Monday, November 13, 2017
WHAT DOES IT MEAN TO BE HABITABLE?
8:15 a.m. MHRGC Salons ABCD

8:15 a.m. Jang-Condell H. *
Welcome

Chair: Stephen Kane

8:30 a.m. Forget F. * Turbet M. Selsis F. Leconte J.
Definition and Characterization of the Habitable Zone **[#4057]**
We review the concept of habitable zone (HZ), why it is useful, and how to characterize it. The HZ could be nicknamed the "Hunting Zone" because its primary objective is now to help astronomers plan observations. This has interesting consequences.

9:00 a.m. Rushby A. J. Johnson M. Mills B. J. W. Watson A. J. Claire M. W.
Long Term Planetary Habitability and the Carbonate-Silicate Cycle **[#4026]**
We develop a coupled carbonate-silicate and stellar evolution model to investigate the effect of planet size on the operation of the long-term carbon cycle, and determine that larger planets are generally warmer for a given incident flux.

9:20 a.m. Dong C. F. * Huang Z. G. Jin M. Lingam M. Ma Y. J. Toth G. van der Holst B. Airapetian V. Cohen O. Gombosi T.
Are "Habitable" Exoplanets Really Habitable? A Perspective from Atmospheric Loss **[#4021]**
We will discuss the impact of exoplanetary space weather on the climate and habitability, which offers fresh insights concerning the habitability of exoplanets, especially those orbiting M-dwarfs, such as Proxima b and the TRAPPIST-1 system.

9:40 a.m. Fisher T. M. * Walker S. I. Desch S. J. Hartnett H. E. Glaser S.
Limitations of Primary Productivity on "Aqua Planets:" Implications for Detectability **[#4109]**
While ocean-covered planets have been considered a strong candidate for the search for life, the lack of surface weathering may lead to phosphorus scarcity and low primary productivity, making aqua planet biospheres difficult to detect.

10:00 a.m. Breakout Session Advertisement

10:10 a.m. BREAK

Chair: Natalie Hinkel

10:40 a.m. Desch S. J. * Hartnett H. E. Kane S. R. Walker S. I.
Detectability, Not Habitability **[#4070]**
Exoplanet characterization must move beyond questions of habitability, to detectability of life, comparing biotic and abiotic geochemical cycles. This shift in thinking guides the types of observations and modeling needed moving forward.

11:10 a.m. Wong M. L. * Friedson A. J. Willacy K. Shia R. L. Yung Y. L. Russell M. J.
A Methane-Rich Early Mars: Implications for Habitability and the Emergence of Life **[#4063]**
We use a coupled radiative transfer and photochemical model to investigate the climate of a CH_4-rich early Mars. Can high levels of CH_4 and SO_2 thaw Mars and make it suitable for the emergence of life? Applications to small terrestrial exoplanets.

11:30 a.m. Froning C. S. * France K. Loyd R. P. Youngblood A. Brown A. Pineda J. S. Schneider P. C. Roberge A.
Flexing our MUSCLES: The HST Mega-MUSCLES Treasury Survey **[#4052]**
The MUSCLES Survey is a large HST program to characterize the energetic emission from M stars. Here, we present the results from MUSCLES and introduce Mega-MUSCLES, a new program designed to provide key inputs to JWST observations of rocky planets.

11:50 a.m. Poster Pop-Ups

Monday, November 13, 2017
TOWN HALL:
NASA HEADQUARTERS AND NExSS FUTURE DIRECTIONS
12:30 p.m. MHRGC Salons ABCD

Come and hear from NASA Headquarters regarding future directions of the Astrophysics and Planetary Sciences divisions, as well as how NExSS and its activities are playing a role in shaping that future.

Monday, November 13, 2017
PANEL SESSION I

HABITABLE ZONE TERRESTRIAL PLANETS AROUND LOW MASS STARS: THE M-DWARF OPPORTUNITY

2:00–4:30 p.m. MHRGC Salons AB

Kopparapu R. Charbonneau D.

Some of the questions we want "answered" or discussed:

1. What observable features do recent climate/photochem/helio models predict for tidal-locked (synchronous and resonant rotating) planets?
2. How does variation in planetary and stellar characteristics (internal and atmospheric composition, age, stellar activity) affect the observables?
3. Discuss opportunities for atmospheric characterization with ELTs and JWST of known (and to be known) M-dwarf HZ planets.
4. How sure are we that there is a firm plan to search every one of the ~450 M-dwarfs within 15pc in the near future?

EXOPLANET COMMUNITY MODELING AND ANALYSIS TOOLS WORKSHOP

2:00–4:30 p.m. MHRGC Salons CD

Arney G. N. Mandell A. M.

A variety of modeling and analysis tools will be needed as new exoplanet observational capabilities come online, and observations of exoplanets span an increasingly wide swathe of parameter space. This will lead to a corresponding increase in the diversity of planetary processes that are observed. Each process would need to be modeled and/or examined in a variety of ways using a set of tools that can be effectively interfaced. Such studies would benefit from inter-tool comparisons, ensuring that our conclusions are not based on one set of assumptions or analytical methods. In addition, model- and tool-inter-comparison projects are valuable for modeling exoplanets or examining exoplanet observations in absence of extensive data on planetary properties: without data for comparison, the results of any given model are strengthened if independent models agree with each other. There is a growing acknowledgement of these needs in light of future telescopes that will discover and observe exoplanets.

The session is an opportunity for all members of the exoplanet community to share and discuss the wide range of software already developed or in development, and strategize how we can better collaborate and communicate. Individual researchers will present community modeling tools and provide short demos for running them. There will be ample time provided for interacting with the modeling tools presented and asking questions of the developers. We will also allow time for discussing inter-tool coupling/comparisons, how the community can work to advance the state of exoplanet and planetary modeling, and how to effectively share models across the community.

POSTER SESSIONS
Monday, November 13, 2017
and Thursday, November 16, 2017

5:00–6:30 p.m. UWCC Grand Ballroom

BIOSIGNATURES POSTERS

Airapetian V . S. Jackman C. H. Mlynczak M. Danch W. D. Hunt L.
Atmospheric Beacons of Life From Exoplanets Around G-M Dwarfs **[#4074]**
We propose to use the powerful emission from broad bands of nitric oxide, hydroxyl, and molecular oxygen as signatures of nitrogen, oxygen, and water rich atmospheres of terrestrial type exoplanets "highlighted" by stellar activity from G-M stars.

Hartnett H. E.
Signs of Life on Anoxic Worlds **[#4081]**
Anoxic metabolisms may be important for understanding exoplanet biosignatures because many systems may not have detectable oxygen. Early Earth was habitable, and inhabited, but would have had quite different biosignatures from today's Earth.

O'Malley-James J. T. Kaltenegger L.
UV Surface Environments of M Star Planets: Surface Habitability and Temporal Biosignatures **[#4128]**
Habitable planets around active M stars can be subjected to high levels of UV radiation. Here we model the UV surface regimes on such planets as a first step toward determining the habitability and novel biosignatures for such worlds.

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DEFINITIONS OF HABITABILITY POSTERS

Airapetian V. S. Glocer A. Khazanov G. Danchi W.
Space Weather Affected Habitable Zones **[#4076]**
Our global models show that atmospheres of terrestrial type exoplanets around M dwarfs are vulnerable to high XUV fluxes and magnetized winds causing atmospheric loss rate of O and N, which will make exoplanets uninhabitable within 10-100 Myr.

Chandler M. A. Sohl L. E. Jonas J. A. Carter D. O.
3-D Climate Modeling of the Cretaceous: Capacity and Conundrums That Reflect on the Promise of Simulating Habitable Exoplanets **[#4082]**
3-D GCM simulations of Paleo-Earth climates such as the mid-Cretaceous permit exploration of the dynamics impacting global or regional habitability of HZ planets, as well as a means to evaluate GCM performance and suggest lines of inquiry.

