PRESENTER ABSTRACTS

Brandon Chalifoux

Assistant Professor of Optical Sciences, James C. Wyant College of Optical Sciences

Figuring lightweight freeform mirrors with ultrafast laser-generated stress

Fabricating lightweight freeform mirrors for space applications is traditionally a time-consuming and expensive endeavor, which often drives decision making in space optical system design. I will present a novel technique, called Ultrafast Laser Stress Figuring (ULSF), that has potential to alleviate key bottlenecks in the process of fabricating lightweight freeform mirrors. I will describe the scientific basis of this technique, where it may help reduce cost and time for lightweight mirror fabrication, and share a selection of key recent results that demonstrate the efficacy and stability of ULSF.

Haeun Chung

Assistant Research Professor, Steward Observatory

MgnoLya: UV SmallSat Mission for Cultivating Our Understanding of the Galaxy-Halo Connection

MgnoLya is a UV SmallSat mission concept designed to map the circumgalactic medium (CGM), the massive reservoir of warm/cool gas that surrounds galaxies and regulates their evolution. While the baryon cycle of accretion and feedback governs galaxy growth, our understanding of the low-redshift CGM remains limited to sparse absorption-line sightlines. MgnoLya addresses this gap by performing the first simultaneous mapping of Lyman-alpha and Mg II emission in the halos of nearby star-forming spiral galaxies. By resolving the spatial and kinematic structure of this gas, the mission will reveal how matter and energy flow between galaxies and within the cosmic web, directly addressing the Astro2020 Decadal Survey priorities. The mission features a novel double-spectrograph payload optimized for high-sensitivity UV observations. This innovative optical design uses different grating orders to simultaneously capture astrophysical Lyman-alpha and Mg II, employing advanced spatial filtering to reduce geocoronal Lyman-alpha scattering by several orders of magnitude. Leveraging high-efficiency, low-scatter gratings and low-noise skipper CCDs, MgnoLya will reach unprecedented surface brightness limits. The University of Arizona will lead the spectrograph payload integration and mission operations.

Erica Corral

Director, Professor, Arizona Research Center for Hypersonics, Materials Science & Engineering Department, Aerospace & Mechanical Engineering Department

University of Arizona's Advancements in Thermal Protection Systems Materials for Aerospace and Defense

The University of Arizona stands as a global leader in the field of ultra-high temperature ceramic materials processing science, manufacturing, and high-temperature property measurement. This expertise is instrumental in comprehending the behavior of these materials under extreme aerothermal heating conditions. In 2008, the High Temperature Testing Laboratory (HTTL) Service Facility was established, directly benefiting technology and workforce transitions into the aerospace industry. This facility plays a crucial role in safeguarding our national security through space and exploration missions. A concise overview of the HTTL's capabilities and research highlights in the realm of thermal protection system materials will be presented.

Dani Mendoza DellaGuistina

Associate Professor, Lunar & Planetary Laboratory

From Asteroids to the Moon: New Insights from OSIRIS-REx/APEX and Artemis Lunar Seismology

Recent and upcoming NASA missions led by the University of Arizona are advancing a new era of in situ planetary science, linking laboratory analysis, spacecraft observations, and geophysical measurements to better understand the evolution and hazards of small bodies and planetary surfaces.

NASA's OSIRIS-REx mission has returned samples from asteroid Bennu, providing unprecedented insight into the composition and history of primitive solar system material. Building on this foundation, the OSIRIS-APEX mission will investigate asteroid (99942) Apophis during its close Earth encounter in 2029—an extraordinary opportunity to observe how tidal forces reshape an asteroid's surface, structure, and dynamical state in real time. These observations will directly inform models of asteroid evolution and planetary defense.

In parallel, the Lunar Environment Monitoring Station (LEMS), to be deployed during Artemis III, will deliver the first modern seismic measurements from the lunar south pole. Designed to operate in extreme environments, LEMS will characterize lunar seismicity, probe the Moon's interior, and assess hazards relevant to sustained human exploration.

Together, these efforts demonstrate the outstanding capability of the University of Arizona's spaceflight program and its leadership in advancing planetary science, exploration, and planetary defense.

