

The Exoplanet Program Analysis Group: Synergies with Solar System Science.

Victoria Meadows (UW, ExoPAG Chair)



Credit: NASA

The Exoplanet Program Analysis Group



The ExoPAG:

- Serves as a community-based group for soliciting and coordinating community analysis and input for Exoplanet Exploration objectives
- Provides findings of analyses to the NASA Astrophysics Division Director, that are made publicly available to the community.
- Enables direct regular communication between NASA and the community, and within the community, through open meetings, e-mail announcements and other mechanisms.
- Helps coordinate the community in providing input for Astro2020.
- Organizes and runs Study Analysis Groups and Science Interest Groups
- Open to all interested scientists. Next meeting around the January 2020 AAS

Credit: NASA

ExoPAG Executive Committee

ExoPAG activities and meetings are organized through an Executive Committee

Victoria Meadows (Chair)

University of Washington

Tom Barclay

Goddard Space Flight Center

Jessie Christiansen

NExSci/Caltech

Rebecca Jensen-Clem

UC-Berkeley

Tiffany Kataria

JPL/Caltech

Eliza Kempton

University of Maryland

Michael Meyer

University of Michigan

Josh Pepper

LeHigh University

Dimitry Savranski

Cornell

Chris Stark

Space Telescope Science Institute

Johanna Teske

Carnegie Observatories

Alan Boss (Past Chair)

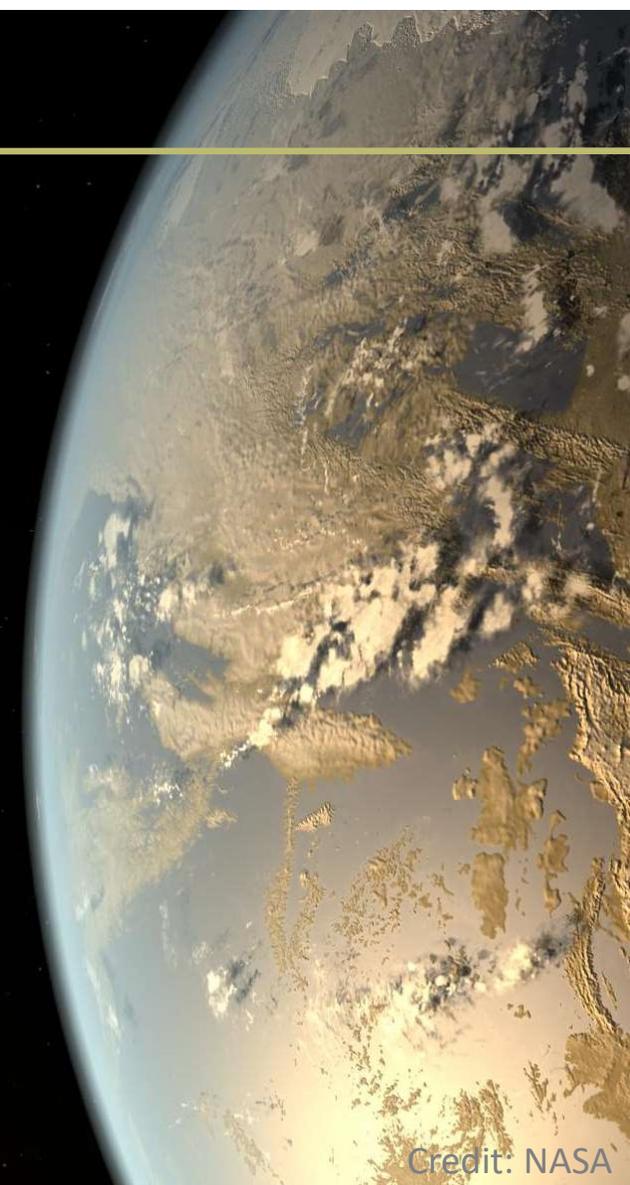
Carnegie Institution of Washington

Martin Still (ex officio)