Checlair J. Abbot D. S.
A Test for the Habitable Zone Concept **[#4147]**
Traditional habitable zone theory assumes that the silicate-weathering feedback regulates the atmospheric CO_2 of planets within the habitable zone. We outline a test for this prediction by using a statistical approach on many planets with future observing facilities.

Del Genio A. D. Way M. J. Amundsen D. S. Aleinov I. Kelley M. Kiang N. Y.
Equilibrium Temperatures and Albedos for Habitable M Star Planets in a Coupled Atmosphere-Ocean General Circulation Model **[#4029]**
3-D exoplanet climate modeling shows that equilibrium temperature assessments of the habitable zone should account for the higher albedos of slowly rotating planets inside the tidal locking radius and the lower albedos of planets orbiting M stars.

Dong C. F. Lee Y. Ma Y. J. Bougher S. W. Luhmann J. G. Jakosky B. M. Curry S. M. Brain D. A. Toth G. Nagy A. F.
Modeling of Ion and Photochemical Losses to Space Over the Martian History: Implications for Exoplanetary Climate Evolution and Habitability **[#4023]**
This study informs our understanding of the long-term evolution of the Martian climate due to atmospheric losses to space, and has implications for analogous change on exoplanets. Thus, it offers fresh insights concerning the habitability of exoplanets.

Hall A. Acker-Moorehead M. Onyilagha J.
Origin of Life: Pathways of the 20 Standard Amino Acids of the Genetic Code **[#4157]**
How nature used four nucleotides to build its proteins and form genetic code is intriguing. Stereochemical, Coevolution, and Adaptive theories have been propounded. We updated biosynthesis pathways and give insight into ancient evolutionary events.

Hayworth B. P. Payne R. C. Kasting J. F.
The Effect of New Collision-Induced Absorption Coefficients on the Early Mars Limit Cycle Hypothesis **[#4125]**
Updating the Limit Cycling (LC) Model for early Mars with new absorption coefficients to test for changes to LC behavior and to potentially lower needed concentrations of greenhouse gases. Thought will be given to the effect of LC on habitability.

Hinkel N. R.
Avoiding 'The Boy Who Cried Wolf' In Exoplanet Habitability **[#4105]**
I will discuss the short-comings in the current definition of the habitable zone as well as how to move forward, taking into account both the physical and chemical relationships between a star and its planet.

Kane S. R. Kopparapu R. K. Domagal-Goldman S. D.
A Catalog of Kepler Habitable Zone Exoplanet Candidates **[#4014]**
This presentation will describe the highlights of the HZ catalog and the plans for further validation of HZ candidates and follow-up studies.

Marounina N. Rogers L. A. Kempton E.
Constraining the Habitable Zone Boundaries for Water World Exoplanets **[#4135]**
We use coupled models of planet interiors, clathrate formation, liquid-gas equilibrium, and atmospheric radiative transfer to constrain the atmospheric abundance of CO_2 and corresponding habitable zone boundaries for water-rich exoplanets.

Mason P. A.
The Large-Scale Structure of Habitability in the Universe **[#4149]**
The emergence of life as we know it relies on several factors. Over time, galactic disks not only allowed for the concentration of elements, but the magnetized galactic wind of disk galaxies also provided protection.

Soto A.
How Ocean-Land Fraction and Distribution Affects Habitable Conditions on Earth-Like Planets **[#4027]**
We investigate how ocean-land fraction and distribution affects the creation of habitable conditions on the surface of Earth-like exoplanets by using a general circulation model to simulate a range of ocean-land fractions as well as distributions.

Tasker E. J. Tan J. Heng K. Kane S. Spiegel D.
We Need to Change How We Discuss Habitability **[#4042]**
Metrics are used to rank planets for follow-up studies. However, the results are frequently over-extended to suggest that we can quantitatively assess a planet's capacity for supporting life. Such misrepresentation risks serious damage to the field.

Turbet M. Forget F. Leconte J. Selsis F. Bolmont E.
Habitability and Observability of Proxima Cen and TRAPPIST-1 Planetary Systems **[#4016]**
We use sophisticated 3-D numerical climate models to explore the habitability of two nearby planetary systems: Proxima Cen and TRAPPIST-1. Then we produce synthetic observables to prepare future observations with JWST and ELT-class telescopes.

Turbet M. Forget F. Leconte J. Tobie G. Charnay B. Selsis F. Bolmont E.
Glaciation Escape on Earth-Like Planets Limited by CO_2 Condensation **[#4017]**
We discuss the ability of Earth-like planets to escape from episodes of complete glaciation (i.e. snowball episodes) through volcanic CO_2 greenhouse warming. We show that CO_2 polar condensation prevents distant planets to escape glaciation.

Yang J. Ding F. Ramirez R. M. Peltier W. R. Hu Y. Liu Y.
Abrupt Climate Transition of Icy Worlds from Snowball to Moist or Runaway Greenhouse **[#4007]**
Icy planetary bodies with low concentrations of greenhouse gases may transition directly to a moist or runaway greenhouse without passing through a habitable Earth-like state.

Young P. A. Truitt A.
Constraining the Habitability Histories of Planets **[#4040]**
We present a method and example for calculating the probability that a planet at a given distance from its star has been habitable for a specified amount of time, even without a known age or composition for the host star.

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DETECTION METHODS POSTERS

Chakrabarty A. Sengupta S.
Using Indian Telescopes for Transit Follow-Up: Prospects for Improved Longitudinal Coverage **[#4064]**
India seeks scopes to do transit searches and follow-ups with the new facilities (2m HCT, 3.6 m DOT) for other teams, by collaborating with them, to provide missing longitudinal coverage leveraging our newly demonstrated transit detection capability.

Elrod M. K.
The Search for Life: In-Situ, Remote Sensing, Modeling, and Archiving **[#4092]**
Instrumentation development and current technology.

Isaacson H. T. Siemion A. P. V.
Breakthrough Listen: Searching for Signatures of Technology **[#4144]**
Breakthrough Listen is searching for signals of extra-terrestrial technologies using radio and optical telescopes. Very nearby stars of all types. Stars across the HR diagram and galaxies are all of interest in the search for techno-signatures.

Lisse C. M. Sitko M. L. Marengo M. Kane S. R. Desch S.
The IRTF/SpeX Survey of Stellar Fluxes and Atomic Abundances in Kepler THZ Planet Systems **[#4061]**
We have used the results from our 100+ hours, 50+ systems NASA/IRTF SpeX spectral survey to understand the nature systems known to host planets and circumstellar disks. We present our latest stellar flux and abundance results for these systems.

Meyer M. R. Quanz S. P. Kasper M. Guyon O. Monnier J.
Blazing a Trail: Towards Imaging Super-Earths from the Ground and Space **[#4108]**
We will review recent progress in imaging super-earths around the very nearest stars, new opportunities for 10 microns imaging, contributions JWST will make to imaging ice giants, and complementary work to be done by WFIRST-AFTA.

Rizzo M. J. Roberge A. Lincowski A. P. Zimmerman N. T. Juanola-Parramon R. Pueyo L. Hu M. Harness A.
Realistic Simulations of Coronagraphic Observations with Future Space Telescopes **[#4097]**
We present a framework to simulate realistic observations of future space-based coronagraphic instruments. This gathers state-of-the-art scientific and instrumental expertise allowing robust characterization of future instrument concepts.

Rogers L. A. HabEx STDT
HabEx: Finding and Characterizing Habitable Exoplanets with a Potential Future Flagship Astrophysics Mission **[#4146]**
The Habitable Exoplanet Imager is one of four flagship missions that NASA is studying in advance of the 2020 Decadal Survey. The primary goal of HabEx is to directly image and characterize rocky planets in the habitable zones of sun-like stars.

