Objectives

The study of the organic inventory of planetary materials occurs at an intersection of many fields including chemistry, biology, geology, and planetary science. In recent years, simple and complex organic materials have been identified and occur more abundantly on extraterrestrial worlds than initially anticipated. Organic compounds have been detected on Mercury, Mars, chondrite parent bodies, Ceres, Enceladus, Titan, Pluto, comets, the atmospheres of the giant planets, and possibly even Venus. The precursor molecules and abiotic synthesis of the complex organics in variable rock and salt environments is a growing field of study. With upcoming New Frontiers calls (Origins, Worlds, and Life: A Decadal Strategy for Planetary Science and Astrobiology 2023-2032) for comet sample return, Enceladus plume sampling, and Ceres sample return mission concepts, understanding the evolution of organics in planetesimal and their role in planet formation and other processes is critical (and timely) for development and science interpretation from these missions. Exploring the impact and effect of organic compounds in Earth's biospheres as well as planetary atmospheres and interiors is critical for the advancement of planetary science.

The workshop will offer a state-of-the-art update of the field, sparking discussions and debates on some of the most pressing unanswered questions surrounding the generation, alteration, and preservation of organic compounds. This workshop will be broken into 5 key topic areas encompassing multiple cutting-edge questions. We aim to promote and inspire future scientific research proposals among participants and inform the science objectives of sample return and in situ missions outlined in the decadal report. Workshop 1 will be primarily focused on outer solar system objects while workshop 2 will focus on inner solar system bodies.

HYBRID SPACE-GROUND OBSERVATORIES



Study Leads: John Mather (NASA), Stuart Shaklan (JPL), Ahmed Soliman (JPL)

Participants: Zahra Ahmed (Stanford University), Jonathan Arenberg (Northrop Grumman Space Systems), Manan Arya (Stanford University), Harsh Bhundiya (University of Southern California), Shannon Brown (JPL), Aman Chandra (University of Arizona), Jessie Christiansen (Caltech), Mario Damiano (JPL), Richard Dekany (Caltech), Juliana Garcia-Mejia (Massachusetts Institute of Technology), Christine Gregg (NASA Ames Research Center), Sungeun Jeon (MIT Lincoln Laboratory), Markus E. Kasper (European Southern Observatory), John Mather (NASA Goddard Space Flight Center), David Miller (JPL), Rhonda Morgan (JPL), Jalo Nousiainen (European Southern Observatory), Sergio Pellegrino (Caltech), Eliad Peretz (NASA Goddard Space Flight Center), Peter Plavchan (George Mason University), William Sanchez (JPL), Aniket Sanghi (Caltech), Jonathan Sauder (Amazon), Stuart Shaklan (JPL), Ahmed Soliman (JPL), Andrew Szentgyorgyi (Harvard Smithsonian Center for Astrophysics), Jamila Taaki (University of Michigan), Ronald Turner (Analytic Services Inc. (ANSER)), Amber Young (Mary W. Jackson NASA Headquarters), Aiden Zelakiewicz (Cornell University)

HYBRID SPACE-GROUND OBSERVATORIES

Study Objectives

Our workshop study provides a unique opportunity to develop a strategic roadmap for advancing hybrid ground-space observatories and partnerships. By bringing together leading experts across technical, engineering, and scientific fields, we aim to create a comprehensive plan for detecting the first Earth-like exoplanet orbiting a sun-like star from this collaborative effort. Our KISS study team will bring together world-class experts, including Nobel Laureates, with multi-disciplinary background needed for the success of this study, covering exoplanet science, high-contrast imaging, space and ground instruments, starshades, mechanical engineering, precision deployment of large space structures and materials, orbital dynamics, formation control for alignment, mission yield, extreme adaptive optics, laser guide stars, atmospheric modeling and turbulence, as well as representatives from the largest ground-based telescopes and observatories. Together, we are committed to this study, eager to drive forward Interdisciplinary innovative approaches.

Our objectives address key technical and science issues and highlight the uniqueness of these concepts through imaging and spectral science products. It is important to relate the predicted performance to potential Habitable World Observatory (HWO) missions at UV/Vis/NIR bands. We will explore integrating and networking several ground-based telescopes to increase the number of potential targets and reduce fuel needs. The key topics are organized into five main categories: exoplanet science, system engineering, instrumentation questions, precursor observations, and starshade technology.

This study was postponed to March 2026 due to the US Government shutdown in 2025.

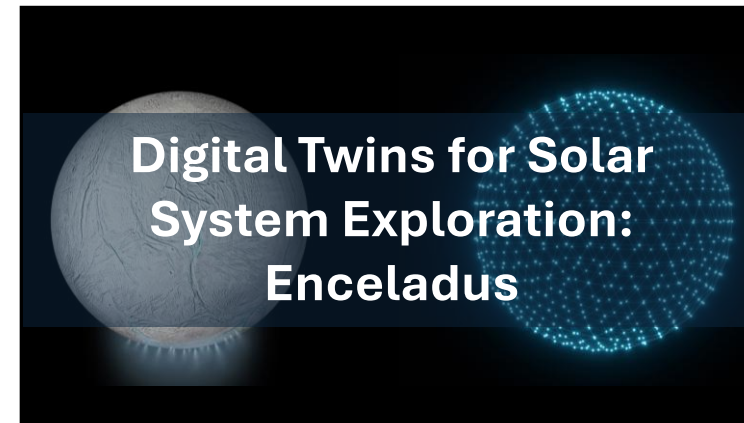
2nd Workshops of 2024 Studies held in 2025



Sample Return from all across the Solar System - Part II

February 24-28, 2025

Building upon the first workshop in September 2024, the second advanced science objectives, measurement and sample requirements for sample return missions, revised enabling propulsion technologies, and assessed the challenges of long-term sample curation.