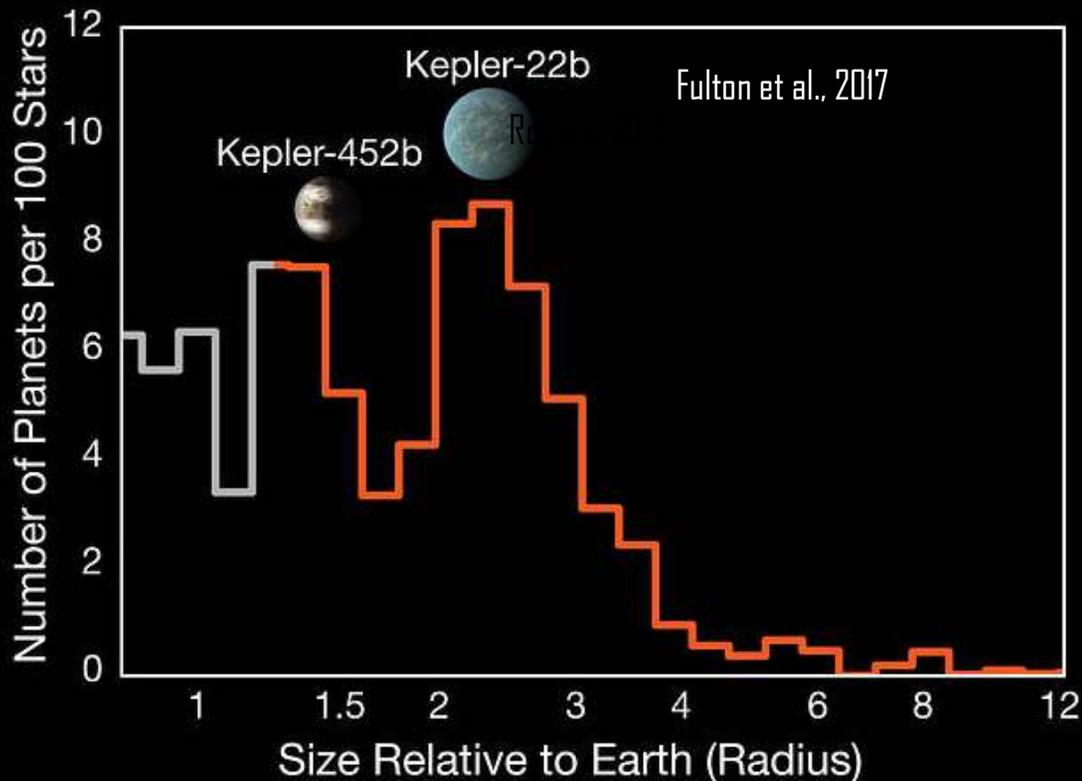
NASA

Selected by NASA for 3-year terms. Calls for membership every year!

