SSERVI

NASA's Solar System Exploration Research Virtual Institute (SSERVI)

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NASA's Intent for SSERVI

SSERVI was created as an expansion of the NASA Lunar Science Institute's scope to include not just the Moon but all potential near-term human destinations (Moon, NEAs, Phobos/Deimos).

This institute was created to further the goals of science and exploration by addressing fundamental and applied science questions and human spaceflight concerns, i.e., to bring science to bear on issues related to potential targets for human exploration.

- Science which enables human exploration
- Science enabled by human exploration

The expansion of SSERVI was the most effective method of integrating science (SMD) and exploration (HEOMD) research goals.

What is a Virtual Institute?

- A virtual, distributed organization effectively integrates interdisciplinary research from institutions and universities across the country and around the world to solve complex, multi-disciplinary problems.
- Eliminates geographical constraints, enabling selection of the best investigations, teams and resources to address NASA's current goals, regardless of where team members or infrastructure are located.
- Cooperative agreement notices (issued every 2-3 years) for long duration awards (5 yrs) provide continuity and overlap between institute teams.
- Virtual technology and communication tools enhance team research.
- By sharing students, facilities and resources, and by reducing travel, the virtual institute model increases cost effectiveness while creating new interdisciplinary research opportunities between disparate teams.

Collaborative Nature of Virtual Institutes

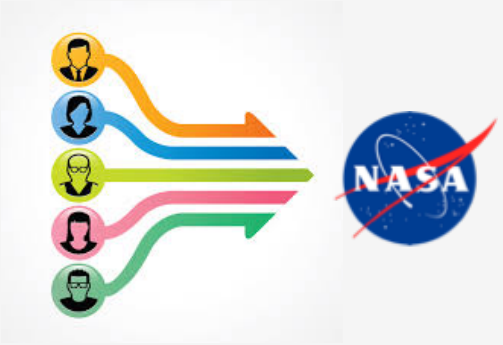
- Teams that were competitive are now expected to collaborate in order to reveal new knowledge at intersections between fields of expertise which otherwise would not have crossed
- This translates into data and facilities sharing, which may hasten scientific discovery, while creating cross-disciplinary exchanges and teaming arrangements that otherwise would not have existed
- By sharing students, facilities and resources, the virtual institute model also reduces cost, providing more bang for the buck
- The long-duration funding of teams enables accelerated results and research continuity
- Teams are expected to participate in virtual and in-person Executive Council meetings, Exploration Science Forum, other team site visits, Director's Seminars at NASA HQ, SSERVI-related workshops, and special sessions at major conferences

SSERVI Mission

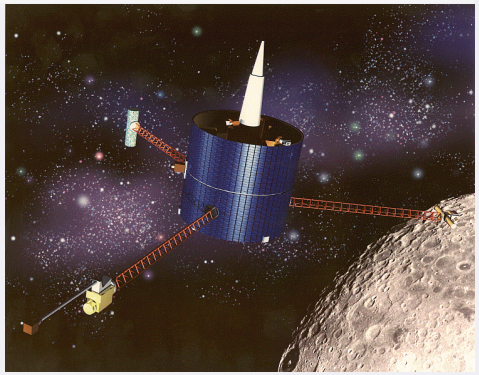
SSERVI fosters collaborations within and among competitively selected domestic teams, the broader exploration science community, and multiple international partners in order to:

1. Advance human exploration of the solar system through scientific discovery

2. Conduct cross-disciplinary research between the science and exploration communities



3. Provide scientific, technical, and mission-defining analyses for relevant NASA programs, planning, and space missions as requested by NASA



4. Explore innovative ways of using information technology for scientific collaboration and information dissemination across geographic boundaries