Sorber R. L. Kar A. Hancock D. A. Leuquire J. D. Suhaimi A. Kasper D. H. Jang-Condell H.
The Search for Hot Jupiters Using Red Buttes Observatory **[#4112]**
The goal of this research is to perform operated observations of transiting exoplanet candidates, catalogued by the KELT (Kilodegree Extremely Little Telescope) Survey, transiting exoplanets around bright stars.

Tanner A. M.
Looking to the Future: What Will It Take to Confirm Life on an Exoplanet? **[#4141]**
I will present a continent neutral overview of ground and space-based observatories which will be devoted to searching for life outside of our solar system. I'll break it down to four phases: Discovery, Reconnaissance, Characterization, and LIFE!

Ellis T. Boyajian T. Bodman E. Wright J.
The Color Dependency of KIC 8462852's Dips **[#4159]**
KIC 8462852 earned its title of "The Most Mysterious Star in the Galaxy" when it was discovered to sporadically dip in luminosity upward of 20% by the Kepler mission. We present current photometry and colors of multiple modern dips.

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EARLY EARTH POSTERS

Ranjan S. Todd Z. Sutherland J. Sasselov D. D.
Planetary Sources for Reducing Sulfur Compounds for Cyanosulfidic Origins of Life Chemistry **[#4024]**
Sulfidic anions (e.g, HS^-, HSO_3^-) are invoked in prebiotic chemistries, but their abundance on early Earth is poorly constrained. We use simple equilibrium chemistry to estimate the abundance of sulfidic anions in surficial aquatic reservoirs.

Silverman S. N. Kopf S. Gordon R. Bebout B. Som S.
Measuring N_2 Pressure Using Cyanobacteria **[#4013]**
We have shown that cyanobacteria can record information about N_2 partial pressure both morphologically and isotopically, and thus may serve as useful geobarometers to help us better understand Earth's ancient atmosphere.

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EXOPLANET CHARACTERIZATION POSTERS

Apai D.
Exploring Habitable Worlds: Science Questions for Future Direct Imaging Exoplanet Missions **[#4049]**
We report on the SAG15 team's comprehensive effort to compile community input on key science questions for future exoplanet imaging missions, many of which are essential to recognizing habitable planets and for correcting interpreting biosignatures.

Batalha N. M. Bean J. Stevenson K. Sing D. Crossfield I. Knutson H. Line M. Parmentier V. Kreidberg L. Desert J.-M. Wakeford H. Crouzet N. Moses J. Benneke B. Kempton E. Berta-Thompson Z. Lopez-Morales M.
The Transiting Exoplanet Community Early Release Science Program for JWST **[#4151]**
We describe the program for JWST Early Release Science designed and executed by the transiting exoplanet community.

Bean J. L.
Comparative Exoplanetology in Era of the Great Observatories, JWST, and Beyond **[#4067]**
My presentation will focus on three topics: exoplanet atmosphere characterization with HST and Spitzer, expectations and plans for transit spectroscopy with JWST, and surprising chemical abundance results for solar twin stars.

Beatty T. G.
Gaussian-Process Techniques for Accurately Characterizing Exoplanet Atmospheres **[#4142]**
Gaussian-Process (GP) techniques create flexible systematic noise models for exoplanet observations. I will discuss real-life applications of GPs to observations of exoplanet atmospheres from the ground and space, and their applicability to JWST.

Bixel A. Apai D.
Probabilistic Assessment of Planet Habitability and Biosignatures **[#4066]**
We have computed probabilistic constraints on the bulk properties of Proxima Cen b informed by priors from Kepler and RV follow-up. We will extend this approach into a Bayesian framework to assess the habitability of directly imaged planets.

Bodman E. H. L. Desch S. J. Wright J. T.
Exoplanet Dust Tails as Windows to the Planetary Interior **[#4121]**
Disintegrating planets provide an opportunity to study the composition of the interiors of exoplanets. We model the dust tail and simulate observable signatures of composition for broadband photometry and IR spectra.

Bott K. Bailey J. Meadows V. Kedziora-Chudczer L. Cotton D. Crisp D.
Comparative Habitable Planet Signatures in Polarized Light **[#4077]**
VSTAR polarized light models of terrestrial worlds are compared for varying cloud, atmospheric, and surface conditions. Archetypal "Earth-like" planets are compared and the observability of their combined polarimetric effects assessed.

Chandler C. O. Kane S. R. Gelino D. M.
The Habitable Zone Gallery 2.0: The Online Exoplanet System Visualization Suite **[#4010]**
The Habitable Zone Gallery 2.0 provides new and improved visualization and data analysis tools to the exoplanet habitability community and beyond. Modules include interactive habitable zone plotting and downloadable 3D animations.

Fujii Y. Del Genio A. D. Amundsen D. S.
Water Vapor in the Upper Atmospheres of Synchronously Rotating Temperate Terrestrial Planets **[#4118]**
Using the GCM ROCKE-3D, we examine how the water vapor mixing ratio in the upper atmospheres of synchronously rotating temperate terrestrial planets responds to the various stellar irradiation.

Hanson J. R. Desch S. J.
Nonstationary Mass Loss of Disintegrating Planets **[#4095]**
We present a nonstationary model of atmospheric mass loss of disintegrating planets. This model explains the observed variable transit depths and can be coupled to mineral condensation in order to predict planet composition based on JWST spectra.

Haqq-Misra J. Wolf E. T. Joshi M. Kopparapu R. K.
Demarcating Circulation Regimes of Synchronously Rotating Habitable Planets **[#4048]**
We investigate the atmospheric dynamics of terrestrial planets in synchronous rotation around low-mass stars using aquaplanet simulations. We define three dynamical regimes in terms of the equatorial Rossby deformation radius and the Rhines length.

Hill M. L. Kane S. R. Duarte E. S. Kopparapu R. K. Gelino D. M. Whittenmyer R. A.
Potential Habitable Zone Exomoon Candidates and Radial Velocity Estimates for Giant Kepler HZ Candidates **[#4003]**
We found 39 planet candidates greater than 3 Earth radii residing in the Optimistic Habitable Zone of their host star. While giant planets aren't favored in the search for eta Earth, they indicate potential for moons residing in the habitable zone.

Jensen A. G. Cauley P. W. Redfield S. Cochran W. D. Endl M.
Possible H? and Sodium D Absorption in WASP-12b **[#4073]**
We report on the possibility of Hα and sodium D absorption in WASP-12b. An Hα detection would be only the second such exoplanetary detection after HD 189733b. We discuss this in the context of atmospheric loss/evolution and star-planet interactions.

Jontof-Hutter D. Ford E. B. Wolfgang A. Lissauer J. J. Fabrycky D. C.
Identifying Potentially Habitable Worlds with Transit Timing **[#4099]**
As planet characterization continue to progress to smaller planets orbiting further out than the earliest exoplanet detections, we evaluate the prospects of characterizing potentially habitable rocky planets around different hosts with TTVs.

Kasper D. H. Cole J. L. Cortez C. N. Garver B. R. Jarka K. L. Kar A. McGough A. M. PeQueen D. J. Rivera D. I. Jang-Condell H. Kobulnicky H. A. Dale D. A.
Characterizing Giant Exoplanets Through Multiwavelength Transit Observations **[#4089]**
Giant exoplanets are important for system habitability. We have observed multiple transits of giant exoplanets using a 2.3 m observatory and Sloan filters. We present early constraints on the atmospheres of the exoplanets.

Lustig-Yaeger J. Lincowski A. P. Meadows V. S.
Extending Atmospheric Characterization to Earth-Sized Exoplanets with JWST: Transits, Eclipses, and the TRAPPIST-1 System **[#4098]**
We explore the potential to characterize the TRAPPIST-1 system of seven transiting planets. We devise a hierarchical observing scheme to maximize information content in observations of the atmospheres of TRAPPIST-1 planets while minimizing JWST time.