Credit: NASA



Terrestrial-class and Neptune-class exoplanets are common



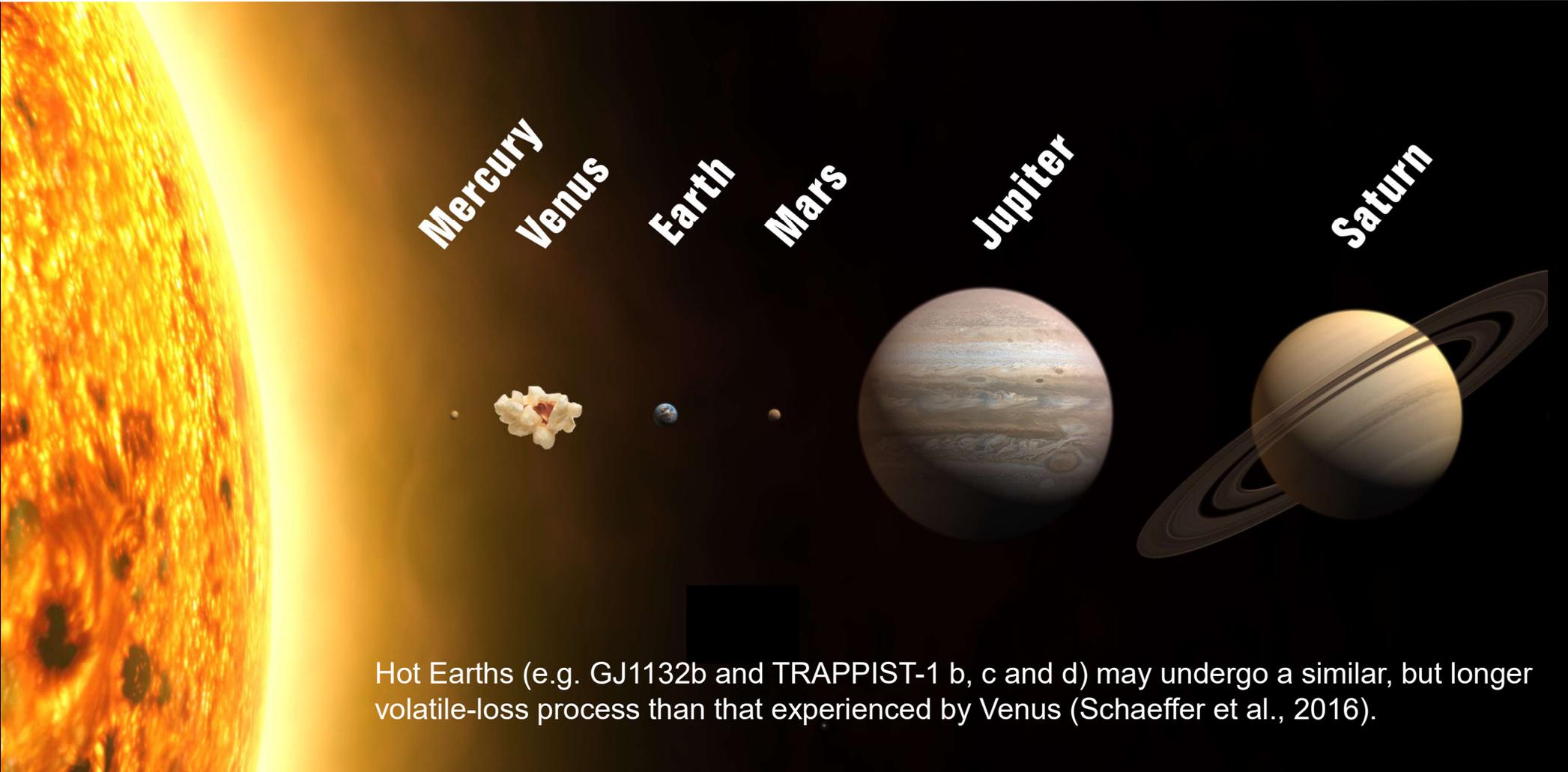
Solar System planets could serve as “exoplanets in our back yard” to understand environments and processes for some of the most common types of exoplanets.

At the same time, the exoplanet population provides a diversity of planetary types that are NOT found in the Solar System, and the evolution and nature of these bodies may inform Solar System science as well.

What observations of the sub-Neptune and Neptune-class exoplanet populations would help us understand the formation, evolution and key processes in Solar System terrestrials?

Planets with $R < 1.5 R_{\text{Earth}}$ are more likely to be terrestrial, and appear to be a distinct population

Terrestrials Undergo Stellar, Geological and Atmospheric Evolution



Hot Earths (e.g. GJ1132b and TRAPPIST-1 b, c and d) may undergo a similar, but longer volatile-loss process than that experienced by Venus (Schaeffer et al., 2016).

Targets for Comparative Planetology of Terrestrial Exoplanets

- **Transiting exo-Venuses**
 - GJ1132 b (Berta-Thompson et al., 2016; Dittman et al., 2017)
- **HZ Terrestrial Planets**
 - LHS 1140 b (Dittman et al., 2016)
 - Proxima Centauri b (Anglada-Escude ; non-transiting)
 - Ross 128 b (Bonfils et al., 2017; non-transiting)
- **Transiting exo-Venuses and HZ Terrestrials**
 - TRAPPIST-1 (Gillon et al., 2016; 2017; Luger et al., 2017)
 - b,c,d exo-Venuses; e,f,g, HZ planets; h beyond HZ
- **What near-term and longer term observations of exoplanet terrestrials can inform our understanding of terrestrial evolution?**