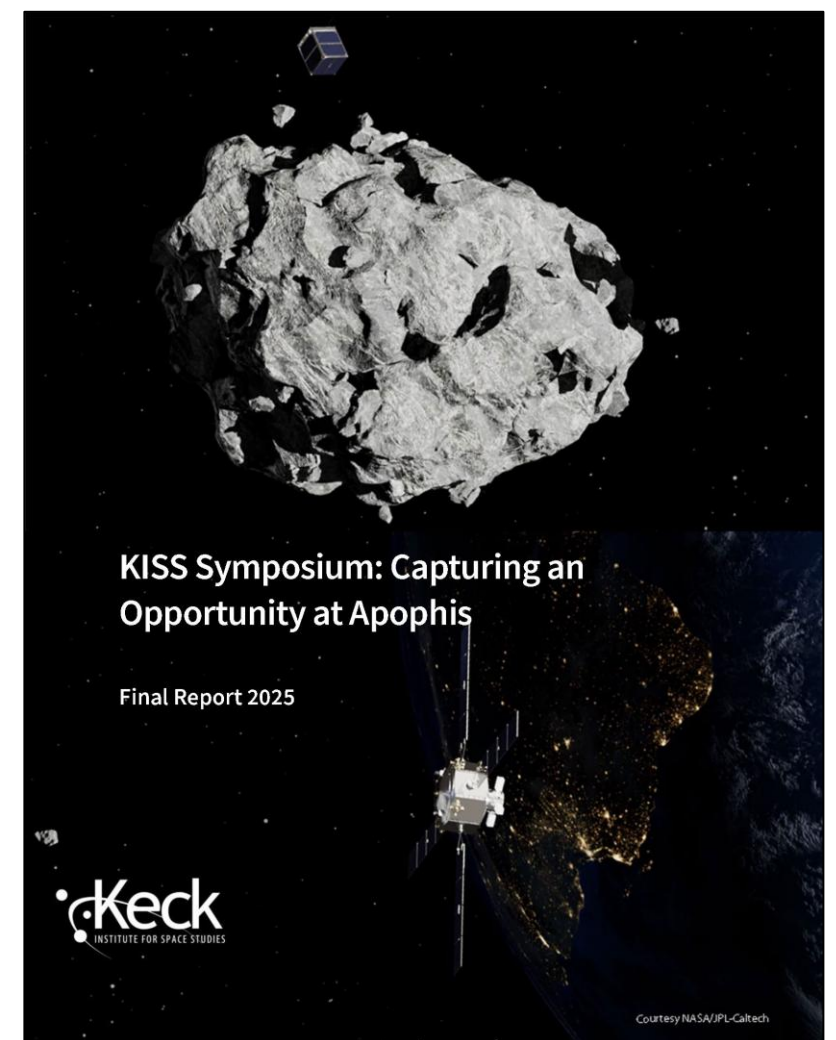
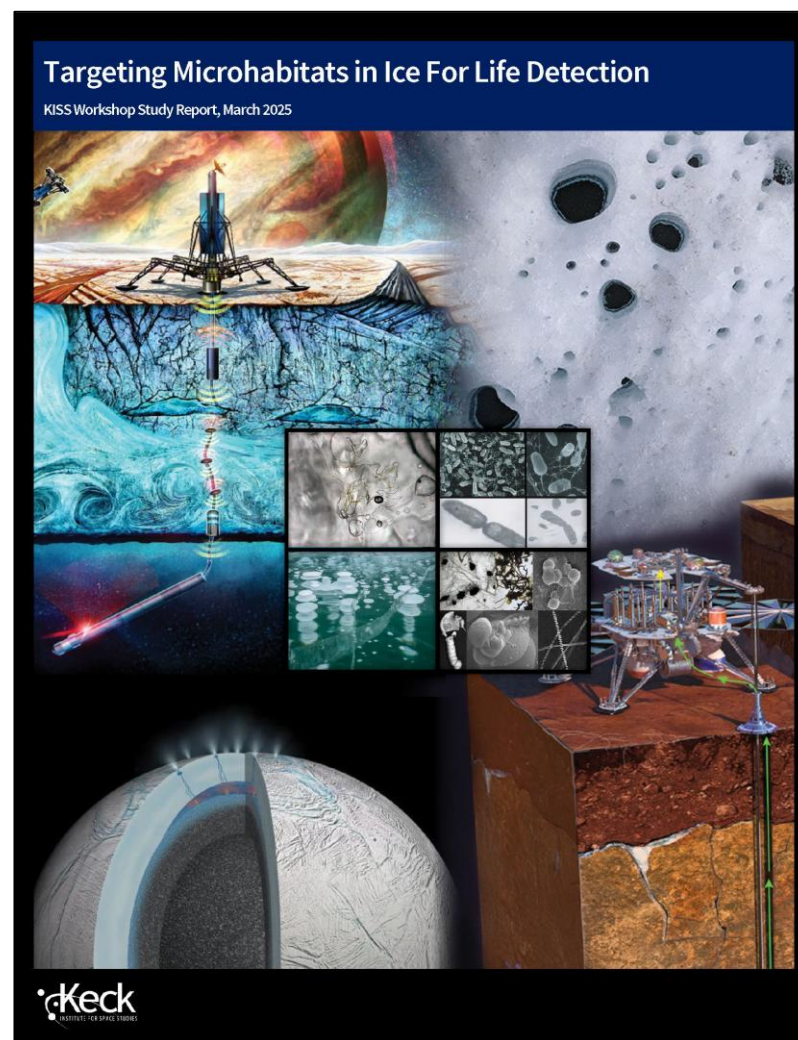
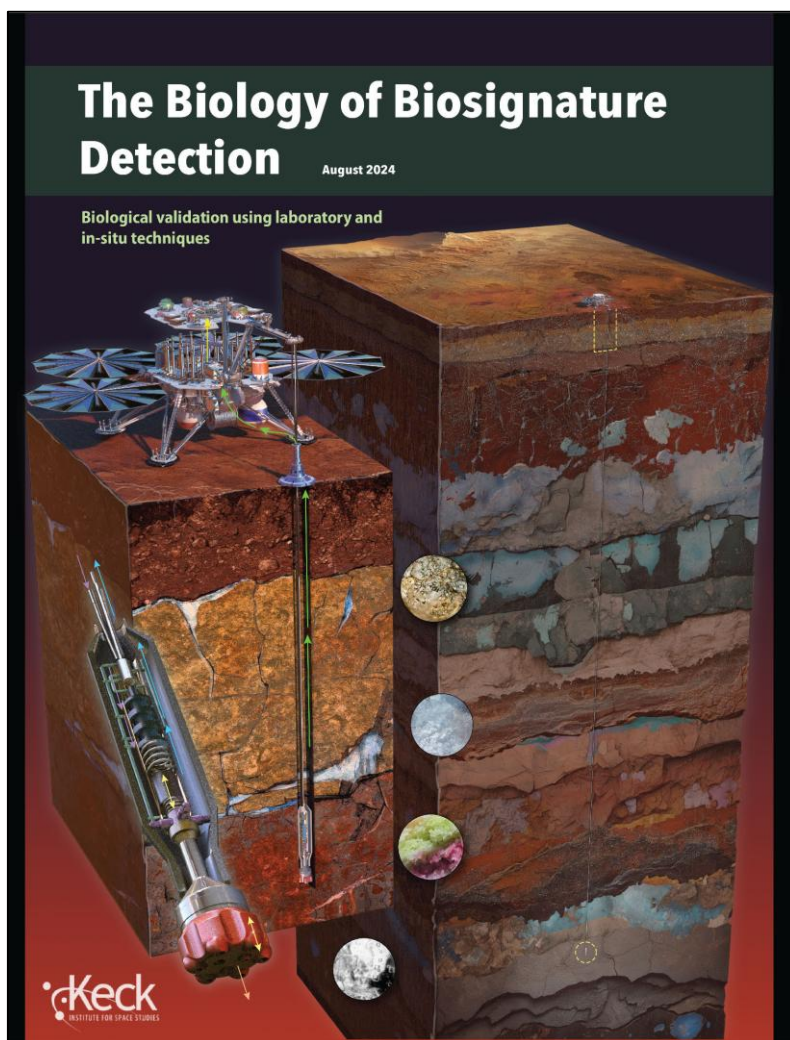
Digital Twins for Solar System Exploration: Enceladus