Lustig-Yaeger J. Tovar G. Schwieterman E. W. Fujii Y. Meadows V. S.
Detecting Oceans on Exoplanets Using Phase-Dependent Mapping with Next-Generation Coronagraph-Equipped Telescopes **[#4110]**
We describe a novel combination of observations to map Earth-like exoplanets using mulit-band lightcurves at multiple phases to identify the angle-dependent behavior of the reflecting surfaces, and thereby increase the robustness of ocean detection.

Mansfield M. Bean J. Line M. R. Kreidberg L.
Constraining the Atmospheric Metallicity of HAT-P-11b **[#4012]**
The core accretion model of planet formation predicts decreasing atmospheric metallicity with increasing planet mass. We present new observations of the Neptune-sized planet HAT-P-11b to constrain its metallicity and test this mass-metallicity trend.

Merrelli A. J. Turnbull M. C. L'Ecuyer T. S.
Terran World Simulator **[#4087]**
The Terran World Simulator was developed to simulate direct detection of terrestrial exoplanets. It can be used to support preparatory studies for direct imaging missions such as NASA's WFIRST and other next generation observatories.

Tanner A. M. Muna D. Addison B. Zohrabi F. Geneser C. Niffenegger R.
Starchive: The Open Access, Open Source Stellar Database **[#4086]**
It has become clear that we must understand the host stars as well as their exoplanets. The Starchive is an open source, open access stellar database and intuitive front-end to help astronomers find planets and determine habitability.

Wang J. J. GPIES Collaboration
The Orbits and Atmospheres of Directly-Imaged Exoplanets from the Gemini Planet Imager Exoplanet Survey **[#4130]**
The Gemini Planet Imager Exoplanet Survey (GPIES) is a survey for young Jovian-mass exoplanets at solar system scales. I will show the orbits and near-infrared spectra of the exoplanets imaged by GPIES and discuss what we can learn from them.

Wolf E. T. Gatlin D. Kopparapu R. K. Haqq-Misra J. H. Villanueva G.
Observational Signals of TRAPPIST-1e Derived from a 3D Climate Model **[#4056]**
We conduct 3D climate simulations of TRAPPIST-1e with a variety of atmospheric compositions. Then we calculate theoretical observables from these worlds, such as thermal phase curves and transit spectra.

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ORIGINS OF LIFE POSTERS

Bose M. Zega T. J. Haenecour P. Domanik K.
Correlated Isotopic Anomalies Associated with Organic Matter in Meteorites **[#4033]**
Rare domains with correlated isotopic anomalies, i.e., anomalous in H, C, and/or N have been identified in pristine carbonaceous meteorites.

Cruz-Castañeda J. Negrón-Mendoza A. Ramos-Bernal S. Colín-García M. Heredia A.
Radiolysis and Termolysis of Tetradecanoic Acid and Docosanoic Acid in Physicochemical Conditions Similar to Hydrothermal Vents **[#4101]**
Our results show the stability of carboxylic acids against different energy sources. Additionally, the reaction products may have importance in chemical evolution, since they could function as reagents towards synthesis of other important compounds.

Gordon R. Hanczyc M. M. Smoukov S. K.
Habitats for Shaped Droplets in the Origin of Life **[#4018]**
Cooled oil droplets are flat and polygonal, like some Archaea and bacteria. Shaped droplet protocells would constrain habitats for the origin of life to those where oil/water emulsions can form, remain, concentrate, and undergo temperature cycling.

Haenecour P. Zega T. J. Howe J. Y. Bose M. Wallace P.
Origins and Delivery of Volatile Elements in Terrestrial Planets: Insight from the Composition and Functional Chemistry of Organic Matter in Meteorites **[#4037]**
We report new EELS data on the elemental compositions and functional chemistries of primordial meteoritic organic matter to investigate the origin(s) of volatile elements in meteorites and their possible delivery to terrestrial planets.

Meléndez-López A. L. Negrón-Mendoza A. Ramos-Bernal S. Colín-García M. Heredia A.
Stability of Molecules of Biological Importance to Ionizing Radiation: Relevance in Astrobiology **[#4090]**
Our aim is to study the stability of amino acids in conditions that probably existed in the primitive environments. We study aspartic acid and glutamic acid, in solid state and aqueous solution, against high doses of gamma radiation at 298 and 77 K.

Rimmer P. B. Xu J. Thompson S. J. Gillen E. Sutherland J. D. Queloz D.
Prebiotic Chemistry on Exoplanets Within the Liquid Water Habitable Zone **[#4094]**
We explore whether life could originate on rocky planets by performing laboratory photochemical experiments and comparing the lamps we use to observe stellar spectra.

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PLANETARY SYSTEM DYNAMICS POSTERS

Jackson J. M. Dawson R. I.
The Origin of Kepler-419B: A Path to Tidal Migration Through Secular Eccentricity Modulation **[#4038]**
The origin of the warm Jupiter Kepler-419B is examined using N-body simulations to rule out or allow for tidal migration of the planet.

Renaud J. P. Henning W. G.
Emergent Tidal Resilience for Exomoons and Extrasolar Planets via the Increased Tidal Dissipation of the Andrade and Sundberg-Cooper Rheological Models **[#4025]**
We find that an exomoon or exoplanet in an eccentric orbit will produce increased tidal dissipation compared to prior models, in certain temperature and frequency domains, when its interior is modeled with realistic rheologies.

Shan Y. Li G.
Obliquity Variations of Habitable Zone Planets Kepler-62f and Kepler-186f **[#4075]**
Obliquity variations play critical roles in a planet's climate and habitability. We study the spin axis dynamics of Kepler-62f and Kepler-186f in a large parameter space, finding the low-obliquity regimes to be stable assuming they are Earthlike.

Unterborn C. T. Hull S. D. Stixrude L. Teske J. K. Johnson J. A. Panero W. R.
Stellar Chemical Clues as to the Rarity of Exoplanetary Tectonics **[#4034]**
A host-star bulk composition affects the geology of terrestrial planets in that system. We present geochemical calculations quantifying how these changes affect the system's potential to produce tectonically active, and truly "Earth-like," planets.

Unterborn C. T.
Redefining "Earth-Like:" Habitable Planet Composition and the Case for Moving Beyond the Mass-Radius Diagram **[#4107]**
The composition of exoplanets affects its likelihood to be Earth-like and habitable. This talk will explore various geophysical consequences of varying exoplanet composition.

POSTER SESSIONS
Monday, November 13, 2017
and Thursday, November 16, 2017

5:00–6:30 p.m. UWCC Grand Ballroom

PLANET FORMATION POSTERS

Ballering N. P. Eisner J. A.
Protoplanetary Disk Masses in Taurus and the Orion Nebula Cluster **[#4133]**
We will discuss two studies of protoplanetary disk masses (a primary factor influencing planet formation): 1) radiative transfer modeling of Taurus disks to constrain dust temperature and opacity, and 2) ALMA observations of disks in the ONC.

Carrera D. Ford E. B. Wolfgang A.
Constraining the Composition of Super-Earths **[#4019]**
We use computer simulations to model planet formation, including migration, accretion, and atmosphere loss via giant impacts. For each model we predict the mass and density ratios of TTV planets, and compare them to super-Earths in the Kepler field.

Feng W. Desch S.
The Diversity of Rocky Bodies from White Dwarf Pollution **[#4102]**
Insight to the chemical diversity of extrasolar rocky bodies may be gained by observing heavy elements in white dwarf atmospheres. The disk accretion scenario is key to understanding the accreted rocky bodies.

