• Welcome
Exoplanet Program Analysis Group (ExoPAG) 24

Michael Meyer (U. Michigan)
Chair, ExoPAG Executive Committee

June 24, 2021
Exoplanet Program Analysis Group (ExoPAG)
https://exoplanets.nasa.gov/exep/exopag/overview

- The Exoplanet Exploration Program Analysis Group (ExoPAG) is a community-based, interdisciplinary forum for soliciting and coordinating community analysis and input in support of Exoplanet Exploration objectives, and of their implications for architecture planning and activity prioritization for future exploration.

- The ExoPAG reports findings of analyses to the NASA Astrophysics Division Director.
The Exoplanet Program Analysis Group (ExoPAG)

- The ExoPAG enables direct regular communication between NASA and the community through public meetings that give the community opportunities to provide scientific and programmatic input.

- The ExoPAG consists of all members of the community who participate in these open meetings.
ExoPAG Executive Committee

Michael Meyer (Chair)  
*University of Michigan*

Tom Barclay  
*University of Maryland*

Natasha Batalha  
NASA-Ames

Jacob Bean  
The University of Chicago

Jessie Christiansen  
NExScI/Caltech

Rebecca Jensen-Clem  
UC-Santa Cruz

John Debes  
Space Telescope Science Institute

Tiffany Kataria  
JPL/Caltech

Josh Pepper  
Lehigh University

Dmitry Savransky  
Cornell

Laura Schaefer  
Stanford University

Vikki Meadows (Past Chair)  
*University of Washington*

Douglas Hudgins (Astrophysics)  
NASA HQ

Hannah Jang-Condell (ExEP DS)  
NASA HQ

Doris Daou (Planetary Liaison)  
NASA HQ

Richard Eckman (Earth Liaison)  
NASA HQ

Gaylan Fowler (Heliophys Liaison)  
NASA HQ

*Thank you for your service!*

Credit: NASA
ExoPAG Executive Committee

Michael Meyer (Chair)  University of Michigan
Natasha Batalha       NASA-Ames
Jacob Bean            The University of Chicago
Michael Bottom        The University of Hawaii
Ofer Cohen            University of Massachusetts Lowell
Knicole Colon         Goddard Space Flight Center
John Debes            Space Telescope Science Institute
Tiffany Kataria       JPL/Caltech
Ilaria Pascucci       The University of Arizona
Josh Pepper           Lehigh University
Dmitry Savransky      Cornell
Laura Schaefer        Stanford University
Douglas Hudgins (Astrophysics) NASA HQ
Hannah Jang-Condell (ExEP DS) NASA HQ
Doris Daou (Planetary Liaison) NASA HQ
Richard Eckman (Earth Liaison) NASA HQ
Gaylan Fowler (Heliophys Liaison) NASA HQ

Our newest members!
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**ExEP Program (Chair: Michael Meyer)**

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**Science Updates (Chair: Knicole Colon)**

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**Business Meeting (Chair: M. Meyer)**

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**Adjourn**
ExoPAG Recent Activities (since ExoPAG23)

- Launch of Exoplanet Explorers (T. Kataria)!
- On-line poll conducted on finding (next slides).
- Present to PSAC in March and June (L. Schaefer).
- Presented to APAC March 15-17 (upcoming June 29-30).
- Participated in NExSS/P/AG roundtable in May.

(Stay tuned for news about Exolanets in Our Backyard II in 2022).

- New APD Cross PAG activities:
  - Cross PAG SAG on URM in APD Space Science (proposed).
  - Discuss Tech Gap synergies & NASA data policy.
What are “ExoPAG Findings”?:

• Process for whole community to contribute to analyses forwarded to Astrophysics Division leadership as input.

• We do not give “recommendations” but “findings” based on analysis.

• Three findings approved in January 2020 and one in March 2021.
  https://exoplanets.nasa.gov/exep/exopag/exopagFoundingDocuments/exopag-findings/

• Ideas for new findings solicited from community (e.g. ExoPAG email and at Business Meetings) and discussed at community forum (e.g. Summer ExoPAG).

• Those with community support are reviewed by ExoPAG EC and top 1-3 findings put forward to ExoPAG for a vote (more than 2/3 support needed to “pass”).

• Ideas not adopted (or selected for vote) can be kept and re-discussed in future.

• Affirmation of findings generally scheduled for winter ExoPAG meeting.

Credit: NASA
ExoPAG Proposed Finding: On-line Poll March 1-10

On the value of investing in interdisciplinary exoplanet science of scale over longer periods of performance.

https://exoplanets.nasa.gov/exep/exopag/exopagFoundingDocuments/exopag-findings/

- Meant to mimic process of in person votes (public, vote once).
- 50 participants vs. ~60 at face-to-face meeting.
- 41 yes, 7 no, 2 abstentions.
- Since more than 2:1 in favor, finding was shared with APD.
## Current Status of SAGs and SIGs