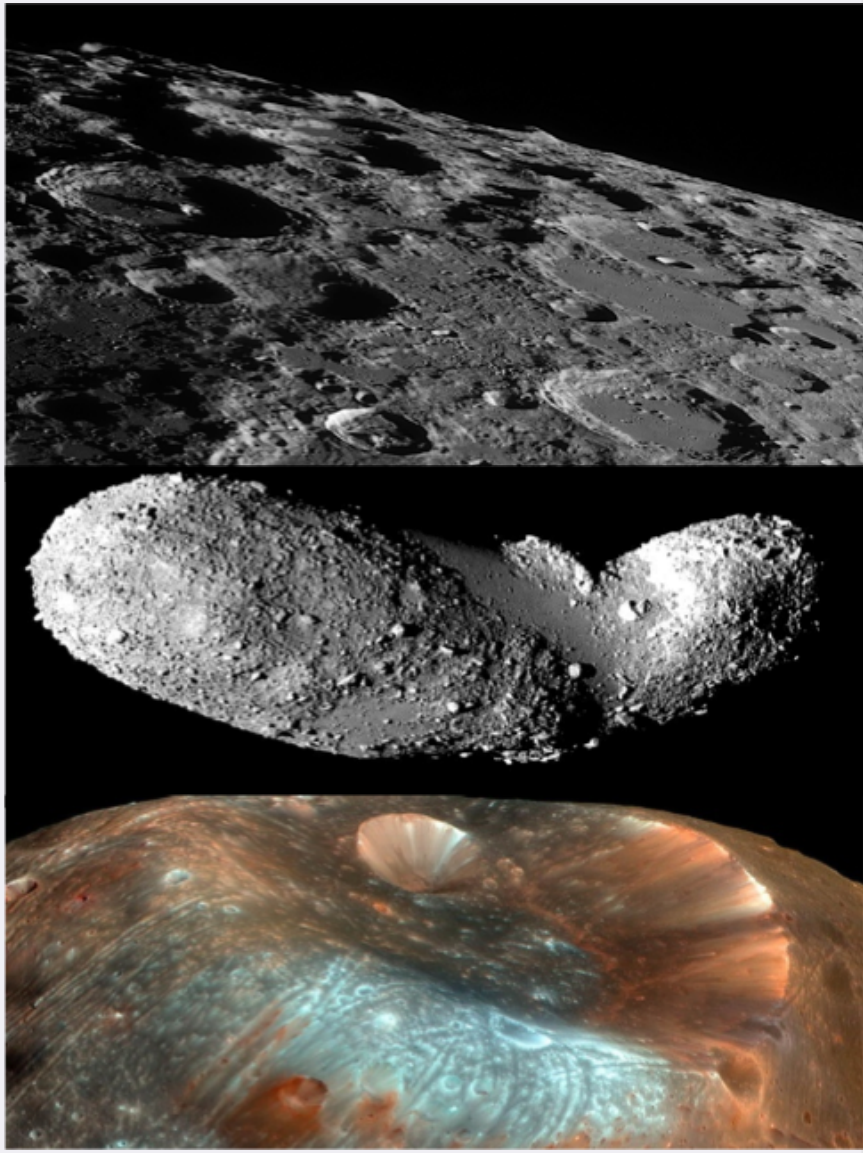
5. Train the next generation of explorers and encourage global public engagement

SSERVI Science and Exploration Research

SSERVI is a virtual institute established to advance basic and applied lunar and planetary science research and to advance human exploration of the solar system through scientific discovery. Focus areas include:

- The Moon, Near Earth Asteroids (NEAs), Phobos & Deimos
- Origin and evolution of the inner Solar System
- Planetary differentiation processes
- Potential human destinations
- Structure and composition
- Regolith, dust and plasma interactions
- Volatiles and other potential resources

sservi.nasa.gov



SSERVI Teams

Thirteen Overlapping Teams: Nine Funded in March 2014, Four Funded in June 2017, Each for Five Years.

Collaboration within this organizational framework has yielded impressive results!