Aaron Eden

Co-Founder, AI Trailblazers, AI Trailblazers

From Biosphere II to Space Settlement: Building Arizona's Aerospace Workforce Pipeline

The Space Settlement Design Competition (SSDC) turns high school students into rapid systems engineers, forcing real tradeoffs across structures, life support, power, transportation, and human factors. This panel shares what we are seeing in Arizona and the Southwest region: SSDC as a practical workforce pipeline for aerospace, advanced manufacturing, AI, and systems engineering. We will cover how the program is run, what students actually produce, what skills industry and universities can meaningfully support, and how partners can plug in without turning it into a sponsorship brochure. The 2026 Southwest SSDC takes place at UArizona's Biosphere II, where students design closed-loop habitats while surrounded by one of Earth's most ambitious sealed ecosystem experiments. Biosphere II's operational data on life support, atmospheric management, and waste recycling, along with its ongoing Mars Analogue research, give students real constraint data for the same engineering challenges the SSDC RFP demands: pressurized volumes, human factors in austere environments, and resource cycling without external disposal. Conversation and approach will include the deep collaboration between organizations (AI Trailblazers, SWSSD, SciTech Institute, Arizona Science Center, Center for the Future of Arizona, and UArizona Biosphere II). Suggested panelists include Ty White (Spaceset), Joseph Sepp Sprietsma (Center for the Future of Arizona), Dr. Thomas Wilson (SciTech Institute), and Aaron Eden (AI Trailblazers). Format: Panel, 45 to 60 minutes.

Julie Euber

CEO, SARSEF

Their Eyes on the Skies: What Kindergarten through High School Students Care about in Space

Since 1955, SARSEF Regional Science and Engineering Fair has showcased the work of Southern Arizona students researching subjects they care about. Research themes change based on pressing topics of day and reflect students' growing passions for STEM fields. Today, as interest in space exploration increases and milestones continue to be surpassed, a review of what students are exploring in space through their science projects could provide a window into what our youngest scientists and engineers are curious about in astronomy fields. The 2026 SARSEF Fair showcased the work of 6,271 Arizona students. The students' projects covered a diversity of topics, from the social sciences to environmental studies to physics and astronomy. In this presentation, we will review trends across the space-related science and engineering projects by students from kindergarten through high school who entered the 2026 SARSEF Fair. We will look at the distribution of space-related projects by grade level, demographics, school location, and school type (Title I, charter, etc.), what sparked their interest in the project, what support or mentorship they sought out, and what specific topics they researched. Suggestions will be offered as to what might spark the most public interest based on student project trends, from what's most popular to what isn't showing up on the science fair project floor, suggesting that the topics feel inaccessible or are unknown to a broader audience.

Andrew Gardner

R&D Software Engineer V, Lunar and Planetary Laboratory

Software for Mission Operations at ASI

ASI's Multi-Mission Operations Center builds on the University of Arizona's decades of space mission operations experience. We partner with instrument and spacecraft teams to provide world-class mission operations and data management services to Pioneer-class missions.â€‹ We will provide detail about the software we have developed to simplify mission operations, as well as an update on our commissioning of our first spacecraft. Co-presenter is Josh Kantargres.

Arie Herrera

Undergraduate Student, School of Mining Engineering and Mineral Resources

A Fuzzy Logic Approach to Determine a Crater Mining Sequence for Icy Regolith Extraction In The Lunar South Pole

The south pole of the Moon is an attractive target for water extraction due to the proven abundance of icy regolith within craters located in permanently shadowed regions. Developing an effective mining plan for this environment requires optimizing the extraction sequence under extreme operational constraints. This work applies fuzzy logic to prioritize crater excavation based on key variables, including haul-road slope and length, material selection according to water content, and proximity to equipment recharging points. The approach also accounts for a six-month daylight cycle at the lunar south pole, with the goal of maximizing productivity while minimizing operational costs.

