WORKINGS: PRINT ONLY

Abshire J. B. Guzewich S. D. Smith M. D. Riris H. Allan G. R.
Observations of Planetary Atmospheric Winds and Gases with Lidar **[#8102]**
Orbiting lidar is capable of retrieving vertically-resolved measurements of atmospheric winds and trace gases and address high-priority science questions about atmospheric processes and surface-atmosphere exchange.

Adams D. Hibbard K. McGee T.
Real-Time In Situ Landing Site Assessment **[#8248]**
Landing spacecraft on other objects in the solar system provides a unique opportunity to make direct *in situ* science measurements, but extraterrestrial environments create unique challenges for the design and testing of the system.

Brown A. J. Michaels T. Fenton L. Hayne P. O. Piqueux S. Titus T. N. Wolff M. J. Clancy R. T. Videen G. Sun W. Haberle R. Colaprete A. Richardson M. I. Byrne S. Dissly R. Beck S. Grund C.
Detection and Quantification of Volatiles at Mars Using a Multispectral LIDAR **[#8038]**
We present a concept for using a polarization sensitive multispectral active lidar system to map the seasonal distribution and exchange of icy volatiles among the reservoirs of the Martian surface and atmosphere.

Byrne P. K.
Leveraging the Strength of Comparative Planetary Geology in the Coming Decades **[#8179]**
Comparing other planets with Earth and one another is a potent tool for understanding the solar system. As the pace of scientific discoveries increases through 2050, it becomes ever more important to leverage the strength of comparative planetology.

Bérczi Sz.
Planning Science Experiments According to the Multihierarchical Structural System of Planetary Objects **[#8003]**
The Multihierarchical Structural System of Planetary Objects is a synchronous view of materials to be measured, technologies, research activities arranged by structural hierarchy of the matter: giving benefits for both scientists and engineers.

Calvin W. M.
Mars 2050: Air Vehicles and Extreme Environments **[#8109]**
Technologies that lead to the development of air vehicles for Mars and deep drilling or rover access to the martian poles will enable pioneering exploration and science of the planet while also benefiting outer planet and ocean world missions.

Clarke J. T.
The Importance of UV/Visible Space-Based Telescopic Observations for Planetary Science **[#8176]**
First rate science has repeatedly resulted from HST observations of solar system objects. This overview of the science goals and outcomes of some of these programs will illustrate the importance of combined telescopic and *in situ* measurements.

Conrad A. R.
The Role of Earth-Based Observatories for Solar System Science in 2050 **[#8195]**
In 34 years 50+ meter ground-based telescopes and 10+ meter telescopes in near-Earth space will be available. We will discuss the potential use of these facilities, in conjunction with spacecraft probes, and how they will be used for planetary science.

Cook A. M. Colaprete A. Mauro D. Stupl J. Nguyen A. N. Kahre M. A. Haberle R. M. Dono Perez A. Uribe E. A. Bonner K. D. Weston S. V.
Aeolus: A Mission to Observe the Thermal and Wind Environment of Mars **[#8157]**
Aeolus is a mission concept to observe the thermal and wind environment of Mars, by measuring surface temperatures and Doppler shifts in atmospheric spectral lines.

Cooper J. F.
2050 Centenarian Retrospective on Space Environment Interactions and Processes of the Saturn Ring and Moon System **[#8095]**
This centenarian retrospective imagines 2050 progress that would have been made on understanding of the Saturn system's space environment and how the principal elements of the system interact through that environment as driven by external influences.

Diniega S. Zurek R.
Paradigm Shifts Towards Understanding the Full Story of Mars, a Possible Future **[#8086]**
A new phase of Mars and planetary science exploration has opened that studies Mars through a holistic lens. We describe the advances needed for achieving this future: in measurement characteristic and type; in technology and access; and in model development.

Duncan M. S. Weller M. B.
Determining Planetary Tectonic State Through Time Using Observations of the Terrestrial Planets **[#8222]**
Comparing planets / Informs evolution path / But need right data.

Ebert R. W. Allegrini F. Bagenal F. Beebe C. Desai M. I. George D. Hanley J. Murphy N. Wolf A.
JUpiter MagnetosPheric boundary ExploreR (JUMPER) **[#8097]**
The JUMPER SmallSat explores Jupiter's magnetospheric boundaries and images its energetic neutral atom emissions. It focuses on how the solar wind interacts with and the contribution of neutral atoms to mass loss from Jupiter's space environment.