Hori Y. Ogihara M.
Atmospheric Growth of the TRAPPIST-1 Planets **[#4123]**
We investigate the atmospheric growth and loss of a (non-)migrating planet around TRAPPIST-1 star and then we discuss whether the TRAPPIST-1 planets can have/retain their primordial atmospheres.

Jang-Condell H.
Constraints on Terrestrial Planet Formation in Close Binaries **[#4083]**
This poster presents a study on the feasibility of the formation of small, rocky planets in close binary systems based on the amount of material available in truncated disks.

Jennings J. Ercolano B. Rosotti G. Birnstiel T.
The Difficulty of Forming Earth Analogs **[#4136]**
In the protoplanetary disc, the streaming instability is a favored mechanism to form planetesimals. It may be induced by photoevaporation. I will discuss the conditions required for this process to produce Earth analogs and the difficulties involved.

Kalyaan A. Desch S. J.
Water Distribution and Icelines in Non-Uniform Alpha-Disks **[#4085]**
Icelines set where planets form in disks, and how much water they can carry. We perform simulations to understand the behavior of radial volatile transport processes that contribute to planet formation, as well as external factors they depend on.

Lopez E. D.
Kepler's Rocky Exoplanets: Born Rocky or Stripped Sub-Neptunes? **[#4129]**
I will review the current evidence for the role of photo-evaporation in shaping the known exoplanet population and the impact this may have on our current estimates of eta-Earth. I will then discuss observational paths forward.

Mai C. Desch S. J.
Exploring Proto-Atmosphere Accretion on Earth-Size Planets **[#4060]**
We perform a numerical study on how protoplanets can accrete extensive hydrogen/helium-rich atmospheres and how these atmospheres are subject to the nebula environment during terrestrial planet formation and their implication on habitability.

Millsaps C. S. Domagal-Goldman S. D.
Building a Planet: Assessing the Habitability of K2-3 d **[#4041]**
We use ATMOS, a 1D coupled photochemical-climate model, to simulate a number of self-consistent atmospheres on the super-Earth K2-3 d over geologic time. We estimate the observational discriminants most likely to suggest habitable surface conditions.

Patience J. Ward-Duong K. Bulger J. van der Plas G. Menard F. Pinte C. Jackson A. Bryden G. Turner N. Harvey P. Hales A. De Rosa R.
Disk Properties Across the Stellar/Substellar Boundary and Implications for Planet Formation and Detection of Planets Around M-Stars **[#4104]**
We report 885μm ALMA submm fluxes for 24 low mass Taurus members. The dust mass declines with object mass, and a number of targets have resolved disks. Based on standard gas:dust mass estimates, very few disks are amenable to giant planet formation.

Perez A. M. Desch S. J. Schrader D. L. Till C. B.
Understanding the Conditions of Planet Formation Through Chondrules **[#4084]**
The heating mechanisms responsible for melting chondrules in the nebula are key to constraining astrophysical models of the disk and the energetic processes that were present during planet formation. We investigate this through furnace experiments.

Seligman D. Z. Laughlin G.
A Vorticity-Preserving Hydrodynamical Scheme for Modeling Accretion Disk Flows **[#4120]**
We present a vorticity-preserving compressible scheme for simulating astrophysical disk flows that was developed in the context of modeling air flow past helicopter rotors.

Wagner K. R. Daniel A. Kasper M.
Status of the Scorpion Planet Survey: Establishing the Frequency of HR8799b-Like Planets **[#4028]**
Wide-orbit giant planets will likely affect plant formation and habitability of inner planets. In this presentation we will review the existing evidence on the occurrence rates of super-Jupiters and present the status of our VLT/SPHERE survey.

Zimmerman M. Z. Jang-Condell H. J.
Modeling Debris Disk Spectra Using Varying Compositions **[#4062]**
We use Spitzer mid-IR spectra to help create a disk model, which allows the amount of different grain compositions within the disk to vary. We use an array of different compositions in order to learn more about the formation of habitable exoplanets.

POSTER SESSIONS
Monday, November 13, 2017
and Thursday, November 16, 2017

5:00–6:30 p.m. UWCC Grand Ballroom

MISCELLANEOUS POSTERS

Byrne J. F.
A Climate Classification Scheme for Habitable Worlds **[#4116]**
This presentation will include an exploration of the internal/external forcings and variability associated with climate using Earth as a reference model in addition to a classification scheme consisting of five categories.

Cardona M. C. Ramírez S. I.
Salinibater Ruber as a Model for the Habitability of Europa's Ocean **[#4039]**
The moon Europa has an ocean enriched with sulfate compounds. This work evaluates the adaptation strategies of Salinibacter ruber, a halophilic bacterium, when subjected to $MgSO_4$ and $NaSO_4$, two of the main salty components of Europa´s ocean.

Colose C. C. Del Genio A. Way M.
Climate Dynamics and Hysteresis at Low and High Obliquity **[#4113]**
We explore climate dynamics for an Earth-like planet, especially one near the outer edge of the habitable zone that is susceptible to global glaciations.

Echaurren J. C.
Korolev Crater, Mars: Estimating the Impact Conditions **[#4015]**
In this work, estimates are made for the main variables that give shape to an impact crater, taking as an example the Korolev impact crater that is on Mars.

Ko B. Shim S. Prakapenka V. Meng Y.
Mineralogy of the Silica-Rich Lower Mantle for Rocky Planets **[#4111]**
Our experiments show that Si-rich lower mantle of rocky planets may consist only of bridgmanite and calcium silicate perovskite, implying different physical properties of the lower mantle than the extrapolated model from the Earth.

Lorenzo A. M. Jr. Desch S. J. Unterborn C. Shim S. H. Byeongkwan K.
ExoPlex: A Code for Calculating the Mineralogy and Mass-Radius Relationships for Rocky Planets **[#4106]**
We present a code for finding the mineralogy and mass radius relationships for rocky exoplanets.

Staguhn J. Meixner M. Cooray A. Leisawitz D. Origins Space Telescope STDT
The Origins Space Telescope — A NASA Decadal Mission Study **[#4152]**
The Origins Space Telescope will discover or characterize exoplanets, the most distant galaxies, nearby galaxies and the Milky Way, and the outer reaches of our solar system. This talk will present the Origins Space Telescope Mission Concept 1.

Quintana E. V. Barclay T. Schlieder J. Boyd P. Thackeray-Lacko B.
Simultaneous, Multi-Wavelength Flare Observations of the M Dwarf Wolf 359 **[#4069]**
Wolf 359 is a nearby late-M dwarf that is known to produce frequent flares. We will present results from our observations in the optical, UV, X-ray, and radio wavelengths and discuss the potential impact on exoplanet habitability.

Roberge A. LUVOIR Mission Concept Team
Big Bang to Biosignatures: The LUVOIR Decadal Mission Concept **[#4065]**
The Large UV/Optical/IR Surveyor (LUVOIR) is a concept for a multi-wavelength space observatory with broad science goals. One of its major aims is to characterize habitable exoplanets around Sun-like stars and search them for signs of life.

Rubio D. G. Ramírez S. I.
Bacterial Growth in the Salty Liquid Water Ocean of Europa **[#4050]**
We are interested in the adaptation strategies displayed by bacteria when exposed to laboratory-controlled conditions that represent the salinity, temperature, and available oxygen conditions of the salty liquid water ocean present on Europa.

Stern S. A.
An Answer to Fermi's Paradox in the Prevalence of Ocean Worlds? **[#4006]**
We suggest that the great majority of worlds with biology and civilizations are interior ocean worlds, cut off from communication by their nature inside of their host world, therefore not easily revealing themselves.

Tan S. P.
Liquid Phase Equilibria for Habitability **[#4138]**
The existence of liquid phase, which amplifies habitability, can be predicted using an equation of state from atmospheric composition, pressure, and temperature. If solid is also present, density inversion that keeps liquid from freezing is examined.