Jaclyn John

PhD Candidate, James C. Wyant College of Optical Sciences

Channeled Infrared Polarimeter for Probing Ice Clouds

Upper-tropospheric ice clouds remain one of the largest sources of uncertainty in modeling Earth's radiation budget. Long-wave infrared polarimetry is expected to be particularly sensitive to the microphysical properties of small ice crystals. The Channeled Infrared Polarimeter (CHIRP) is currently in development under a NASA ESTO IIP for the purpose of measuring ice clouds with a 1 K polarimetric resolution for 200 K cloud tops. Channeled polarimeters employ three major steps to produce a polarization-modulated signal with a wavelength-dependent carrier frequency on the focal plane. Enabling technologies of CHIRP include a meta-surface polarization grating (MPG). The MPG combines a diffraction grating and beam-splitting polarization analyzer into one optical component, which is expected to simplify calibration and improve performance compared to a legacy IIP polarimeter. A benchtop demonstration of CHIRP's instrument concept will be shown, as well as plans to further advance CHIRP's TRL for the ultimate goal of flight readiness.

Jarron Leisenring

Associate Astronomer, Steward Observatory

CCD and CMOS Sensor Manufacturing at UA's Imaging Technology Lab

For over 25 years, the Imaging Technology Laboratory (ITL; https://itl.arizona.edu) has dedicated itself to advancing scientific sensors critical to driving breakthroughs in our understanding of the cosmos. Originally formed to optimize processes for backside illumination, ITL has pioneered improvements in quantum efficiency, wavelength coverage, and reliability to meet the demanding observational requirements for astronomy, planetary science, and Earth-observing missions. ITL has developed unique and world-class capabilities in sensor manufacturing, semiconductor back-end processing, 3D heterogenous integration, and sensor characterization. Core capabilities include device hybridization / flip-chip bonding, silicon wet etching, thin film deposition, packaging, wire bonding, surface metrology, and cryogenic characterization to optimize the performance of backside illuminated sensors. ITL has delivered over 4,000 sensors and fully integrated instruments to the worldwide scientific and commercial imaging communities. They are used in astronomy, Earth observing, semiconductor industry, high energy physics, and many other applications. For example, ITL sensors recently started producing results for two major ground-based projects contributing to our understanding of the nature of dark matter and dark energy and their role in the evolution of the Universe. The Vera C. Rubin Observatory will continuously scan the sky over the next 10 years with its LSST camera, the world's largest digital camera at 3.2 gigapixels. The Dark Energy Spectroscopic Instrument (DESI) is measuring the spectra of millions of galaxies and quasars. ITL provided about half of the scientific sensors for each of these projects, enabling both observatories to map large scale structures of the Universe with unprecedented precision Located in the Applied Research Building at the University of Arizona, ITL is operated by Steward Observatory and is affiliated with the Center for Semiconductor Manufacturing.

Pranav Nair

Research Intern, School of Mining and Mineral Resources

Surface Power Generation for Effective Sustainability on the Moon

Power infrastructure is an incredibly important aspect of Lunar development, setting the foundation for exploration, colonization, and mining operations on the Moon. As NASA prepares to launch the next steps of the Artemis Program, greater emphasis will be placed on how power will be generated, managed, and distributed to all constituents, such as robotics, habitats, and mining operations. This presentation explores the different generation architectures for sustainable energy to facilitate activities on the Moon An effective way to generate power is to use a hybrid mix of a wide range of technologies with fail-safes and redundancies built in. Solar and Fission Surface Power systems are the two leading technologies that are capable of delivering high performance and reliability for Lunar sustainability, especially through the dark periods of Lunar night. Photovoltaic Solar Arrays are lightweight and easy to deploy. These structures are scalable to be able to generate continuous power for the 14 days of light on the South Pole of the Moon, especially in areas of high illumination. Fission Surface Power (FSP), such as Kilopower, can provide high outputs of power to sustain all activities even through periods of eternal darkness and in permanently shadowed regions on the Moon. A complex architecture, considering the strengths of both these technologies, will be able to support the mission to create a permanent settlement on the Moon. The energy facilities can be constructed using the materials found on the Moon, leveraged through In-Situ Resource Utilization (ISRU). This will greatly reduce the amount of cargo and trips needed from Earth to the Moon, and therefore will decrease costs.