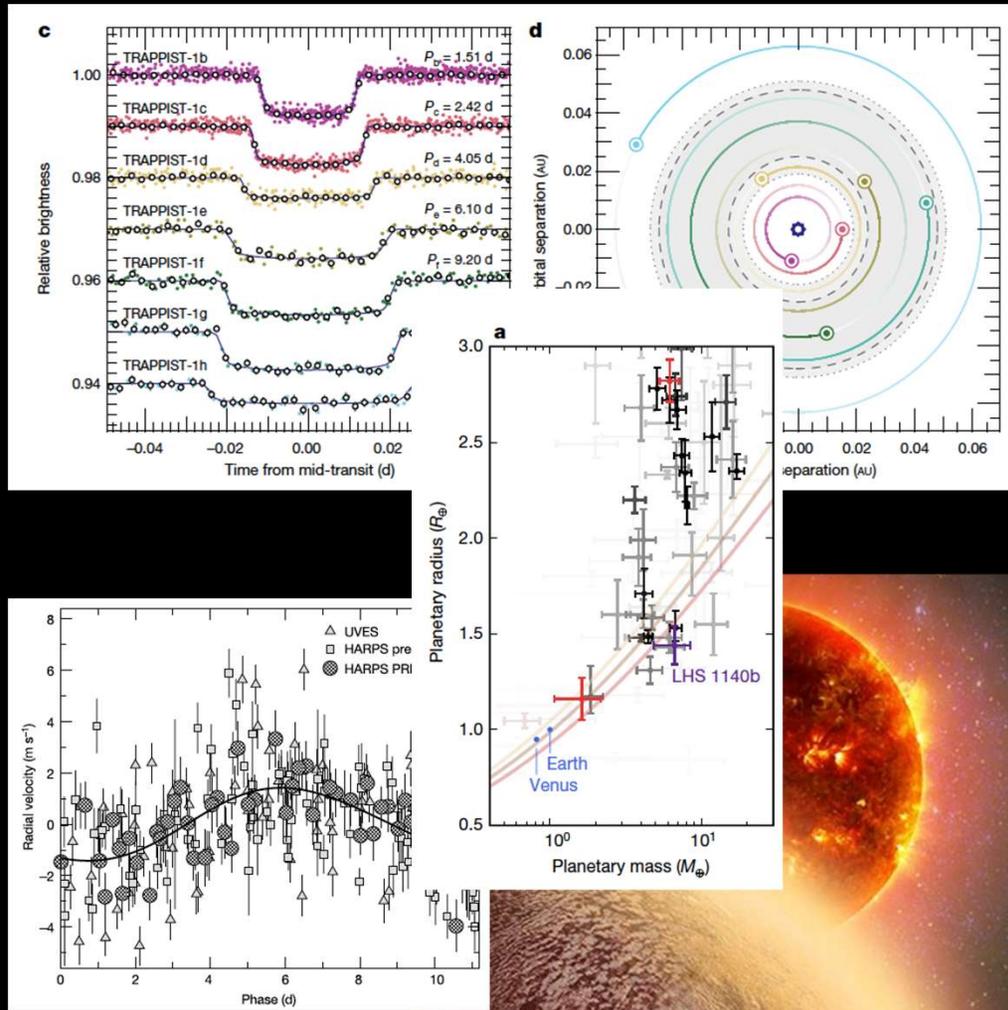
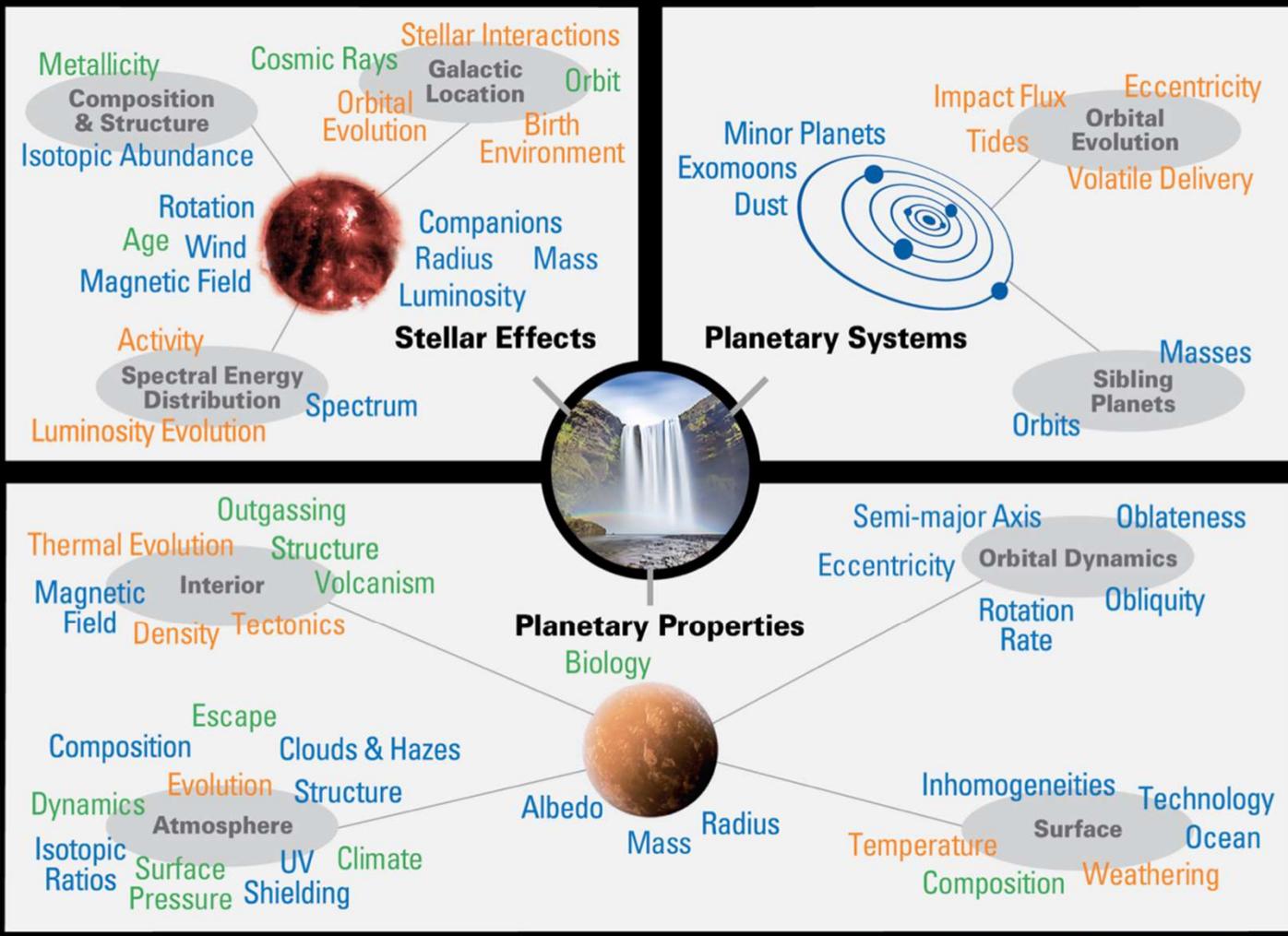