Elder C. M. Bramson A. M. Blum L. W. Chilton H. T. Chopra A. Chu C. Das A. Davis A. Delgado A. Fulton J. Jozwiak L. Khayat A. Landis M. E. Molaro J. L. Slipski M. Valencia S. Watkins J. Young C. L. Budney C. J. Mitchell K. L.
New Frontiers-Class Missions to the Ice Giants **[#8147]**
Ice giants are the least understood class of planets in our solar system but the most commonly observed type of exoplanet. We identify the major hurdles to achieving an ice giant mission within the cost constraints of a New Frontiers-class mission.

Espley J. R.
If It Has a Magnetic Field We Want to Measure It: Planetary Magnetometry of the Future **[#8058]**
Measuring magnetic fields helps us understand planetary magnetospheres, interior structures like aquifers and oceans, and interior geophysics like dynamos. A variety of missions with magnetometry could be accomplished in the coming decades.

Garvin J. B. Glaze L. S. Johnson N. M. Parsons A. M. Mahaffy P. Conrad P. Trainer M.
Visions for the Exploration of Venus in the Coming Decades **[#8220]**
A vision for Venus exploration extended to circa 2050 that builds on the present state of knowledge and the next one or two missions is developed on the basis of long-standing questions and hypotheses about the planet, including the loss of an ocean.

Greathouse T. K. Retherford K. D. Mandt K. E. Wyrick D. Y.
Thermal Mapping to Achieve 3-D Structure and Dynamics of Planetary Atmospheres Throughout the Solar System **[#8083]**
We have completed our first look at all planets in the solar system. It is now time to move forward with more complete studies of solar system planetary atmospheres to further our understanding of atmospheric dynamics of planets unlike the Earth.

Harris W. M. Gaylor D. E. Furfaro R.
Wayfarer: Small Body Exploration with a Common-Format Microsatellite **[#8153]**
Small bodies have shown diversity in their properties that is best explored statistically by visits to many objects. We present Wayfarer, a low-cost microsatellite deployed via rideshare for multi-mission study of near Earth objects.

Hsieh H. H. Bodewits D. Denneau L. Kelley M. S. Knight M. M. Moskovitz N. A. Thomas C. A.
Data Organization and Accessibility for Small Solar System Bodies in the Era of Large Surveys **[#8104]**
We currently have access to large data sets for small bodies, and will see even larger ones in the future, but lack the tools to analyze them in a coordinated fashion. We will discuss efforts to address this shortcoming in advance of future surveys.

Keane J. T. Becerra P. Basu K. Davis B. Fox V. Hays L. Herman J. Holstein-Rathlou C. Hughes A. Marcucci E. Mendez Ramos E. Nelessen A. Neveau M. Parrish N.
Io: The Volcanic World That Will Tell Us How Ocean Worlds Work (and a Mission Concept to Get Us There) **[#8161]**
Io is the ideal target to study tidal heating and volcanism — two major processes that shape the formation, evolution, and habitability of rocky and icy worlds. We will demonstrate its importance and present a mission concept for its exploration.

Keane J. T.
Gravity Science in the Year 2050 **[#8162]**
Gravity science provides a unique view into the interiors of solar system worlds. I will highlight recent advances in gravity science (particularly in light of GRAIL), current gaps in our knowledge, and what might be on the horizon for 2050.

Lim L. F. Southard A. E. Getty S. A. Hess L. A. Hagopian J. G. Kotecki C. A.
A Miniature Electron Probe for In Situ Elemental Microanalysis **[#8033]**
The Mini-EPMA under development will enable advanced, fine-scale *in situ* mapping of the elemental composition of planetary materials. Composition provides key evidence about the processes by which rocks, soils, and ices were formed and altered.

Limaye S. S. Jessup K. L.
Questions About Venus and Measurements Needed to Address Them from Future Missions to Venus **[#8118]**
Search for ultraviolet absorbing bacteria in the clouds of Venus from future missions to Venus with capable instrumented aerial platforms.

Mazarico E. Neumann G. A. Lucey P. G. Petro N. E. Sun X. Abshire J. B.
High-Resolution Lidar Spectroscopy for Solar System Exploration **[#8022]**
Lidar spectrometers enable both rapid reconnaissance and detailed monitoring of planets, natural satellites, and small bodies, with a new class of combined observations relevant to geophysics, geology, geochemistry, and atmospheric science.