- Part II

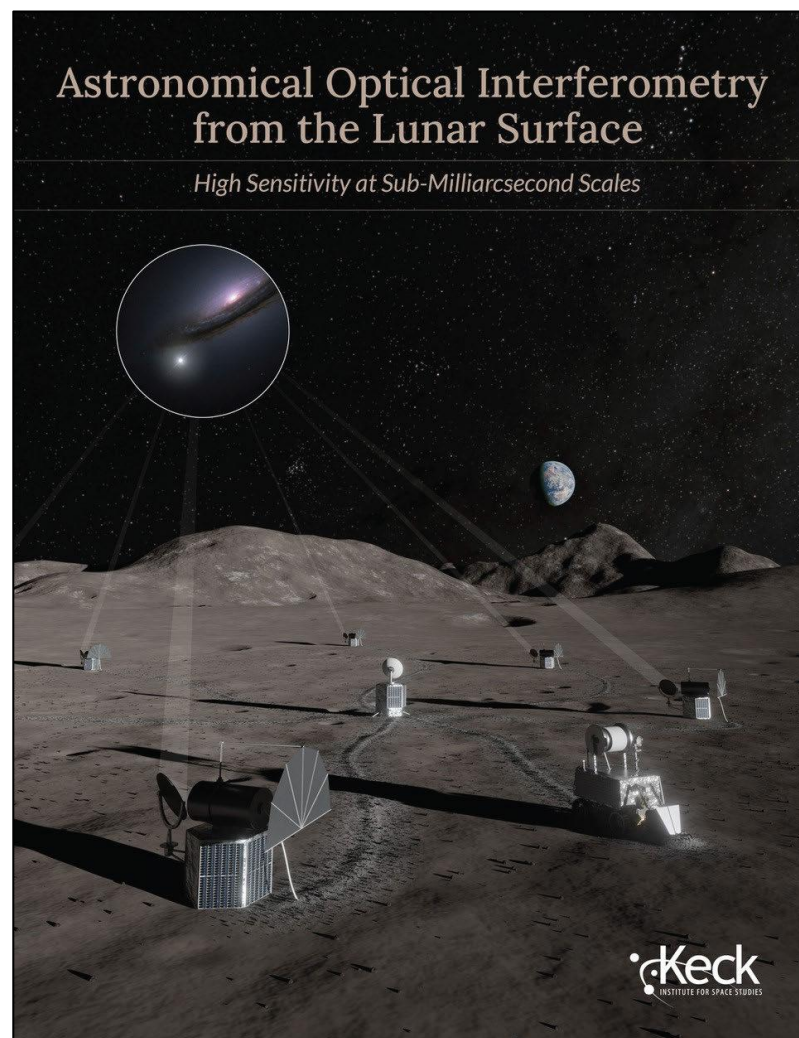
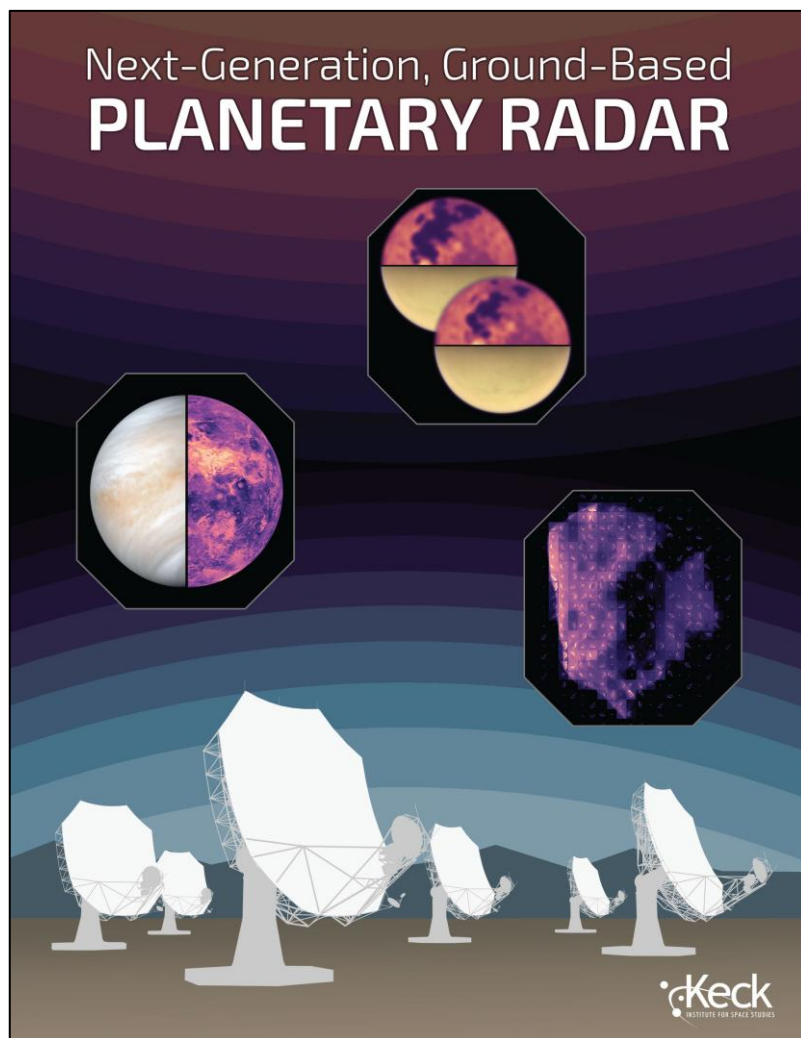
May 6-9, 2025

The objectives for the second workshop were (re)evaluate the Digital Exploration Twin prototype and identify what would be needed to generalize the ET beyond the Enceladus mission use case.