Brock Parker

Graduate Student, Steward Observatory/Department of Astronomy

Read Noise Characterization and Optimization of Skipper CCDs Using Multiple Readout Electronics

In the ultraviolet (UV), detector read noise often dominates the scarce few photons received from ultra-faint, diffuse sources. CCDs with high quantum efficiencies and sub-electron read noise are essential for observations of the UV universe. Skipper CCDs achieve photon-counting resolution by implementing multiple non-destructive readouts of the charge in each pixel, beating down the read noise. Our lab has developed a vacuum UV characterization setup for Skipper CCDs, including read noise, dark current, quantum efficiency, and gain. We present the read noise of two 1278x1058 Skipper CCDs developed for the OSCURA mission. We compare the single-sample and multiple-sample read noise achieved with two different controllers: the Low Threshold Acquisition Controller (LTA) developed by Fermilab and an Archon controller developed by STA. We also discuss the differences and uniformity of several different LTAs for both detectors. We verify theoretical readout noise reduction through non-destructive readouts, finding good agreement to deep sub-electron levels. Using both sets of readout electronics, we perform readout sequence optimization, improving readout time to acceptable duty cycles for astronomy, while still achieving sub-electron noise. Through this optimization, we present read noise curves, detailing acceptable operating regimes and parameters.

Federico Pederson

PhD Student, Department of Material Science and Engineering

Characterization of Sulfur - Regolith Composites in Lunar & Martian Construction

The concept of a permanent human presence on the lunar surface has been under investigation across the scientific community following the re-definition of NASA's Artemis missions for manned lunar exploration and the Artemis base camp concept. A critical challenge facing these plans is determining the mechanisms for constructing large scale structures in a cost effective and sustainable way. The focus of this presentation is to shine light on the development and characterization of cast sulfur regolith composites as a potential construction material for the lunar environment. Additionally, a brief description on how sulfur cement can be paired with large-scale 3D printing for lunar settings will be included to show how this material would be used in field. Sulfur concretes have been a niche alternative for ordinary Portland cements since the early 1900's and are formed by mixing molten elemental sulfur, aggregates, and other additives. The research presented will cover how variations in the heating and cooling rates during the casting process affect the microstructure and phases present in the final sulfur composite. The micro-characterization portion of this study utilizes X-ray diffraction, Raman spectroscopy, and scanning electron microscopy to construct a multiscale view of the sulfur when cast in variable heating profiles. The goal for characterizing the casting processes for sulfur cement, is to provide mission planers with a complete understanding on how to best implement this material and what niche it can fill in space construction.

Walter Rahmer

Optical Sciences PhD Student, CatSat Flight Director, Steward Observatory

CatSat Spacecraft and Mission Update

CatSat is a 6U CubeSat designed and built primarily by students at the University of Arizona in partnership with Tucson companies. The primary goals of the spacecraft were to measure the free electron density in the ionosphere through high-frequency (HF) sounding and demonstrate a novel inflatable antenna technology for future space missions. Following launch on July 3rd, 2024, the student team navigated numerous challenges and moved through all major sections of the original mission plan. The spacecraft continues to operate after nearly two years in orbit, far beyond its expected lifetime. In this extended period, the focus of the mission has shifted to center on developing student experience and leveraging the onboard radio functions to provide a service to the amateur radio community.

Joseph Shields

Director, Large Binocular Telescope Observatory

New Science Opportunities at the Large Binocular Telescope

The Large Binocular Telescope provides University of Arizona scientists with access to one of the most powerful optical/infrared telescopes in the world. The LBT has a versatile complement of instruments supporting a wide range of science. This presentation will focus on recent and ongoing upgrades that enhance the LBT's capabilities for study of solar system objects and extrasolar planets. New instrumentation is opening expanded opportunities for high angular resolution imaging, and high precision radial velocity measurements.