Figure Credit: NASA/JPL-Caltech

The Exoplanet – Solar System Synergy

Exoplanets = Planets
 Planetary evolutionary outcomes, including atmospheric composition, will be influenced by:
 planet formation and migration processes,
 interior outgassing composition and history
 history of planetary and stellar interactions
 -- including atmospheric loss and photochemistry

Which Solar system planetary observations and theories can illuminate key processes that affect the formation, evolution and habitability of a diversity of planets?

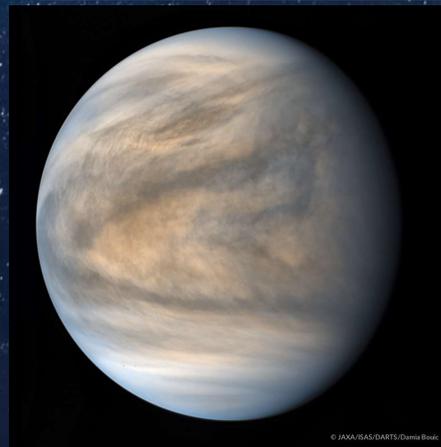


Exoplanets in our Backyard: Solar System and Exoplanet Synergies on Planetary Formation, Evolution, and Habitability

- Motivation: Bring together planetary science and exoplanet communities to coordinate cross-division efforts for analog studies of the planets most relevant to known exoplanets
- Date: Week of Feb. 3
- Location: Houston, TX
- Organizing Committee:
 - Vikki Meadows (ExoPAG)
 - Stephen Kane (ExoPAG)
 - Darby Dyar (VEXAG)
 - Giada Arney (VEXAG)
 - Noam Izenberg (VEXAG)
 - Abi Rymer (OPAG)
 - Lynnae Quick (OPAG)
 - Kathy Mandt (OPAG)

The most common exoplanet classes discovered are in need of detailed analog studies in our solar system:

- Orbiting close to their star, like Venus
- Neptune-size mass range



© JAMA/ISAG/DARTS/Damir Boic



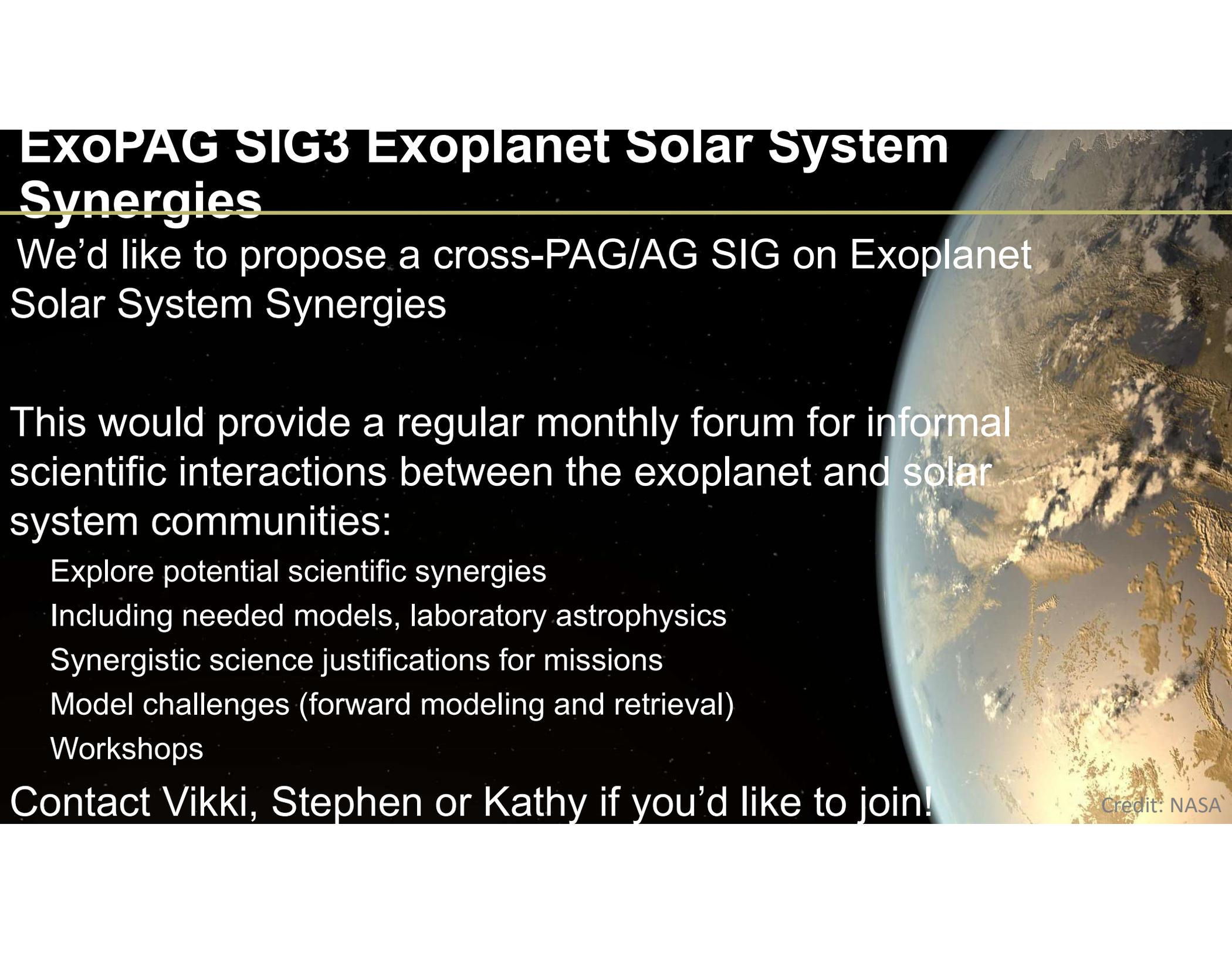
Uranus

Photographed by Voyager 2
in January 1986

Neptune

Photographed by Voyager 2
in August 1989

ExoPAG SIG3 Exoplanet Solar System Synergies



We'd like to propose a cross-PAG/AG SIG on Exoplanet Solar System Synergies

This would provide a regular monthly forum for informal scientific interactions between the exoplanet and solar system communities:

- Explore potential scientific synergies

- Including needed models, laboratory astrophysics

- Synergistic science justifications for missions

- Model challenges (forward modeling and retrieval)

- Workshops

Contact Vikki, Stephen or Kathy if you'd like to join!

Credit: NASA