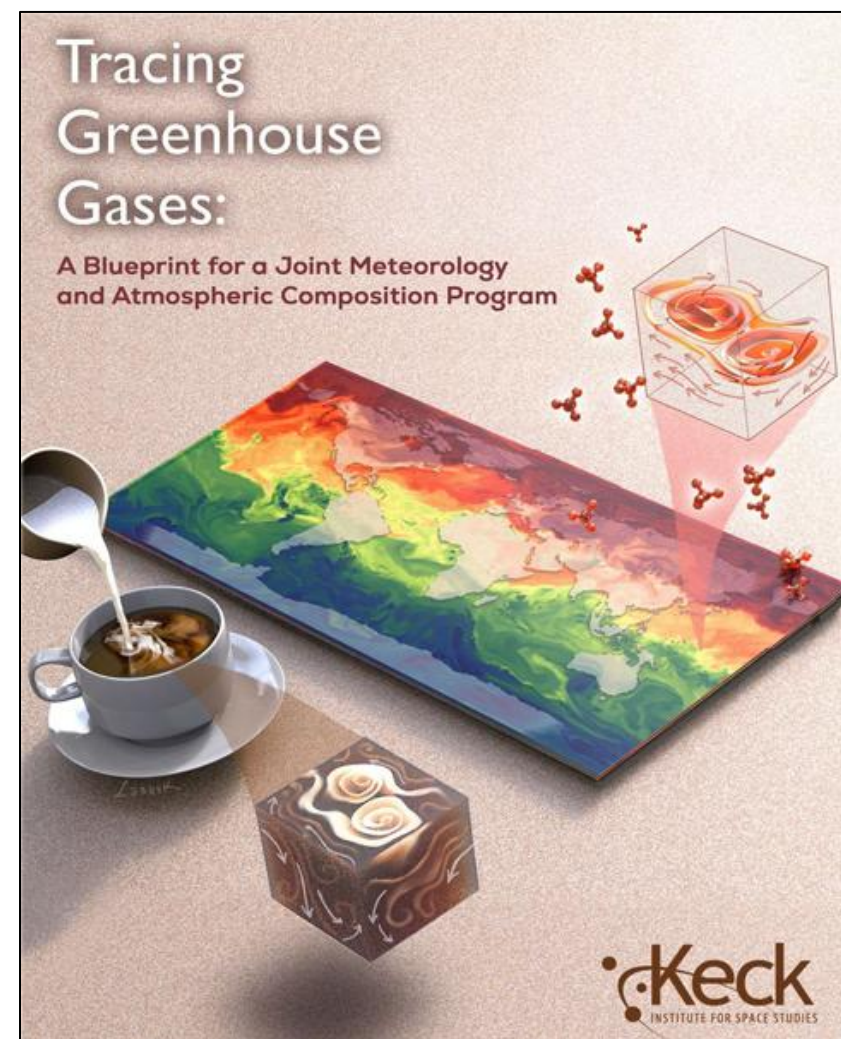
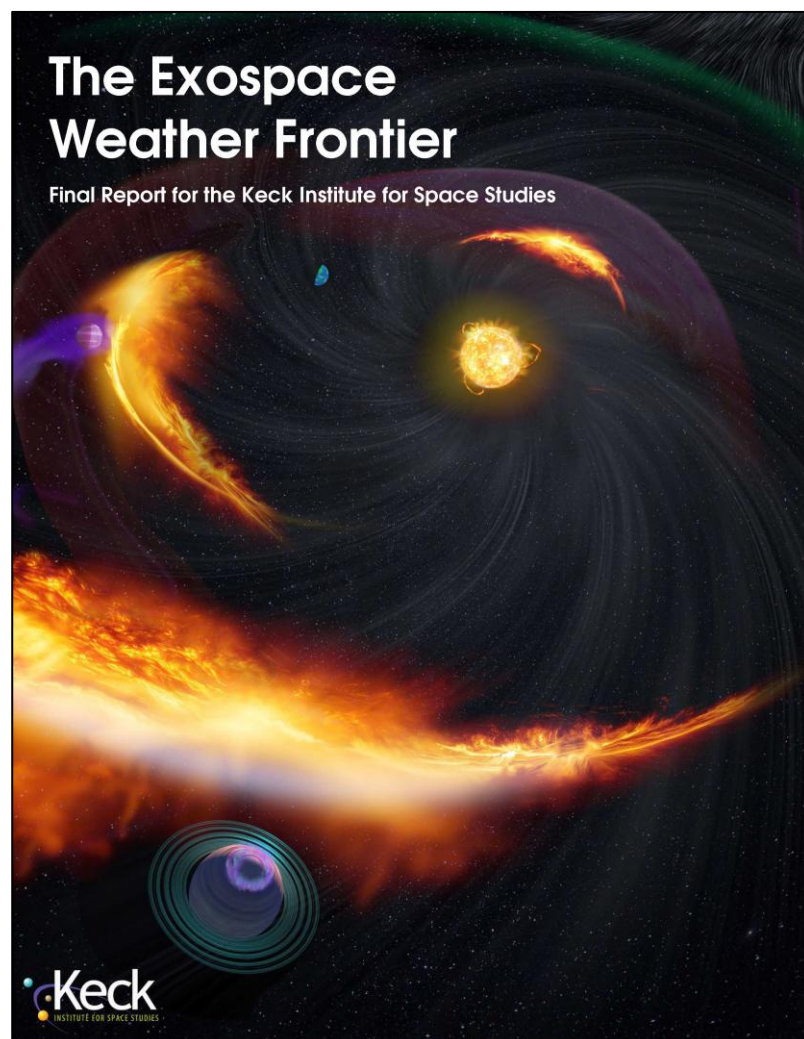
8 REPORTS PUBLISHED IN 2025



8 REPORTS PUBLISHED IN 2025



8 REPORTS PUBLISHED IN 2025



TECHNOLOGY DEVELOPMENT

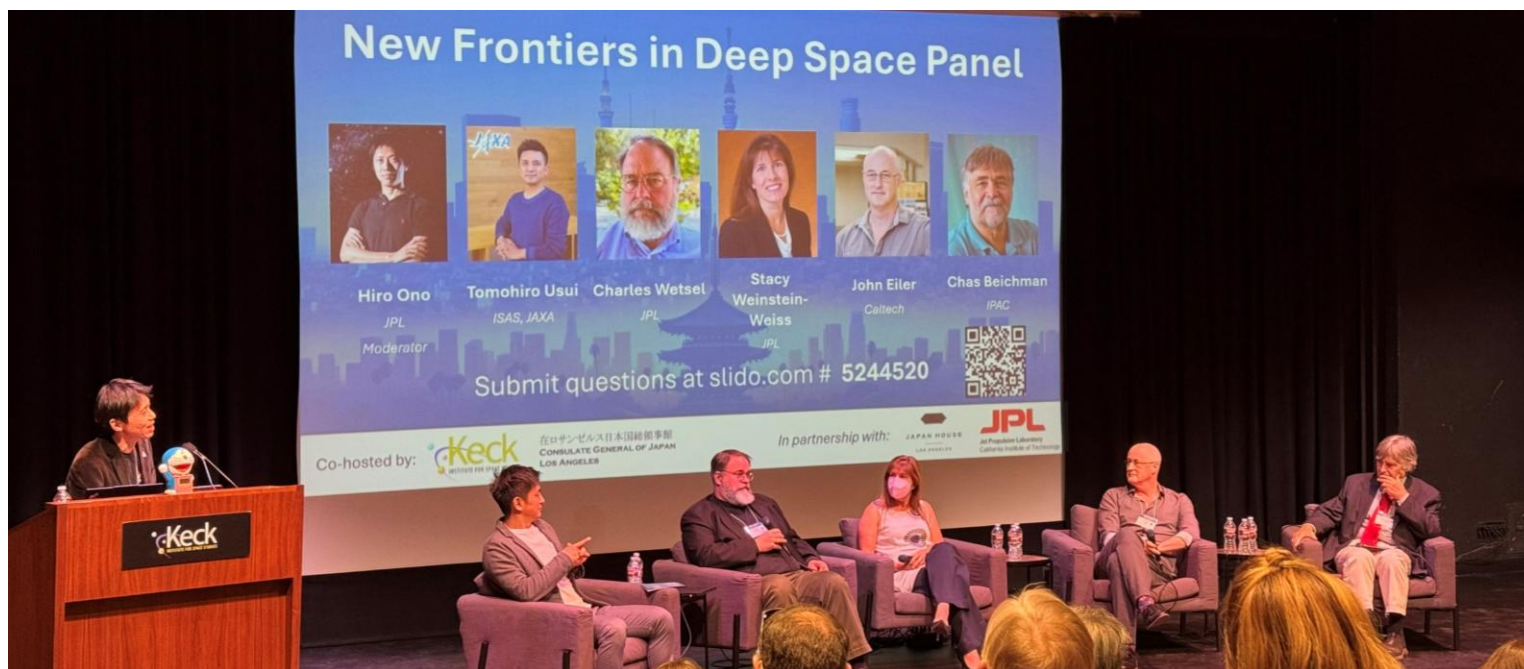
Ongoing technical development funded by KISS includes:

- *“Towards Low-Noise Microwave Amplifiers with Outstanding Room-Temperature Noise Performance”*, led by Austin Minnich and selected in 2023
- *“Prebiotic Chemical Formation Pathways of Urea and Nucleobases”*, led by Geoff Blake and selected in 2023

Ongoing technical development facilitated by KISS includes:

- *“The Search for Water Worlds Around Nearby Stars”*, led by Heather Knutson selected in 2023 and funded by the Wilf Family Discovery Fund
- *“A Focal Plane Architecture for 3D Mapping of the THz Universe”*, led by Sunil Gowala (PMA) selected in 2024 and funded by the Wilf Family Discovery Fund
- *“Expanding Concepts of Habitability: Aerotrophy”* led by Alex Sessions (GPS) selected in 2025 and funded by the Wilf Family Discovery Fund

EXPLORING TOGETHER: US-JAPAN SPACE COLLABORATION SYMPOSIUM



1
Symposium



150+ in
person
attendees as
well as
online
viewing



148
Organizations
represented

EXPLORING TOGETHER: US-JAPAN SPACE COLLABORATION SYMPOSIUM

Symposium Objectives

Exploring Together: US-Japan Space Collaboration Symposium celebrates the long-standing and successful partnership between the United States and Japan in space science and exploration. Co-hosted by the Keck Institute for Space Studies at Caltech and Consulate General of Japan in Los Angeles, and in partnership with JAPAN HOUSE Los Angeles and NASA's Jet Propulsion Laboratory (JPL), this event highlighted existing US-Japan space activities and fostered new collaborations within the US and Japanese space community.

This symposium showcased the latest advancements and future developments in lunar exploration and beyond, including areas of existing and potential future collaboration between US and Japanese efforts. Through expert panels, attendees heard from leading experts from the US and Japan as they discussed groundbreaking missions and evolving technologies that promise to shape the next era of space discovery. These sessions underscored the value of and opportunity for collaboration between US and Japanese space agencies, private industries, and research institutions.

The event also provided a platform to enhance connections, with representatives from both public and private sectors engaging in networking and discussions of potential partnerships. By fostering linkages between industry and academia, *Exploring Together* aimed to catalyze the innovation needed for future space science and exploration, while strengthening the bonds between the United States and Japan as they look toward the future of space activities.



KISS SHOWCASE EVENT

The inaugural KISS Showcase on April 17, 2025, highlighted the outcomes and impact of 16 Keck Institute for Space Studies (KISS) initiatives, showcasing the groundbreaking research, innovative collaborations, and the transformative ideas that have emerged from KISS in recent years. Through engaging discussions and networking opportunities, the showcase highlighted value of KISS to our community, as well as inspiring new ideas and partnerships for the future of space exploration.



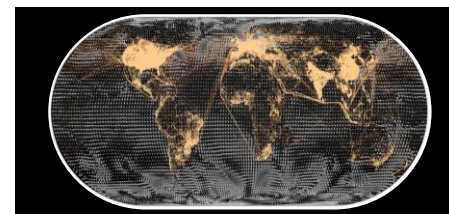
Capturing an Opportunity at Apophis (2024)



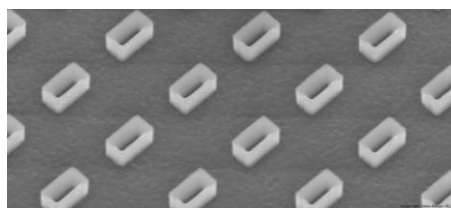
Real Time Detection and Tracking of Fires that Matter (2020-2021)



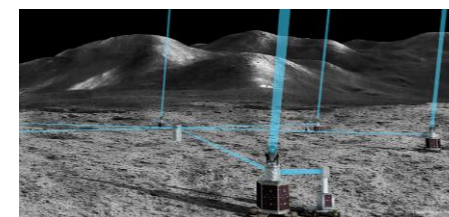
Towards Low-Noise Microwave Amplifiers with Outstanding Room-Temperature Noise Performance (2023)



Forging Community Consensus for an Integrated GHG and Winds Program (2024)



Metasurface Optics for High-Contrast Imaging (2024)



Astronomical Optical Interferometry from the Lunar Surface (2024)

KISS SHOWCASE EVENT



The Next-Generation Ground-Based Planetary Radar (2020-2021)



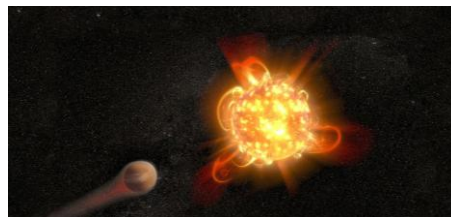
Developing a Continuity Framework for Satellite Observations of Climate (2022)



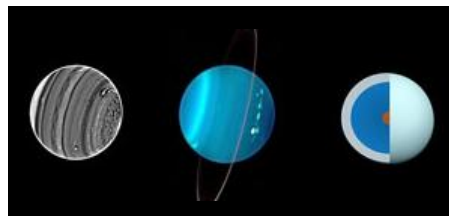
Data-Driven Approaches to Searches for the Technosignatures of Advanced Civilizations (2019)



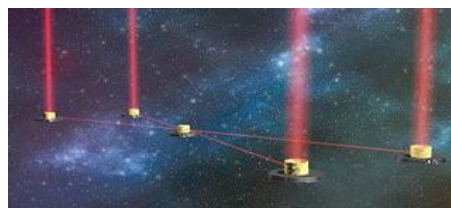
Sample Return from all across the Solar System (2024)



