

The Outer Planets Assessment Group (OPAG) and Exoplanets

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The Outer Planets Assessment Group (OPAG)



- NASA's community-based forum designed to provide science input for planning and prioritizing outer planet exploration activities for the next several decades.
- Chartered by NASA's Solar System Exploration Division and reports findings at meetings of the Solar System Exploration Sub-Committee of the NASA Space Science Advisory Committee.
- Open to all interested scientists
- Regularly evaluates outer solar system exploration goals, objectives, investigations and required measurements on the basis of the widest possible community outreach
- Next meetings: August 20-21, 2019 in Boulder, CO and **February 3-4, 2020 at LPI**

OPAG serves as a voice for the Outer Planets Community to NASA

OPAG Steering Committee and SOC Team for “Exoplanets in our Backyard”

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|--|--|
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<i>Goddard Space Flight Center</i> |
| • Linda Spilker (<i>Deputy Chair</i>)
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| • Jeff Bowman
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<i>Applied Physics Laboratory</i> |
| • Scott Edgington
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| • Amanda Hendrix
<i>Planetary Science Institute</i> | • Britney Schmidt
<i>Georgia Institute of Technology</i> |
| • Mark Hofstadter
<i>Jet Propulsion Laboratory</i> | • Thomas Spilker
<i>Consultant</i> |



- Lynnae Quick – Expert in volcanism and magmatism throughout the solar system. Investigates the evolution and maintenance of subsurface oceans in icy moons, and evaluates their potential to serve as analogs for cold, H₂O-rich exoplanets.
- Abigail Rymer – Expert in interactions between the Sun and planets in our Solar System. Explores Giant Planets with a particular focus on what we can learn from exploring the Ice Giants.
- Kathleen Mandt – Expert on atmospheric evolution and the implications for the origin and evolution of volatiles in planetary atmospheres.

There is a strong general interest from the Outer Planets community in working with the Exoplanets community in the characterizations of Exoplanets

Ice Giants as Exoplanet Analogs

- Ice Giant mass/radius common among detected exoplanets
- Our Ice Giants only explored by single flybys
- Major questions remain about interior, composition, and interaction with the Sun

WHITE PAPER FOR EXOPLANET SCIENCE STRATEGY 2018

Solar System Ice Giants: Exoplanets in our Backyard.

Co-authors and 102 endorsers:

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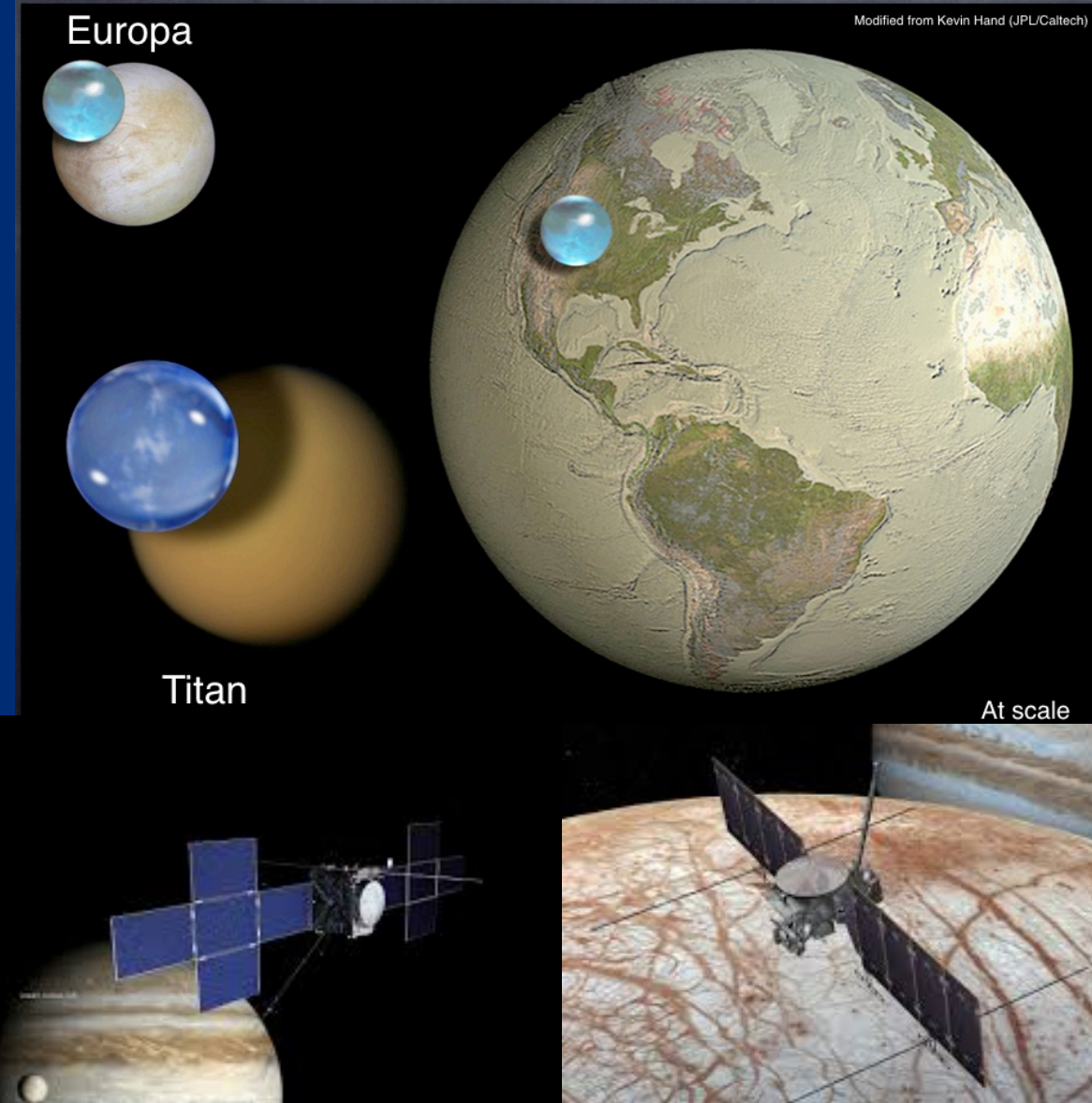
'It Takes a Village.' Collaborative Outer Planet Missions.