Tuesday, November 14, 2017
PLANET FORMATION AND DYNAMICS
8:25 a.m. MHRGC Salons ABCD

8:25 a.m. Jang-Condell H. *
Announcements

Chair: Aki Roberge

8:30 a.m. Apai D. *
The Formation of Habitable Worlds: Constraints, Challenges, and Pathways **[#4127]**
I will review the constraints, challenges, and pathways toward habitable planet formation.

9:00 a.m. Salyk C. *
Observing How Habitable Conditions Develop in Protoplanetary Disks **[#4126]**
An understanding of planet formation is necessary to infer the occurrence of habitable worlds beyond our solar neighborhood. I'll discuss how molecular spectroscopy is used to study the formation of potentially habitable planets.

9:20 a.m. Kim J. S. * Pascucci I. Allen L. Apai D. Bergin T. Ciesla F. Eisner J. Fang M. Krijt S. Najita J. Rieke G. Salyk C.
Earths in Other Solar Systems: Fundamental Protoplanetary Disk Properties and Their Evolution **[#4071]**
Earths in Other Solar Systems is a NASA interdisciplinary exoplanet research program aiming at understanding how and where habitable planets form. We present an overview of objective 2: How are volatiles and organics processed in protoplanetary disks?

9:40 a.m. Schneider A. C. * Shkolnik E. L.
HAZMAT III. The UV Evolution of Mid-Type M Dwarfs with GALEX **[#4093]**
Using photometry from the Galaxy Evolution Explorer (GALEX), we investigate the UV evolution early- and mid-type M dwarfs and discuss how that evolution could affect potentially habitable planets.

10:00 a.m. Breakout Session Advertisements

10:10 a.m. BREAK

Chair: Leslie Rogers

10:40 a.m. Mulders G. D. * Pascucci I. Apai D. Ciesla F. J. O'Brien D. P.
Constraining Planet Formation Models from the Kepler Exoplanet Population **[#4047]**
We use the Kepler exoplanet population to constrain the different planet formation models, with a focus on constraining exoplanet composition.

11:00 a.m. Ford E. B. * Carrera D. Jontof-Hutter D. Lissuer J. J. Rogers L. A. Wolfgang A.
Orbital Dynamics of Planetary Systems with Super-Earths and Mini-Neptunes **[#4080]**
Planet formation directly determines various properties of planets that impact their habitability. I propose to review the orbital dynamics of exoplanetary systems, emphasizing the implications for characteristics likely to impact habitability.

11:30 a.m. Brain D. * Chaffin M. Jakosky B. Luhmann J. Dong C. Yelle R. Egan H.
Would Mars be Habitable If It Orbited an M Dwarf? Lessons from the MAVEN Mission **[#4043]**
MAVEN measures atmospheric escape from Mars. The MAVEN data can be used to guide thinking about a Mars-type planet around an M Dwarf. Could it retain enough of an atmosphere to allow for a habitable surface?

11:50 a.m. Krijt S. * Bowling T. J. Lyons R. J. Ciesla F. J.
Fast Litho-Panspermia in Tightly-Packed Systems Around M Dwarfs **[#4051]**
We investigate the fate of impact ejecta in tightly-packed planetary architectures like the TRAPPIST-1 system, finding that material transfer in such configurations is many orders of magnitude faster compared to the inner solar system.

12:10 p.m. Poster Pop-Ups

12:30 p.m. LUNCH

Tuesday, November 14, 2017
PANEL SESSION II

PLANETARY ASTROBIOLOGY: IDENTIFYING SOLAR SYSTEM AND EXOPLANET SYNERGIES

2:00–4:30 p.m. UWCC Salon E

Meadows V. S.

In this panel session, we will bring together authors of a new book in the University of Arizona Space Science Series, *Planetary Astrobiology*. This book is motivated by the profound questions of how life originated and the search for habitable environments beyond Earth. To adequately address these questions requires an interdisciplinary approach at the intersection of astronomy, planetary science, biology, and other fields. In this session, chapter authors and editors of this book will discuss their plans and chapter outlines and solicit feedback from the rest of the community. Solar system and exoplanet researchers will be able to discuss current and future directions of this book, and we will find commonalities in how our communities view, plan for, and conduct in the search for life on planets both nearby and orbiting distant stars. By weaving together solar system and exoplanet science, this book aims to break down barriers traditionally separating exoplanets from solar system planets in the search for life elsewhere in the universe. All attendees are invited to attend and provide feedback.

HOW DO STAR AND PROTOPLANETARY/DEBRIS DISK COMPOSITION AFFECT PLANET COMPOSITION?

2:00–4:30 p.m. MHRGC Salon D

Teske J. K.

While results from Kepler indicate that small planets are common in the Galaxy, detecting them and distinguishing their characteristics is still challenging, especially those in the traditional "habitable zones" of their stars. And yet, the small sample of well-characterized planets varies widely in size, density, and orbital properties. Does this diversity originate in how planets form within circumstellar disks that themselves are diverse? We want to better understand how star and disk properties are related to planet properties to inform the assessment of habitability in detected planet systems, and to help prioritize the best targets more for intensive/expensive follow-up observations. Specifically in this breakout, we will focus on the following questions:

1. What is the most up-to-date picture of host star compositions and their relation to planet properties?
   Invited talk by Kamber Schwarz — Cataloguing the Chemical Inventory in Disks: Implications for Planets (25 minutes)
2. What is the most up-to-date picture of protoplanetary/debris disk compositions and their relation to planet properties?
   Invited talk by Gijs Mulders — The Relation Between Exoplanets and Stellar Composition" (25 minutes)
3. How do various planet formation mechanisms impact planet composition?
4. What assumptions can we confidently make about the similarity of star-disk-planet compositions (for small, terrestrial planets)? Contributed talks (6 minutes each)
   Daniel Carerra — Origin of Super-Earth Atmospheres
   Nick Ballering — Measuring the Composition of Debris Disk Dust
   Cayman Unterborn — Gauging Terrestrial Exoplanet Diversity from Host Star Compositions
   Wanda Feng — The Diversity of Exoplanetary Composition from White Dwarf Pollution
   Leslie Rogers
5. What assumptions still need testing, and what star/disk simulations or observations would be most informative for future characterization of habitable systems?
   Discussion amongst the group (60 minutes)

A STATISTICAL APPROACH TO
CHARACTERIZING HABITABLE EXOPLANETS
2:00–4:30 p.m. UWCC Salons FG

Kempton E. M-R.

While we may never be able to characterize individual extrasolar planets to the degree that we can for solar system planets, exoplanets provide us with a rich sample of objects for performing statistical studies of comparative planetology. Such studies can be brought to bear on habitable-zone planets as a way of identifying and confirming broad trends related to habitability and the emergence of life. In this session, we will develop and discuss the statistical comparative planetology approach in the context of broader discussions about exoplanet habitability. Presentations will focus on tools and specific observations that could be used to find indicators of habitability among a large sample of planets. We will then move on to a group brainstorming activity and small-group discussions centered on developing a set of statistical experiments necessary to assess planetary habitability. Our goal is to identify what observational and theoretical resources will be necessary to execute meaningful statistical studies of habitable planets and to motivate impactful future work to this end.

Wednesday, November 15, 2017
BIOSIGNATURES
8:25 a.m. MHRGC Salons ABCD

What are the indicators of habitable conditions and their histories?

8:25 a.m. Jang-Condell H. *
Announcements

Chair: Robert Howell

8:30 a.m. Domagal-Goldman S. D. *
The History and Future of Exoplanet Biosignatures **[#4156]**
This is a review of exoplanet biosignature science, including proposed biosignatures, biosignature theory, biosignature frameworks, and future exoplanet biosignature observatories.