Sarah Sutton

Photogrammetry Program Lead, R&D Engineer/Scientist, Lunar and Planetary Laboratory

EMission Imager for Lunar Infrared Analysis in 3D (EMILIA-3D), a selected payload for a commercial lunar lander

The Emission Imager for Lunar Infrared Analysis in 3D (EMILIA-3D) consists of a thermal imager to measure scene temperature and a visible-wavelength stereo camera to create 3D reconstructions of the terrain. The combined thermal and stereo images, taken throughout the lunar day, will provide an unprecedented understanding of the thermal emission phase function of the upper lunar regolith. The results of this experiment will support the interpretation of orbital thermal imaging and provide crucial input to models of the evolution of volatiles at the lunar surface. EMILIA-3D is one of three instruments recently selected for NASA's Payloads and Research Investigations on the Surface of the Moon: Stand-Alone Landing Site-Agnostic (PRISM-SALSA) program. This proposal was supported by UASI.

Victor Tenorio

Professor of Practice, School of Mining Engineering and Mineral Resources

Mine Planning and Production Performance for Icy Regolith Extraction from Selected Craters of the Shackleton de Gerlache Ridge, "The permanently shadowed craters of the Shackleton de Gerlache Ridge near the lunar south pole are among the highest alue targets for icy regolith extraction in support of sustained lunar exploration and in-situ resource utilization. This study presents an evaluation of selected crater floors from a mining perspective, explicitly linking geomorphic conditions to practical mine planning and production performance. Feasible extraction scenarios from crater bottoms are examined under realistic operational constraints, including variable illumination, crater slope, equipment mobility, power availability, and logistical considerations. Production rates are estimated by surface slopes, and haul distances required for equipment recharging, capturing the operational challenges associated with extreme temperature and limited or absent solar exposure. Two power architectures are assessed: solar power systems deployed on intermittently illuminated terrain and fusion-based systems capable of providing continuous power, allowing comparison of duty cycles, system resilience, and achievable production. Representative mine plans are developed for six-month operational periods consistent with crew rotation, maintenance requirements, and expected mechanical and electrical availability. Results show that mining viability is governed primarily by equipment performance, power reliability, and the synchronization of operational cycles, rather than geomorphic variability alone."

Carlos Vargas

Assistant Professor & Assistant Astronomer, Department of Astronomy & Steward Observatory

NASA's Aspera Mission Status Update

Aspera is a space mission funded in the NASA Astrophysics Pioneers Program, and the first NASA mission ever to be entirely led and managed by the University of Arizona. Aspera uses a far-ultraviolet space telescope to map the 'missing' gas surrounding galaxies for the first time. The mission has a planned launch date early in 2027 in partnership with Rocket Lab. In this talk, I will provide a brief update on the integration and testing of the Aspera instrument at the University of Arizona.

Hao Xin

Professor of Electrical and Computer Engineering, Professor of Physics, Electrical and Computer Engineering Dept.

Luneburg Lens Enabled Active and Passive RF Sensors for Autonomous Space Domain Awareness

This talk presents two Luneburg lens-enabled RF sensors that apply the unique wide-angle, broadband properties of Luneburg apertures to modern Space Domain Awareness (SDA) needs. The first sensor is an active Luneburg lens radar designed for orbital debris detection, offering multi-beam capability without mechanical steering and enabling compact, low-cost apertures suitable for spaceborne platforms. Its configurable radar modes provide precise range and Doppler measurements to support small debris tracking and characterization. The second sensor is a passive Luneburg lens RF receiver developed for space-related signals intelligence (SIGINT). Its multi-directional, multi-band reception enables autonomous detection and analysis of RF emissions from spaceborne or reflected sources, supporting emitter identification, spectral characterization, and anomalous activity monitoring with minimal power requirements.

Xubin Zeng

Professor, Department of Hydrology and Atmospheric Sciences

SmallSat Snow Lidar with onboard quantum computing

Motivation: Snow depth and snow water equivalent (SWE) are one of the most important observables from the 2017 Earth Science Decadal Survey; Quantum is one of the top national priorities; AI is another top national priority. Objective: Develop a Smallsat snow mission with a CubeSat-sized lidar and onboard quantum computing; Use the accurate measurements (along a line) of lidar snow depth and SWE to train passive remote sensing measurements with wide swaths through AI and physically based approach. Readiness: We have made significant progress in relevant scientific readiness, tech readiness, and programmatic preparation Current strategy: engage with NASA earth science and chief technologist office and with Space Force for further maturation of science and technology; work closely with our NASA and private sector partners; seek a pathfinder mission and compete for mission opportunities.