



The Nexus for Exoplanet System Science

<https://nexss.info>

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(and many others to be named in a minute)

ExoPAG 13, 1/4/16

What is NExSS?

- A research coordination network dedicated to the study of planetary habitability
- A NASA cross-division initiative bringing astrophysicists, planetary scientists, Earth scientists, and heliophysicists together to bring a “systems science” approach to this problem

Scientific goals of NExSS

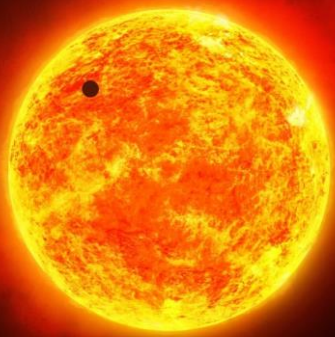
- Investigate the diversity of planets
- Understand how planet history, geology, and climate interact to create the conditions for life
- Put planets into an architectural context as stellar systems built over time by dynamical processes and sculpted by stars
- Use experience from solar system (including Earth) history to identify where habitable niches are most likely to occur and which planets are most likely to be habitable
- Leverage NASA investments in research and missions to accelerate discovery and characterization of potential life-bearing worlds

How Was NExSS Formed?

- Leveraged selections from *existing* FY15 ROSES NRAs and CANs
- 17 PIs already selected from NAI, XRP, APT, ADAP, Living With a Star proposal calls were invited to become part of the pilot project
- No new research funds as a result of joining NExSS
- NExSS teams are responsible for organizing community-wide activities that reach well beyond NExSS team members

Why NExSS?

- Serve as a facilitator to bring community together on important topics
- Observations will not be able to directly constrain everything we need to assess habitability
- How can the community best approach decisions on which detected planets to follow up on to optimize the search for life?
- Understand what unobserved aspects of planets might be inferred from what can be observed
- Place planets into the larger context of their stellar systems and evolution
- Complement ExoPAG priorities by bringing in viewpoints from other disciplines

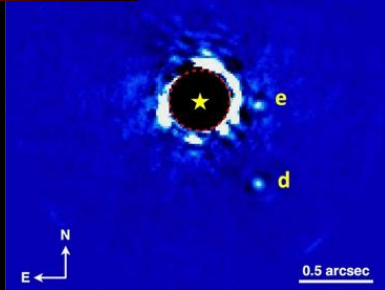


D. Fischer
 E. Ford
 J. Wright
 D. Deming
 A. Jensen
 J. Graham

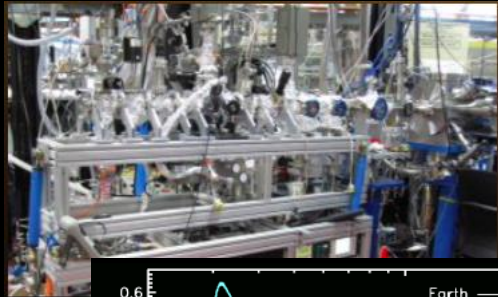
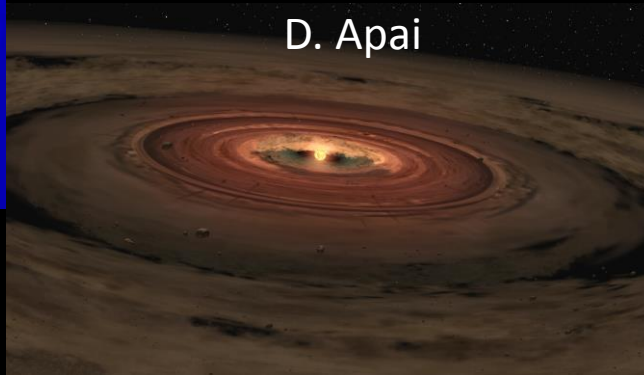
The NExSS Teams

HQ reps:
 Mary Voytek (PSD)
 Martin Still (ASD)
 Jeff Newmark (HSD)
 Shawn Domagal-Goldman

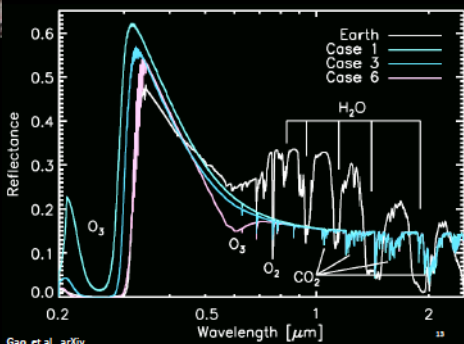
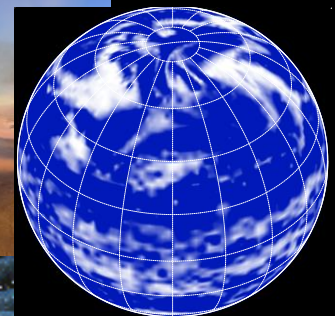
Co-leads:
 Natalie Batalha
 Dawn Gelino
 Tony Del Genio



N. Turner
 H. Jang-Condell
 D. Apai



H. Imanaka
 J. Fortney



B. Moore
 V. Airapetian



W. Henning
 S. Desch
 V. Meadows
 T. Del Genio

White paper: Laboratory Work for Understanding Exoplanet Atmospheres (led by J. Fortney)

- NASA Astrophysics R&A program (NOIs due 1/22): “highlights the timeliness of Laboratory Astrophysics proposals pertaining to JWST” added on 12/11
- Topics raised by NExSS team members
 - Pressure-induced line broadening parameters (self- , foreign)
 - Optical properties of particles, haze formation
 - Reaction rate constants
 - Photoabsorption cross-sections at high T
 - Lab spectroscopy of continuum absorption
 - Oxygen absorption by early magma ocean
- Draft to be released for community comment later this month

Upstairs Downstairs: Consequences of Internal Planet Evolution for the Habitability and Detectability of Life on Extrasolar Planets

Tempe, AZ, Feb. 17-19 (led by S. Desch)

nai.nasa.gov/calendar/www-upstairs-downstairs

- Workshop Without Walls concept: in-person attendance + virtual participation
- Winter school for grad students, early postdocs (Apai, Desch)
- Guiding themes
 - current and near-future obs bearing on aspects of exoplanet geophysics and geochemistry that affect habitability and detectability
 - understanding of planet formation to inform ability to predict planet compositions and geophysical, geochemical parameters
 - long-term obs. aims for atmospheres, biosignatures and effect of surface-atmosphere interactions
 - limits of understanding of planet material behaviors and surface tectonics
 - limits of understanding of solid planet evolution



Other planned activities, collaborations:

- Participating in proposed SAG#16 (Biosignatures, led by S. Domagal-Goldman, N. Kiang, N. Parenteau), feeds into STDT
- Possible workshop in support of SAG#15 (Obs constraints and science questions for direct imaging missions, led by D. Apai)
- Cross-team, cross-discipline collaborations as a result of NExSS
 - Planetary scientists and astrophysicists to characterize short-period rocky planets
 - Statistical and machine learning approaches to detect low-mass planets in presence of stellar activity
 - Heliophysicists and astrophysicists to estimate mass loss in young Sun-like stars

Ideas for possible future workshops

- How can we identify potentially habitable planets?
- Initial conditions and dynamical histories favoring habitable planets
- Space weather constraints on escape and other aspects of habitability
- Limits to planet detection by various techniques
- Characterizing planets that are unlikely to be habitable