9:00 a.m. Harman C. E. Jr.* Felton R. C. Domagal-Goldman S. Kasting J. F.
Oxygen False Positives in Terrestrial Planetary Atmospheres: An Update from the Front Lines **[#4072]**
We revisit reported accumulations of abiotic O_2 in the atmospheres of terrestrial planets orbiting M dwarfs as part of an ongoing photochemical model intercomparison. Some of the reported cases rely on assumptions that may not be self-consistent.

9:20 a.m. Ranjan S. * Wordsworth R. D. Sasselov D. D.
The Surface UV Environment on Planets Orbiting M-Dwarfs: Implications for Origins-of-Life Chemistry and Need for Experimental Follow-Up **[#4008]**
Multiple lines of evidence suggest UV light may have played a key role in the origin of life on Earth. However, temperate M-dwarf planets are UV-poor environments. I discuss the implications for origin-of-life scenarios on M-dwarf planets.

9:40 a.m. Johnson B. W. * Goldblatt C.
A New Model of the Earth System Nitrogen Cycle: How Plates and Life Affect the Atmosphere **[#4054]**
We have developed an Earth system N cycle model, including biologic and geologic fluxes and key nutrients such as phosphorus. The atmosphere can change mass significantly over Earth history, and the solid Earth contains most of the planet's N.

10:00 a.m. Poster Pop-Ups

10:10 a.m. BREAK

Chair: Meredith Elrod

10:40 a.m. Sohl L. E. * Chandler M. A. Way M. J. Jonas J. A.
The Role of Topography in Modulating the Climates of Habitable Worlds **[#4103]**
Using topography (realistic, reconstructed, or idealized continental distributions) in coupled atmosphere-ocean GCM simulations of potentially habitable planets reveals diverse habitable states not apparent from aquaplanet simulations alone.

Wednesday, November 15, 2017
EXOPLANET CHARACTERIZATION I
11:00 a.m. MHRGC Salons ABCD

How can we observe indicators of habitability?

Chair: Meredith Elrod

11:00 a.m. Meadows V. S. * Lustig-Yaeger J. Lincowski A. Arney G. N. Robinson T. D. Schwieterman E. W. Deming L. D. Tovar G.
Characterizing Terrestrial Exoplanets **[#4114]**
We will provide an overview of the measurements, techniques, and upcoming missions required to characterize terrestrial planet environments and evolution, and search for signs of habitability and life.

11:30 a.m. Lincowski A. P. * Meadows V. S. Crisp D. Robinson T. D. Luger R. Arney G. N.
Habitability Imposters: Extreme Terrestrial Climates in the Habitable Zone of M Dwarf Stars **[#4091]**
We use coupled climate-photochemical modeling of TRAPPIST-1 planets to present a variety of evolved environmental states and their spectral discriminants, for use by upcoming M dwarf planet characterization observations.

11:50 a.m. Feng Y. K. * Robinson T. D. Fortney J. J.
Characterizing Earth Analogs in Reflected Light: Atmospheric Retrieval Studies for Future Space Telescopes **[#4068]**
We present the first systematic exploration of retrievals on the atmospheres of terrestrial exoplanets as observed in reflected light with future direct imaging space missions.

12:10 p.m. Poster Pop-Ups

12:30 p.m. LUNCH AND EXCURSIONS

Thursday, November 16, 2017
EXOPLANET CHARACTERIZATION II
8:25 a.m. MHRGC Salons ABCD

8:25 a.m. Jang-Condell H. *
Announcements

Chair: Dawn Gelino

8:30 a.m. Luger R. * Lustig-Yaeger J. Agol E.
Probing the Orbital and Atmospheric Properties of the TRAPPIST-1 Planets with JWST **[#4100]**
We investigate planet-planet occultations in the TRAPPIST-1 system. We show that these events are potentially detectable with JWST and can yield information about the eccentricities, masses, and day/night temperature contrast of the planets.

8:50 a.m. Kempton E. M.-R. * Rogers L. A. Marounina N. Le H. V.
Determining the Bulk Water Abundance of Low-Mass Exoplanets **[#4053]**
I describe efforts to build a self-consistent whole-planet modeling framework by coupling together calculations of a planet's interior structure and atmosphere to determine the observable signatures of a planet with a specified water content.

Thursday, November 16, 2017
EXOPLANET DETECTION METHODS AND MISSIONS
9:10 a.m. MHRGC Salons ABCD

Chair: Dawn Gelino

9:10 a.m. Batalha N. M. * Bryson S. T. Shabram M. Thompson S. E. Burke C. J. Coughlin J. L. Christiansen J. L.
Kepler Completes Its Prime Mission **[#4145]**
In 2017, Kepler formally completed its prime mission. The final planet catalog will be described, and some of the key new product deliveries will be highlighted. We will also report on a first look at planet occurrence rates using the DR25 products.

9:40 a.m. Charbonneau D. *
A Review of the Near-Future Opportunity Afforded by the Discovery of Temperate, Terrestrial Planets Orbiting Nearby M-Dwarfs **[#4132]**
Temperate, terrestrial planets orbiting nearby small stars offer the only opportunity to study the atmospheres of potentially habitable exoplanets in the next decade. I will review the M-dwarf opportunity with a focus on recent progress.

10:10 a.m. Breakout Session Advertisements

10:20 a.m. BREAK

Chair: Angelle Tanner

10:50 a.m. Turnbull M. C. * Macintosh B. Kasdin J. Seager S. Roberge A. Marley M. Mandell A. Lupu R. Hildebrandt S. Lewis N. Shaklan S. Stark C.
Direct Imaging of the Nearest Planetary Systems with NASA's WFIRST Mission **[#4155]**
Using the Coronagraph Instrument (CGI), WFIRST will enable our generation, for the first time in human history, to directly image and characterize planets similar to those in our solar system. We will review the purpose and status of the mission.

11:10 a.m. Rackham B. V. * Apai D. Giampapa M. S.
The Light Source Problem: The Effect of Heterogeneous Stellar Photospheres on Searches for Transiting Exoplanet Biosignatures **[#4032]**
TESS will soon enable the study of terrestrial exoplanet atmospheres. However, spots and faculae in stellar photospheres can complicate these measurements by mimicking or masking atmospheric features. We detail our work to constrain this effect.

11:30 a.m. Cable M. L. * Spilker L. J. Postberg F. Waite J. H. Kempf S. Clark K. Reh K. Sherwood B. Lunine J. I.
Enceladus Life Finder (ELF): A Proposed Mission to Assess the Habitability of a Plume-Bearing World **[#4124]**
Enceladus is a uniquely accessible ocean world due to its plume emanating from the south polar terrain. Here we discuss the Enceladus Life Finder mission concept and its implications for this and other ocean worlds.

11:50 a.m. Hinkel N. R. *
Using Stellar Abundances to Predict Exoplanet Host Stars **[#4059]**
Using the Hypatia Catalog, we have formulated a planet-predicting algorithm that uses an ensemble of stellar abundances to determine which stars in the solar neighborhood are likely (+90%) to host to-date undetected giant exoplanets.

12:10 p.m. Poster Pop-Ups

12:30 p.m. LUNCH

Thursday, November 16, 2017
PANEL SESSION III

DESIGNING THE FUTURE OF EXOPLANET EXPLORATION: NASA MISSION STUDIES FORUM

2:00–4:30 p.m. MHRGC Salons AB

Stapelfeldt K. R. Domagal-Goldman S. Stevenson K.

What are NASA and the community doing to design the future of Exoplanet Exploration ? This session will address this question by reviewing how NASA is organized to meet this challenge and what the community is doing to develop options for future exoplanet missions. Data archives, groundbased observations that support current and upcoming missions, and technology development are all going on today. The range of possible futures we'll discuss includes an Explorer mission dedicated to transit spectroscopy (FINESSE) and four large mission concepts to be considered by the 2020 Decadal Survey: 1) Habitable Exoplanet Imaging Mission (HabEx), 2) Large UV-Optical-InfraRed Surveyor (LUVOIR), 3) Lynx (a large general-purpose X-ray telescope), and 4) the Origins Space Telescope (OST).