- *112 refereed journal articles in 2016*
- *494+ publications since SSERVI started 3 yrs ago*
- *Many additional conference publications and other scientific products*

Bill Bottke, *Southwest Research Institute*
Institute for the Science of Exploration Targets: Origin, Evolution and Discovery (ISET)

Dan Britt, *University of Central Florida*
Center for Lunar and Asteroid Surface Science (CLASS)

Jack Burns, *University of Colorado*
Network for Exploration and Space Science (NESS)

Bill Farrell, *Goddard Space Flight Center*
Dynamic Response of Environments at Asteroids, the Moon, and moons of Mars (DREAM2)

Tim Glotch, *Stony Brook University*
Remote, In Situ and Synchrotron Studies for Science and Exploration (RIS^{4}E)

Jennifer Heldmann, *Ames Research Center*
Field Investigations to Enable Solar System Science & Exploration (FINESSE)

Amanda Hendrix, *Planetary Science Institute*
Toolbox for Research and Exploration (TREX)

Mihaly Horanyi, *University of Colorado*
Institute for Modeling Plasma, Atmospheres and Cosmic Dust (IMPACT)

David Kring, *Lunar and Planetary Institute*
Inner Solar System Impact Processes

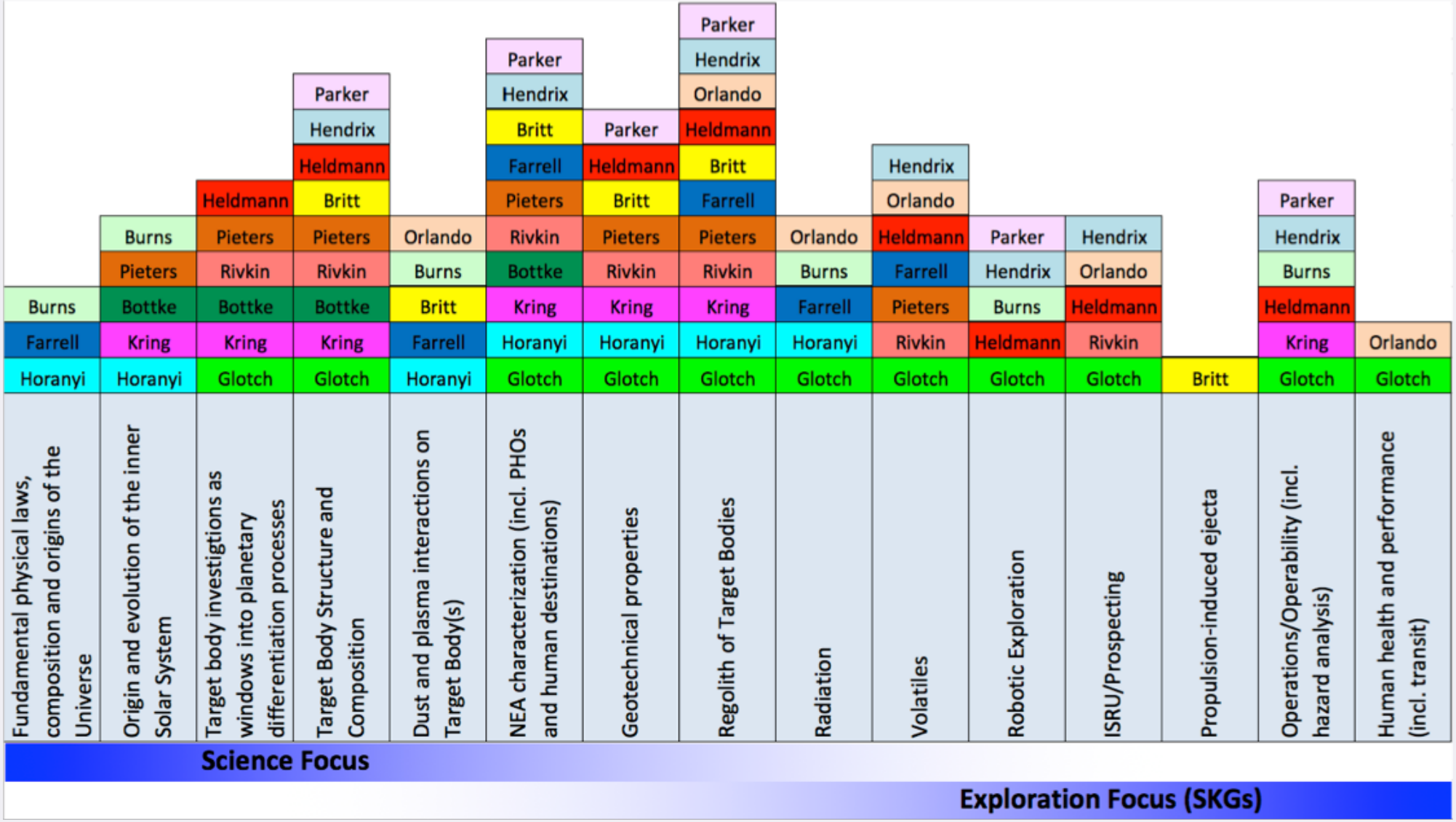
Thomas Orlando, *Georgia Tech*
Radiation Effects on Volatiles and Exploration of Asteroids & Lunar Surfaces (REVEALS)