<table>
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<tr>
<th>Close Year</th>
<th>SAG or SIG</th>
<th>Title</th>
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<tbody>
<tr>
<td>2021</td>
<td>SAG 19</td>
<td>Exoplanet imaging signal detection theory and rigorous contrast</td>
<td>Mawet &amp; Jensen-Clem</td>
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<td>metrics (final report accepted by APD and closed!)</td>
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<td>SIG 2</td>
<td>Exoplanet Demographics (report this meeting)</td>
<td>Christiansen &amp; Meyer</td>
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<td>Exoplanet Solar System Synergies (on-going).</td>
<td>Meadows &amp; Mandt</td>
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<td>SAG 21</td>
<td>Stellar Contamination on Transit Spectra (report this meeting)</td>
<td>Rackham &amp; Espinoza</td>
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<td>SAG 22</td>
<td>Exoplanet Host Properties (on-going)</td>
<td>Pepper, Stark, &amp; Hinkel</td>
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Summary of Findings

- The contrast curve represents a single choice of a detection threshold, false positive fraction, and true positive fraction (e.g. a 3σ contrast curve indicates a detection threshold of 3σ, a false positive fraction of 0.001 assuming the noise follows a Gaussian distribution, and a true positive fraction of 0.5). Fixing these values with respect to separation from the central star may not be optimal for all applications.

- A contrast curve can be invoked as a frequentist upper limit on the detectability of a planet with a certain separation and brightness. However, a Bayesian upper limit is better suited to rejecting hypotheses regarding a particular planet’s detection because it is a statement about the probability of a parameter (e.g. a planet’s brightness) to lie within a given interval in the data.

- The contrast curve includes the implicit assumption that the noise in the science image follows a Gaussian distribution. However, the presence of speckles near the coronagraph’s inner working angle in the final post-processed science image indicate that the noise is not fully whitened.

- Modern techniques for speckle subtraction (e.g. the Regime-Switching Model detection map; Dahlqvist et al., 2020), generally outperform first-generation techniques (e.g. LOCI; Lafrenière et al., 2007) when applied to the same datasets. However, machine learning techniques (e.g. SODINN; Gomez Gonzalez et al., 2018), do not yet outperform first-generation techniques.

https://exoplanets.nasa.gov/exep/exopag/sag/#sag19
ExoPAG 24 Final Session: Today 4:10-5:15 EST.

• Brief update on SIG3.

• Review of progress on actions.

• Share new ideas for ExoPAG priorities and activities!

• Consider proposing a finding for future discussion!

• Feel free to share announcements for the community.

Note: We anticipate ExoPAG Community Forum to be held after Astro2020 is released.
ExoPAG Meeting 24  June 24, 2021

- Meeting Website & Agenda: bit.ly/ExoPAG24
- ARC Q&A Tool: bit.ly/ExoPAG24_ARC
- Suggestions Form: bit.ly/ExoPAG24_Suggestions
- Proposed Findings Form: bit.ly/ExoPAG24_Findings
• Back-up Slides
ExoPAG Proposed Finding:

On the value of investing in interdisciplinary exoplanet science of scale over longer periods of performance.

"Whereas exoplanet science is inherently interdisciplinary, requiring expertise in heliophysics, earth science, planetary science, and astrophysics, among other disciplines, as well as deep and broad knowledge in theory, computation, observation, experiment, statistics, and instrument development, and whereas interdisciplinary research can require longer timeframes and greater resources to take full advantage of such diverse expertise within a collaboration, and whereas existing opportunities of scale that permit longer periods of performance to support interdisciplinary research teams are restricted to areas that specifically address the goals of the astrobiology program,

We find that longer term programs of scale (e.g. five year periods of performance and up to several million USD awards) would enable NASA to rapidly and efficiently address linked sets of the Exoplanet Exploration Program Science Gaps, for example 01-03, 02, 04-06, and 07-08-10, which contribute significantly to achieving NASA’s strategic goals, provided that such new opportunities did not come at the expense of existing programs which are also extremely valuable to help NASA achieve its strategic goals."
• Business Meeting Slides
ExoPAG 24 Final Session: Today 4:10-5:15 EST.

- Brief update on SIG3 (Laura).
- Review of progress on actions (Eric/Karl).
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Credit: NASA
New Ideas for ExoPAG Activities:

- Consider a new exozodi SAG based on the results from the HOSTS survey, new results from ALMA, recent high contrast imaging of debris disks in reflected light, studies of dust in the Solar system (and beyond), and archival results from Spitzer/Herschel (cf. SAG-1 report). Do we need a renewed effort to assess risk to exoplanet imaging missions presented by zodiacal light? (J. Debes).
- Discussion of common standards for publishing exoplanet discoveries (D. Savransky).
- Analysis of synergies between ground- and space-based technology (wavefront control and diffraction suppression), as well as science algorithm development, in the context of high contrast imaging. This could be particularly relevant in the era of JWST, rapid developments on the ground (e.g. focal plane wavefront sensing), ELTs, Roman CGI, and future direct imaging missions (to be discussed in future).
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Tentative Plans for ExoPAG Community Forum:

- After Astro2020 is released.

- Discussion to understand the recommendations, not proposing changes!

- May invite members of the committee for discussion:
  
  https://tinyurl.com/2skx23s5

- NASA will be charged with making a formal response and will do so later in the year (and will not soliciting input on that at this community forum).

- Will also have other agenda items at this forum (e.g. update on SAG22, etc).
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