What observations of our Ice Giants would help advance Exoplanet characterization efforts?

Icy Moons and Habitability

- Major focus in Planetary Science is determining if life could exist on “Ocean Worlds”
- Exoplanet scientists are also posing this question about the potential for life on icy exomoons
- Bulk densities and effective temperatures of some exoplanets (e.g., Trappist-1h & Kepler 138 d) are consistent with H₂O-rich compositions and possibly ice-covered surfaces



What observations could Planetary missions exploring icy moons make to advance Exoplanet studies searching for habitable ocean worlds beyond the solar system?

Advancing Space Science Requires NASA Support for Coordination Between the Science Mission Directorate Communities

Kathleen E Mandt, and 40+ co-authors from 16+ organizations (see QR code for full list)
Johns Hopkins University Applied Physics Laboratory, Laurel, MD
Contact Kathleen.Mandt@jhuapl.edu or @mommascientist to be added as a co-signer



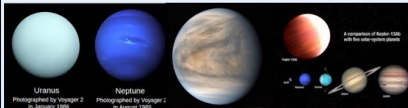
♦ Abstract

Awareness is growing that cross-disciplinary efforts are needed to make important advances in space science. This requires greater coordination and collaboration between the four communities represented by the NASA Science Mission Directorate (SMD) Divisions. **The Exoplanet Science Strategy (NAS, 2018)** states that advancing exoplanet science requires collaboration, and calls for a coordinated effort throughout the entire space science community. However, this need for coordination is not limited to the exoplanet community. Many professional societies and organizations recognize this and are beginning to bring scientists together, primarily in the form of topical workshops and Town Halls. **We outline here specific steps that can be taken by the space science community and by NASA to further cross-disciplinary research.**

♦ Community Recommendations

♦ Inventory Needs

Inventory community needs: Communities should evaluate outstanding questions within their respective areas that also advance science for other communities. For example, Astrophysics and Planetary communities can determine questions about our solar system that need to be answered to advance exoplanet characterization.



♦ Advocate Across Disciplines

Advocate for observations that benefit multiple communities: Despite broad relevance, planetary science missions to Venus and the Ice Giants have been pushed to the sidelines by other goals within the Planetary community that have a narrower focus, as, for similar reasons, has any effort to fund a dedicated solar system telescope. This has prevented in situ observations that are needed for advancing exoplanet research. Advocacy from the astrophysics community in support of Venus and Ice Giants missions and a solar system telescope is needed to raise the priority of these missions within the overall science community. The same can be said for an Interstellar Probe, which would focus on Heliophysics science, but could also be used to benefit Planetary and Astrophysics research.