McGovern P. J. Goossens S. J. Lemoine F. G.
Geophysical Mapping and Monitoring of Active Planets (GMAP) **[#8226]**
Recent findings require a strongly upward revision of volcano-tectonic activity rate estimates for Venus and Mars. We propose a program of Geophysical Mapping and Monitoring of Active Planets (GMAP) including seismology, gravimetry, InSAR, and GPS.

Miura Y. Kato T.
Formation of Recycle Fluid Water on any Space Surface as Supports of Life **[#8101]**
The present result can be applied for compact water-CO_2 gas exchange method from any primordial rocks at next 2050 space exploration to support any celestial bodies, astronauts, and human life activity on any extraterrestrial surfaces.

Nagihara S. Zacny K.
Heat Flow Measurements on Moons and Planets for the Next Three Decades **[#8029]**
We discuss the recent advances in planetary heat flow instrumentation and what we may be able to achieve in the next three decades.

Neumann G. A. Mazarico E. Sun X. Garvin J. B. Lemoine F. G. Smith D. E. Genova A. Head J. W. Goossens S. McGovern P. J.
The Next Revolution in Planetary Topography and Gravity **[#8129]**
The next generation of topography and gravity missions will inform the internal evolution of terrestrial, bodies, structure of their crust, the early history of the solar system, and the processes that give rise to life.

Oleson S. R. Lorenz R. D. Paul M. V. Hartwig J. W. Walsh J. M.
Titan Submarines! **[#8144]**
A NIAC Phase II submarine concept, dubbed 'Titan Turtle' for Saturn's moon Titan's northern sea, Ligea Mare. A design concept including science and operations is described for this -180°C liquid methane sea.

Parker A. H.
Centennial Missions: Conducting Planetary Science on Century Timescales **[#8241]**
How do we explore the evolution of surfaces, atmospheres, interiors, magnetospheres, and orbits of the worlds in our solar system over timescales stretching beyond a single human lifetime?

Senske D. Zasova L. Economou T. Eismont N. Esposito L. Gerasimov M. Ignatiev N. Ivanov M. Lea Jessup K. Khatuntsev I. Korablev O. Kremic T. Limaye S. Lomakin I. Martynov M. Ocampo A.
The Venera-D Concept, Scientific Exploration of Venus in the Post-2025 Time Frame **[#8027]**
To address the overarching scientific questions regarding the evolution of Venus, the coming decades offer the opportunity for the comprehensive exploration of Venus — from orbit, in the clouds, and on the surface enabled by the Venera-D concept.

Srivastava N.
Future Scientific Exploration of the Moon: Sample Return from the Lowell Crater, Orientale Basin **[#8066]**
A case for sample return from the Lowell crater has been made stating its geological importance and uniqueness on the Moon. Such an endeavor would provide samples essential for making significant advancements in lunar science and exploration.

Tiscareno M. S. Showalter M. R.
Observing Outer Planet Systems in the Mid-21st Century **[#8205]**
We offer several ideas on space telescopes, spacecraft missions, and the workforce of the future. Most importantly, technology will enable a major increase in time-domain observations, transforming our view of many parts of the outer solar system.

Vance S. D. Kedar S. Bills B. G. Wenkert D.
Seismic Exploration of the Solar System's Icy Moons **[#8136]**
Seismic investigations offer comprehensive views into the deep interiors of planetary bodies and thus hold the potential for enabling detailed exploration and resource utilization on icy satellites in the coming decades. Here: Callisto, Europa.

Villanueva G. L. Mandell A. Protopapa S. Faggi S. Smith M. D. Wolff M. Hewagama T. Mumma M. J.
Planetary Spectrum Generator (PSG): An Online Tool to Synthesize Spectra of Comets, Small Bodies, and (Exo)Planets **[#8006]**
The Planetary Spectrum Generator is an online tool for synthesizing planetary spectra (atmospheres and surfaces) in a broad range of wavelengths (0.1 µm to 100 mm, UV/Vis/near-IR/IR/far-IR/THz/sub-mm/radio) for any observatory, orbiter, or lander.

Zuniga A. F. Rasky D. J. Pittman R. B.
Lunar COTS: Using the Moon's Resources to Enable an Economical and Sustainable Pathway to Mars and Beyond **[#8032]**
The Lunar Commercial Orbital Transfer Services (LCOTS) plan presents a cost-effective approach to partner with industry to establish low-cost cislunar capabilities and services, such as lunar transportation, lunar mining, and lunar ISRU operations.