Alex Parker, *Southwest Research Institute*
Exploration Science Pathfinder Research for Enhancing SS Observations (ESPRESSO)

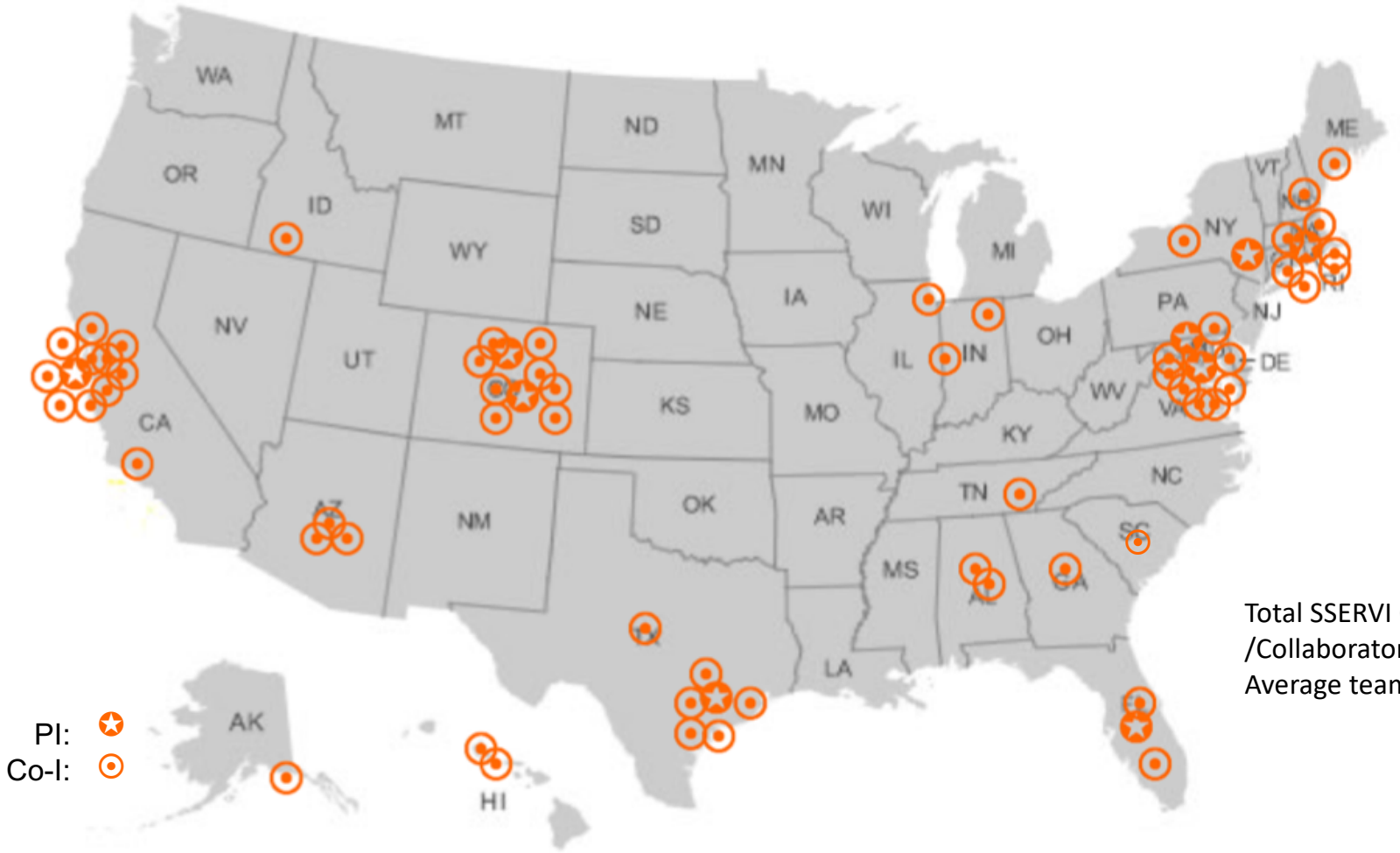
Carle Pieters, *Brown University*
Evolution and Environment of Exploration Destinations: Science and Engineering Synergism (SEEED)