♦ Recommendations to NASA

♦ SMD Advisory committees

Assign cross-division representatives to the NASA SMD Advisory Committees, which play a critical role in advising Division Directors on strategic decisions, and shape the future of space science. Cross-division representation will provide input needed for cross-division coordination.

♦ Meetings

Fund cross-division meetings between the space science communities: ROSES Topical Workshops, Symposia, and Conferences as written does not appear useful for enabling cross-division workshops. A separate program focused entirely on workshops that enable cross-division collaboration is needed in future ROSES calls.

♦ Active and Future Missions



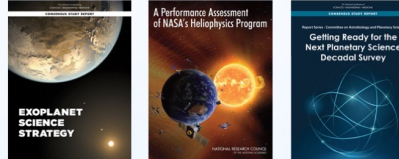
Incorporate cross-division science objectives into active and future missions: Steps that NASA could make to open up opportunities on active and future missions include:

- Evaluate active directed missions for their cross-division science potential and coordinate funding between Divisions to allow experts to work with mission teams to achieve the objectives. The Planetary Science Participating Scientist program is an ideal model for achieving this.
- All future directed mission studies should include an evaluation of cross-division science potential, similar to the effort being made for the Heliophysics Interstellar Probe study and the Large Astrophysics Mission Concept Studies.
- New and extended mission proposals should be encouraged to consider the feasibility of adding cross-division science objectives, and report on the results of this evaluation in the relevance section. Any cross-division goals should receive sufficient support from NASA and should not cut into the primary objectives of the mission.
- Consider mechanisms by which multiple science Divisions may support development of new cross-disciplinary strategic mission concepts and contribute funding to their formulation.

♦ Decadal Surveys



Request cross-division representatives to serve on decadal survey committees, which are the foundation of future space exploration. Including cross-division discussions in the decadal survey process will enable cross-division coordination.



♦ Networks, Institutes & Programs



Establish additional formal interdisciplinary networks, institutes, and R&A programs. NAS (2018) recommends: "Building on the NExSS model, NASA should support a cross-divisional exoplanet research coordination network that includes additional membership opportunities via dedicated proposal calls for interdisciplinary research." For exoplanets, areas that would benefit from greater coordination include: atmospheric loss and evolution, magnetospheres, and ocean worlds beyond the solar system. Other areas that would benefit from similar programs include: atmospheric dynamics, ocean worlds, aeronomy, and the study of astrospheres. Dedicated institutes and/or ROSES R&A programs would expand these efforts.



Create opportunities for mission scientists to participate in interdisciplinary networks. NExSS only supports researchers on R&A grants, but not those funded by NASA missions. Scientists working on missions like Cassini, New Horizons, Europa Clipper, and potential future missions to Venus and the Ice Giants could make valuable contributions to programs like NExSS.

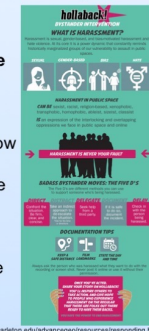
♦ Recommendations to both

♦ A Socially Healthy Community



NASA is in a position of power to eliminate barriers such as discrimination and harassment that prevent the space science community from being healthy and diverse. Much of the serious harm to the community caused by discrimination and harassment is directly connected to an abuse of power derived from control of NASA funds. NAS (2018) states: "To maximize scientific potential and opportunities for excellence, institutions and organizations can enable full participation by a diverse workforce by taking concrete steps to eliminate discrimination and harassment and to proactively recruit and retain scientists from underrepresented groups." One important step employed by STScI is the double-blind peer-review for HST proposals, described in Physics Today as "a first-of-its-kind peer-review process for allocating time on NASA's workhorse space telescope has the potential to level the playing field for women and other marginalized groups in science." NASA could also take this valuable step to reduce bias in funding decisions. NASA can also lead in eliminating abuse of power in the form of discrimination and harassment by Principal Investigators, Co-Investigators and Project Managers that prevent our community from being socially strong and healthy.

The space science community can also take action to eliminate barriers. The most direct action that every member of the community can take is to attend Bystander Intervention training, now offered at many science conferences, and to implement the methods included in that training. Additionally, the community can advocate that NASA and leading institutions take action to eliminate discrimination and harassment in space science.



♦ References

NAS. 2018. Exoplanet Science Strategy. Washington, DC: The National Academies Press.
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