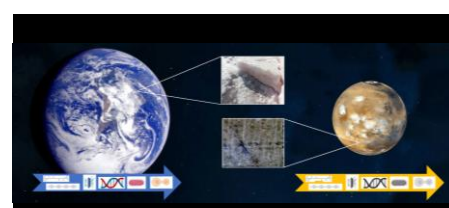
Blazing Paths to Observing Stellar and Exoplanet Particle Environments (2023)



Determining the Interior Structure of Uranus (2023)



Exploring Exoplanets with Interferometry (2022)



The Biology of Biosignature Detection (2023)



Enabling Fast Response Missions to NEOs, ISOs, and LPCs (2022)



Unlocking a New Era in Biodiversity Science: Linking Integrated Space Based and In-Situ Observations (2018)

STANDARDIZED SPACE TELESCOPES FOR THE FUTURE OF SCIENTIFIC DISCOVERY



1
Symposium



25
participants



13
organizations

Study Leads: Jason Rhodes (JPL) and Aaron Tohuvavohu (Caltech)

Participants: Spencer Anunsen (Cosmic Frontier), Jim Bell (Arizona State University), Richard Hedrick (PlaneWave Instrument), Shawn Higbee (LLNL), Sona Hosseini (JPL), Eric Huff (JPL), Kevin Iott (PlaneWave Instrument), Juna Kollmeier (Carnegie Science), Phil Larson (John Hopkins University APL), Charles Lawrence (JPL), Dave Levine (Cosmic Frontier), Creon Levit (Planet), Dimitri Mawet (Caltech), Jon Morse (BoldlyGo Enterprises LLC), Bala Ramamurthy, Susan Redmond (Caltech), Jason Rhodes (JPL), Diana Scognamiglio (JPL), Aaron Tohuvavohu (Caltech), Amy Trangsrud (JPL), Abhishek Tripathi (UC Berkeley), Sarah Tuttle (University of Washington), Dave Van Buren (JPL), Gautam Vasisht (JPL), Sam Waldman (Neutralino Space)



STANDARDIZED SPACE TELESCOPES FOR THE FUTURE OF SCIENTIFIC DISCOVERY

Symposium Objectives

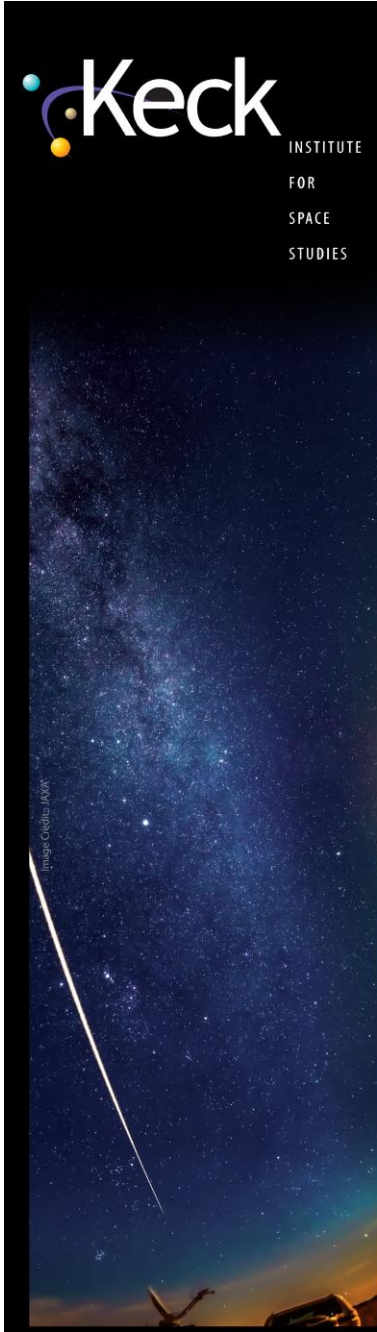
This KISS co-hosted Symposium is designed to break the conventional space telescope development paradigm by establishing a scalable, pathway to build and deploy a standardized platform for high-performance space telescopes—ensuring that cutting-edge, orbital-class observatories become accessible to a broader scientific community. The Symposium will focus on both the science goals enabled by this new approach of space telescope development, as well as addressing the engineering and execution required to realize this vision on orbit.

Key areas of focus include:

- **Designed-for-Manufacture Scientific Tools:** Developing instruments that are optimized for volume production without sacrificing performance.
- **Precision Optics in a new engineering paradigm:** Exploiting novel design approaches to achieve high-performance optical systems within relaxed size, weight, and power constraints.
- **High-Throughput Calibration and Qualification:** Establishing streamlined processes that ensure science-quality performance without the lengthy testing cycles of traditional methods.
- **Iterative Manufacturing and Low-Cost Satellite Approaches:** Pioneering production techniques that enable rapid build, test, and launch cycles.
- **Programmatic impact of abundant, low-cost, data and changes to the scientific ecosystem**
- This integrated effort will provide a clear execution pathway for producing a standardized, 1-meter class UVOIR telescope platform that not only meets current scientific needs but also serves as a testbed for future enhancements and larger systems.

Sponsored by Renaissance Philanthropy, this Symposium is part of a program to democratize access to tools for scientific discovery in space.

SAMPLE RETURN MISSIONS FROM SMALL BODIES – HAYABUSA, HAYABUSA2, AND BEYOND



Keck
INSTITUTE
FOR
SPACE
STUDIES

The Keck Institute for Space Studies
presents the following lecture:

Sample Return Missions from Small Bodies – *Hayabusa, Hayabusa2, and Beyond*

Dr. Shogo Tachibana
UTokyo Organization for Planetary and Space Science


Tuesday, February 25, 2025

4:30 PM Refreshments
5:00 PM Lecture

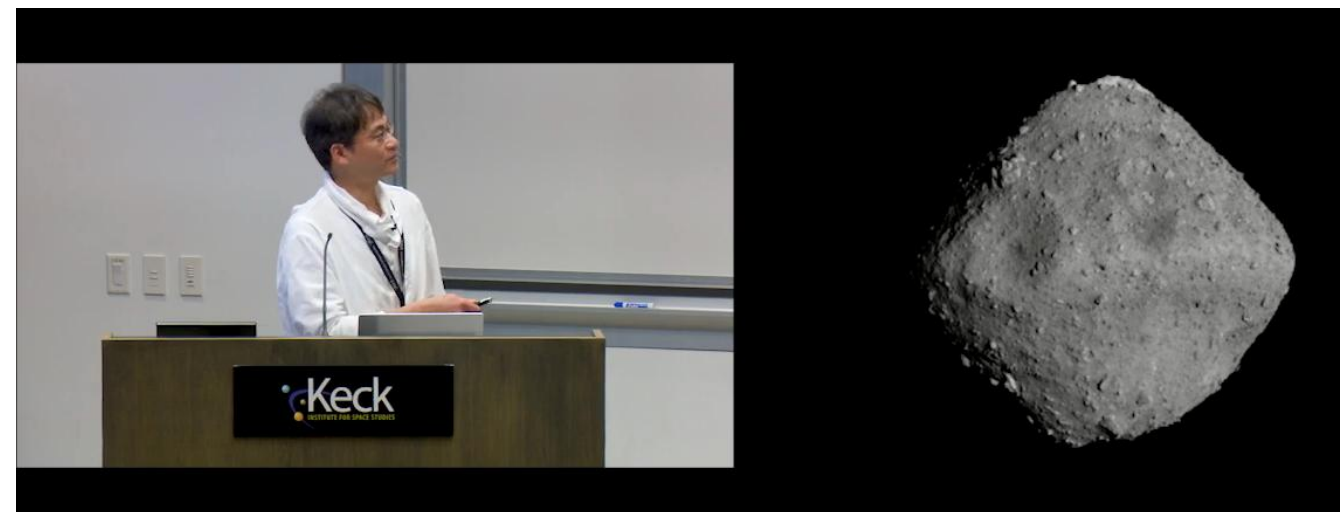
Hameetman Auditorium
California Institute of Technology

Small bodies such as asteroids and comets are believed to preserve records of the origin and early evolution of the Solar System. To demonstrate their significance, JAXA has conducted two asteroid sample return missions: the Hayabusa mission, which returned samples from the S-type asteroid Itokawa in 2010, and Hayabusa2, which delivered samples from the C-type asteroid Ryugu in 2020. In this talk, Shogo Tachibana will present the findings from these samples, compare them with those from the B-type asteroid Bennu brought back by NASA's OSIRIS-REx mission, and discuss the achievements of small-body sample return missions. He will also share expectations for future sample return missions.

Register here or on our
website: kiss.caltech.edu



Registration is required for this lecture as seating is limited.




Shogo Tachibana

Professor, UTokyo Organization for Planetary and Space Science

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WHAT MAKES A MODEL A DIGITAL TWIN? AN ATMOSPHERIC SCIENCE-BASED PERSPECTIVE



The Keck Institute for Space Studies presents the following lecture:

What Makes a Model a Digital Twin? – An Atmospheric Science-based Perspective

Dr. Dev Niyogi
The University of Texas at Austin


Wednesday, May 7, 2025
4:30 PM Refreshments
5:00 PM Lecture

Sharp Lecture Hall, Arms Building
California Institute of Technology

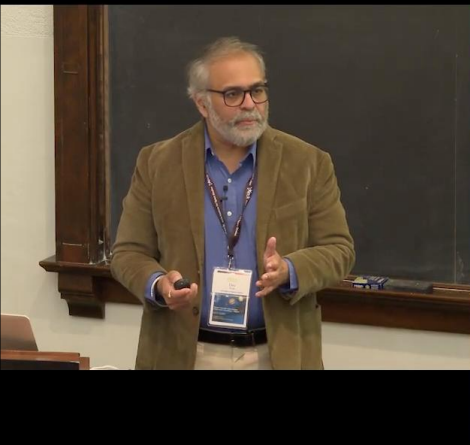
This presentation explores the evolution of digital twins from traditional modeling approaches. While models have long served as the backbone of knowledge representation and scenario development, digital twins have emerged as notable tools in the recent Artificial Intelligence/Machine Learning (AI/ML) era. Though conceptualized over three decades ago, the recent popularization of digital twins into prominence comes with hundreds of applications, accompanied by numerous definitions.

This talk examines a curiosity-driven question: What is the difference between a model and a digital twin? What are some of the characteristics or defining attributes of a digital twin? By analyzing their defining characteristics and applications, the talk will seek to explore this distinction. By virtue of the expertise and applications undertaken, the perspectives is grounded in atmospheric modeling and urban infrastructure applications, but it is suggested that the conclusions and perceptions transcend specific domains, offering generalizable principles applicable across disciplines.

Register here or on our website: kiss.caltech.edu



Registration is required for this lecture as seating is limited.



The University of Texas at Austin
Department of Earth and Planetary Sciences
Jackson School of Geosciences

WHAT MAKES A MODEL A DIGITAL TWIN?

(An Atmospheric Science based Perspective)

DEV NIYOGI
The University of Texas at Austin



MAY 07, 2025

Dev Niyogi

Professor and William Stamps Farish Chair, The University of Texas at Austin

This presentation explored the evolution of digital twins from traditional modeling approaches. While models have long served as the backbone of knowledge representation and scenario development, digital twins have emerged as notable tools in the recent Artificial Intelligence/Machine Learning (AI/ML) era. This talk examined a curiosity-driven question: What is the difference between a model and a digital twin? What are some of the characteristics or defining attributes of a digital twin? By analyzing their defining characteristics and applications, the talk will seek to explore this distinction.

UNSEEN BUT MEASURED: CARBON-I'S GLOBAL MAPPING OF TRACE GASES



The Keck Institute for Space Studies
presents the following lecture:

Unseen but Measured: *Carbon-I's Global Mapping of Trace Gases*

Prof. Christian Frankenberg
Carbon-I Principal Investigator
Caltech / JPL

Tuesday, July 22, 2025
4:30 PM Refreshments
5:00 PM Lecture

Sharp Lecture Hall, Arms Building
California Institute of Technology

NASA's Earth System Explorer (ESE) program was created to fly mid-class, PI-led Earth-science missions that address high-priority observables from the 2017 Decadal Survey. Four candidate missions—including Carbon-I—were selected in May 2024 for one-year Phase A concept studies under this call. NASA will evaluate the four studies and down-select to one or two winners that will proceed to full development.


Carbon-I will be the first mission to merge land-imaging spatial detail with high-resolution atmospheric spectra, yielding simultaneous views of the atmosphere and the underlying surface. Its ≤ 400 m global sampling—paired with a < 50 m Target Mode over 100×100 km scenes—lets the sensor “peek” through cloud gaps and deliver far more data in the humid tropics, where carbon fluxes, uncertainties, and natural feedbacks are largest.

Over its planned three-year mission, Carbon-I would create the first global maps of CH_4 , CO_2 , and CO at sub-kilometer scales, revealing both natural and human-driven emission processes and providing the observational foundation needed to close critical carbon-budget gaps. We will outline the mission concepts, how we got there and paths forward.

[Register here or on our website: kiss.caltech.edu](https://kiss.caltech.edu)



Registration is required for this lecture as seating is limited.










Christian Frankenberg
Carbon-I Principal Investigator

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THE CONTINUING LEGACY OF GALILEO AT 30



The Keck Institute for Space Studies presents:

The Continuing Legacy of Galileo at 30


Monday, December 8, 2025
4:30 PM Registration and Reception
5:00 PM Panel including audience Q&A
Chen 100 Lecture Hall
California Institute of Technology

The **Continuing Legacy of Galileo at 30** is a public panel event honoring the enduring legacy of NASA's Galileo mission to Jupiter. Sponsored by JPL and the Caltech Keck Institute for Space Studies, it will take place thirty years and one day after Galileo's historic orbit insertion. The panel will feature leading scientists whose discoveries with Galileo data revolutionized our understanding of Jupiter and its moons, as well as those leading the missions of the future that will stand on the shoulders of Galileo's success.