Andy Rivkin, *Applied Physics Lab, Johns Hopkins University*
Volatiles, Regolith and Thermal Investigations Consortium For Exploration and Science (VORTICES)

Science/Exploration Balance in SSERVI Teams

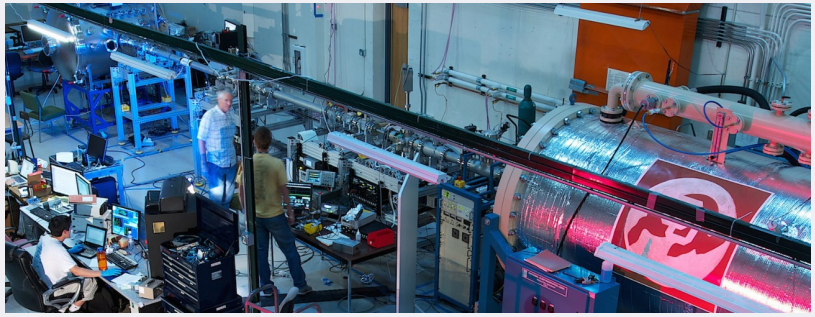


PI/Co-I Geographic Distribution



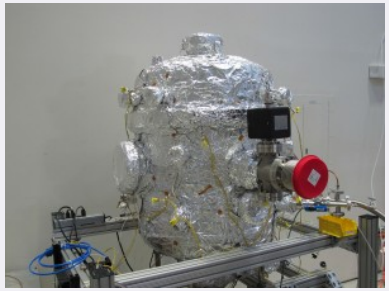
Total SSERVI Co-Is /Collaborators: 318
Average team size ~30

Shared Facilities (Open to Community)



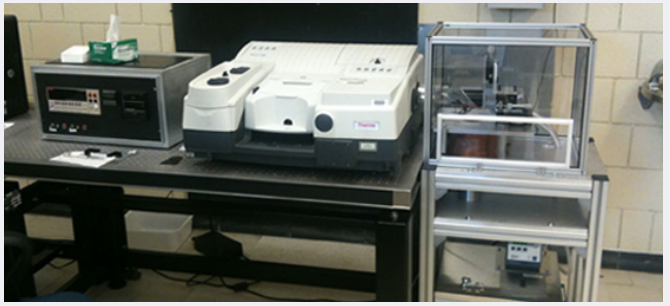
Dust Accelerator Lab at University of Colorado
A 3 MV linear electrostatic dust accelerator which is used for a variety of impact research activities as well as calibrating dust instruments fro space application. The 3 MV Pelletron generator is capable of accelerating micron and submicron particles of various materials to velocities approaching 100 km/s.

For more info see: http://impact.colorado.edu/facilities.html



Ultra High Vacuum Chamber (UHV) & Ice and Gas Target Chambers at U. Colorado
Dedicated chambers that can be directly connected to the DAL for impact experiments requiring very clean conditions with exceptionally low background gas pressure, extreme cold temps, or various atmospheric gas pressures.