Both HabEx and LUVOIR would image rocky exoplanets in habitable zones from ultraviolet to near-infrared wavelengths. OST will study circumstellar disks and obtain mid-infrared spectra of transiting habitable exoplanets, while Lynx would address the impact of stellar activity on habitability. We will discuss how individual scientists can become involved with these mission studies and the overall NASA Exoplanet Exploration Program (ExEP), and also invite your comments on what more NASA could or should be doing to advance the field toward the goal of discovering and characterizing habitable exoplanets in the solar neighborhood.

2:00 p.m. Introduction/Overview (Doug Hudgins, NASA Headquarters)
2:10 p.m. Origins Space Telescope Mission Concept (Johannes Staguhn, Johns Hopkins University)
2:25 p.m. Lynx Mission Concept (Jeremy Drake, Harvard Center for Astrophysics)
2:40 p.m. HabEx Mission Concept (Leslie Rodgers, University of Chicago)
2:55 p.m. LUVOIR Mission Concept (Aki Roberge, NASA Goddard Space Flight Center)
3:10 p.m. Break
3:20 p.m. FINESSE Explorer Mission Concept (Jacob Bean, University of Chicago)
3:35 p.m. Technology Development for Exoplanet Missions (Karl Stapelfeldt, JPL/Caltech)
3:50 p.m. Groundbased Mission Support (Dawn Gelino, NExScI TBC)
4:00 p.m. Community Discussion (ExoPAG EC members lead)

WILL EVIDENCE OF EXTANT LIFE ON AN EXOPLANET BE DETECTED BY 2040?

2:00–4:30 p.m. MHRGC Salons CD

Marounina N.

The search for evidence of life beyond the confines of Earth is a driving impetus in the field of exoplanets. Indeed, it is a primary motivation for the Habitable Worlds 2017 Workshop and it requires an interdisciplinary approach. This session will center around a debate of the proposition: **Will evidence of extant life on an exoplanet be detected by 2040?** This proposition is intentionally broad so that every attendee (including geologists, astronomers, planetary scientists, heliophysicists, and biologists) will have a perspective that they can add. The aim is for a lighthearted, friendly debate that will provide a fun way to synthesize the diverse topics covered throughout the workshop.

An initial case will be made by a pre-selected panel of 6 scientists from among the workshop registrants (3 for the "yes" side and 3 for the "no" side). Ample time will allow members of the audience to give arguments in support of either side and to ask questions to both teams. The goal is to foster high levels of active involvement from many different audience members. There will be a general vote on the debate question before and at the end of the debate. The winning side will be determined by the team that swayed the most voters.

POSTER SESSION II

5:00–6:30 p.m. UWCC Grand Ballroom

Friday, November 17, 2017
WRAP-UP
8:30 a.m. MHRGC Salons ABCD

8:30 a.m. Breakout Session Reports

9:30 a.m. Discussion

10:00 a.m. Adjourn

PRINT ONLY

Colon K. D. Barentsen G. Vinicius Z. Vanderburg A. Coughlin J. Thompson S. Mullally F. Barclay T. Quintana E.
Chasing Small Exoplanets with Ground-Based Near-Infrared Transit Photometry **[#4022]**
I will present results from a ground-based survey to measure the infrared radius and other properties of small K2 exoplanets and candidates. The survey is preparation for upcoming discoveries from TESS and characterization with JWST.

Laine P. E.
White Dwarfs and Icy Worlds — Evolving Habitability **[#4044]**
White dwarfs are the final state of stellar evolution of the most stars in the Milky Way. Could the icy worlds in outer system remain habitable during the whole lifespan of the star all the way to slowly cooling white dwarf?

Laine P. E.
Transits in the Solar System and the Composition of the Exoplanet Atmospheres **[#4058]**
It would be useful to measure Earth's and other terrestrial planets' transits, occultations, and reflections from different locations in the solar system, in order to compare their light curves and spectra to ones from exoplanets.

Lestrade J.-F.
Exo-Kuiper Belts and Water Deliverable to Planets **[#4030]**
The ice and hydrated minerals of planetesimals in exo-Kuiper belts provide a reservoir of water deliverable to the inner planetary system. We study how early stellar encounters can trigger comet showers and deliver water to the planets.

Miller H. A. Lopez T. M. Fischer T. P. Schrenk M. O.
Identifying the Linkages Between Microbial Activity and Gas Flux of Subaerial Volcanic Environments: A Guide to Exploring Magmatic Planets and Moons **[#4137]**
Promising contemporary analogs of habitable environments are fumaroles associated with active volcanism. Experimental studies linking sediments, microbes, and volatile outgassing may lead to new bio- or geosignatures of habitability.

Miura Y. Kato T.
Habitable Planets with Dynamic System of Global Air-Liquid-Solid Planet and Life **[#4153]**
Habitable zone is dynamic three phase states (air-liquid-solid), which will be obtained in water-planet with volatile exchanges. Water and carbon-bearing grains at older extraterrestrial stones suggest that there are no global ocean water systems.

Mojzsis S. J. Kelly N. M. Brasser R. Abramov O.
Thermal Effects of Impact Bombardments in the Early Solar System **[#4117]**
We report new 3-D analytical thermal models to explore how silicate crusts thermally responded to bombardment, provide detailed dynamical models of solar system evolution to explain these bombardments, and explain how this modulates habitability.

Ramirez R. M.
Habitable Zones: Extensions in Space and Time **[#4002]**
We expand the definition of the CO_2-H_2O habitable zone in time and space. We 1) argue for habitable conditions in both the pre- and post-main-sequence, and 2) show that hydrogen and methane can increase the size of the habitable zone.

Saeed M. I. Goderya S. N. Khan F. M. Chishtie F. A.
New Photometric Observations of Three Transiting Hot Jupiters Named TrES-3b, WASP-2b, and HATP-30b **[#4115]**
This work involves study of three hot Jupiters using a 0.8 m telescope at Tarleton State University. TAP software is used for light-curve analysis of observed data. This suggests that hot Jupiters can be observed using small telescopes as well.

Sandora M. E.
Habitability and the Multiverse **[#4122]**
Are the laws of physics set to maximize the habitability of the universe? We study how plate tectonics, core and mantle composition, homochirality, photosynthesis, and planet size depend on physics, and make predictions for where life will be found.

Simon J. B. Armitage P. J. Youdin A. N. Li R.
Planetesimal Formation: Evidence for a Universal Initial Size Distribution **[#4005]**
We present numerical simulations of planetesimal formation via the streaming instability and provide evidence that the initial size distribution is universal, which may have far reaching consequences for understanding the origin of these bodies.

Tyler R. H.
The Importance of Self-Tuned Wave Guides in Fluid Habitats for Life **[#4031]**
This study shows that self-tuned wave guides can form in fluids, with an important consequence of greatly raising the efficiency in which a system's spin/orbit energy is tidally transferred to the fluid.

Wilson D. J. Gaensicke B. T.
Remnant Planetary Systems at White Dwarfs **[#4055]**
Observations of remnant planetary systems at white dwarfs provide measurements of the bulk chemistry of solid planets and probe the fate of planetary systems. I will review the field and discuss evidence for water in extrasolar systems.

Zahnle K. J. *
Limits to Creation of Oxygen-Rich Atmospheres on Planets in the Outer Reaches of the Conventional Habitable Zone **[#4078]**
The habitable zone can be extended outwards by adding greenhouse gases, H_2 in particular. Here we point out that without hydrogen escape, such planets will not develop O_2 atmospheres, and thus represent a different kind of habitability than our's.