The panel includes:

- Erik Conway**, Purdue University, Historian of Science and Technology
- Bob Pappalardo**, JPL, Europa Clipper Project Scientist
- Rosaly Lopes**, JPL, Academic Engagement
- Elizabeth Turtle**, Johns Hopkins Applied Physics Laboratory, Dragonfly Principal Investigator, Europa Imaging System Principal Investigator
- Bill O'Neil**, Galileo Project Manager

The event will be held at the Chen 100 Lecture Hall, on the Caltech campus. Reservation is required but admission is free.

Registration is required: 

for more information go to:
www.kiss.caltech.edu



The Continuing Legacy of Galileo at 30 was a public panel event honoring the enduring legacy of NASA's Galileo mission to Jupiter, taking place thirty years and one day after Galileo's historic orbit insertion. The panel featured leading scientists whose discoveries with Galileo data revolutionized our understanding of Jupiter and its moons, as well as those leading the missions of the future that will stand on the shoulders of Galileo's success.

Environmental Impacts of Fires at the Wildland-Urban Interface

Webinar Recording, January 31, 2025

How do scientists measure air quality, and what do we know about the air in greater Los Angeles following the January fires? Experts from Caltech, the Jet Propulsion Laboratory (JPL), and the University of Colorado Boulder shared information about the environmental hazards of smoke, data collected since the January 2025 fires, and lessons learned from previous similar fires.

This event was hosted by the Caltech Science Exchange and co-sponsored by the Keck Institute for Space Studies, Resnick Sustainability Institute, and Linde Center for Global Environmental Sciences.



Ronald and Maxine Linde
Center for Global Environmental Science

Speakers

- **Joost de Gouw**, Professor of Chemistry, University of Colorado Boulder
- **Sina Hasheminassab**, Science System Engineer at JPL, specializing in air pollution monitoring & analysis
- **Haroula Baliaka**, Caltech graduate student in environmental science and engineering
- **Lauriane Quenee**, Caltech Senior Director for Environmental Health and Safety
- **Francois Tissot**, Professor of Geochemistry and Heritage Medical Research Institute Investigator, Caltech
- **Jessica Neu**, JPL Assistant Division Manager



**KISS Showcase and
Caltech-JPL Networking Mixer**
April 17, 2025

Caltech

Keck
INSTITUTE FOR SPACE STUDIES

JPL

CALTECH – JPL MIXER

This mixer was designed to bring together 140+ Campus faculty and JPL researchers who are interested in collaborating on topics of mutual interest. This event enabled Caltech faculty to interact with JPL researchers with the goal to build strong and diverse joint research programs in the fields of Earth and Space Science, and Technology.

The hope is that this networking mixer opens possibilities for joint research beginning with opportunities through the Keck Institute for Space Studies, the JPL Researchers On Campus (JROC), President's and Director's Research and Development Fund (PDRDF), the Brinson Exploration Hub, and other relevant programs.

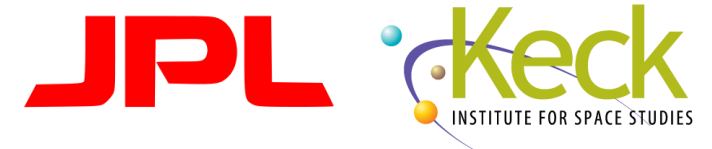
The reception was hosted by the JPL Office of Research and Development and the Keck Institute for Space Studies.

NASA SUMMER SCHOOL ON SATELLITE OBSERVATIONS AND CLIMATE MODELS



August 25 – 29, 2025

Each year, the JPL Center for Climate Sciences hosts a summer school at the Keck Center that brings together the next generation of climate scientists - about 30 graduate students and postdocs from around the world - to engage with premier climate scientists from the Jet Propulsion Laboratory and elsewhere. This yearly summer school focuses on topics on the leading edge of climate science research.



THE CONTINUING LEGACY OF GALILEO AT 30



The Galileo at 30 Celebration celebrated the legacy of NASA's Galileo mission to Jupiter. Sponsored by JPL and the Caltech Keck Institute for Space Studies, the event was held on December 8, 2025, marking 30 years + 1 day from the spacecraft's historic orbit insertion. The program featured invited talks from scientists whose groundbreaking discoveries with Galileo data transformed our understanding of Jupiter and its satellites and set the stage for future missions. The event was followed by an evening panel discussion for the public.

KISS AFFILIATE PROGRAM

Nominated by the Caltech faculty, KISS Affiliates are an ongoing cohort of Campus graduate students and postdocs who are seen as the next generation of space exploration leaders.

Many KISS Affiliates share that their interactions with the Institute and the people they meet through the Institute comprise some of their best experiences at Caltech.

KISS provides them unique experiences with industry CEOs, astronauts, space mission leaders, NASA leadership and world-renowned space exploration researchers.



2025 KISS AFFILIATES



William Feasey
EAS grad student



Kevin Gauld
EAS grad student



Satvik G. Kumar
EAS grad student



Anika Patel
PMA grad student



Yuri Tamana
GPS grad student



Jessica Todd
EAS postdoc



Tony Yap
GPS grad student

KISS AFFILIATE 2025 PROGRAM



***KISS Affiliates Welcome,
January***



***Dinner with Guest Speaker,
Dev Niyogi, May***



Pitch Practice Session, March



Yuri's Night, April



***Dinner with Guest Speaker,
Shogo Tachibana, February***



***KISS Fellows and Affiliates
Summer Mixer, August***



***Dinner with Guest Speaker,
Christian Frankenberg, July***



***Lunch with Sara Seager,
October***



Astrolab and SpaceX Tour, November

KISS TEAM



Bethany Ehlmann
Director
Departed 2025



Harriet Brettle
Executive Director



Janet Seid
Senior Program
Manager



Antonio Soriano
Events and Web
Content Coordinator



Patama Taweessup
Grants Manager



Jordan Patton
Event Assistant



Isabella Weggler
Event Assistant



Ruby Guan
Event Assistant

KISS STEERING COMMITTEE

The Steering Committee includes representatives from Caltech and JPL, providing guidance and expertise on KISS activities, including the technical review of KISS study programs.



Jack Beauchamp
Caltech



Becky Castano
JPL



Tom Cwik
JPL (outgoing)



George Djorgovski
Caltech



Charles Lawrence
JPL



Rosaly Lopes
JPL



Jonathan Lunine
JPL



Austin Minnich
Caltech



Jessica Neu
JPL



**Shouleh
Nikzad**
JPL (incoming)



Mark Simons
Caltech



Yuk Yung
Caltech