For more info see: http://impact.colorado.edu/facilities.html



Vibrational Spectroscopy Lab at Stony Brook University
Spectroscopic tools allow examination of geologic materials similar to those that are present on Mars, the Moon, or other solar system bodies for better interpretations of remote sensing data.

For more info see: http://aram.ess.sunysb.edu/tglotch/

Reflectance Experiment Laboratory
RELAB

Reflectance Experiment Lab at Brown University
Spectroscopic data for compositional information about unexplored or unsampled planetary surfaces. Can obtain high precision, high spectral resolution, bidirectional reflectance spectra of earth and planetary materials.

For more info see:
http://www.planetary.brown.edu/relab/

Shared Facilities (Open to Community)

Physical Properties Lab (U. Central Florida)
The fully equipped density laboratory at the University of Central Florida includes: (1) A Quantachrome Ultrapycnometer 1200 with sample chambers of 10, 50, and 135 cm3. (2) A new custom-built pycnometer for much larger samples with sample chambers of 163, 405, and 1030 cm3. In addition, this instrument has a special insert for thin slabs (up to ¼ in. thick) with an effective volume 86 cm3. (3) ZH Instruments SM-30 magnetic susceptibility meter. (4) A fieldspec reflectance spectrometer with a wavelength range of 0.4-2.5 microns.

For more info, contact britt@physics.ucf.edu

GSFC Radiation Facility (NASA GSFC)
A new dedicated 1 MeV proton beam line used to create radiation-stimulated defects in materials to help determine low energy H retention effects.

For more info, contact william.m.farrell@nasa.gov

Microgravity Drop Tower
The drop tower provides a zero g experience with a high speed camera set up to fall along with the experiment (allows 0.7sec of freefall). An LED backlight makes it easy to track individual ejecta particles. Images are recorded with a high-resolution camera at 500 frames/second, which allows tracking of individual particles.

For more info, contact josh@ucf.edu

Regolith Testbeds at NASA's Ames and Kennedy Space Center
The 4m x 4m x 0.5m testbed at NASA Ames is filled with 8 tons of JSC-1A regolith simulant. The Swamp Works Regolith Bins at KSC are a 120 ton bin with BP-1 and ~4 ton bin of JSC-1A — both excellent for investigations in resource prospecting and regolith.

For more info contact joseph.minafra@nasa.gov

The Solar System Treks Portal (SSTP)

SSERVI and the Jet Propulsion Laboratory's Solar System Treks Portal is a free, web-based application that provides high-quality, detailed visualizations of planetary bodies using real data from 50 years of NASA exploration.

https://moontrek.jpl.nasa.gov
https://marstrek.jpl.nasa.gov
https://vestatrek.jpl.nasa.gov

The Trek Suite allows astronomers, citizen scientists and students to study a wide range of features on several planetary bodies.

Bridging Science and Exploration Communities

The Exploration Science Forum (ESF) consists of scientific sessions, poster sessions, student lightning round talks, and award ceremonies

- An in-person conference with virtual component
- Held each summer at NASA Ames Research Center, Mountain View, California
- June 26-28, 2018
- All past Forum recordings are available on sservi.nasa.gov

Community Support and Leadership

- **SSERVI** hosted and Co-chaired "Lunar Science for Landed Missions" Workshop requested by SMD.
- **SSERVI** teams wrote a white paper on Transformative Lunar Science requested by SMD AA.
- **SSERVI** hosts numerous community workshops
  - Ex. "Carbon in the Solar System" workshop planned for April 2018
- Provide scientific input and virtual meeting support for Global Exploration Roadmap (**GER**) and Science White Paper (SWP).
- **SSERVI** staff serve active roles in LEAG & SBAG (Executive/Steering Committees)
- **SSERVI** continues **Focus Groups** to bring together communities to share science and exploration strategies
  - As an example, the ALSEP Focus Group has brought back data previously thought lost.
- **NASA Postdoctoral Program (NPP),** with postdocs shared between teams to facilitate inter-team collaborations.