

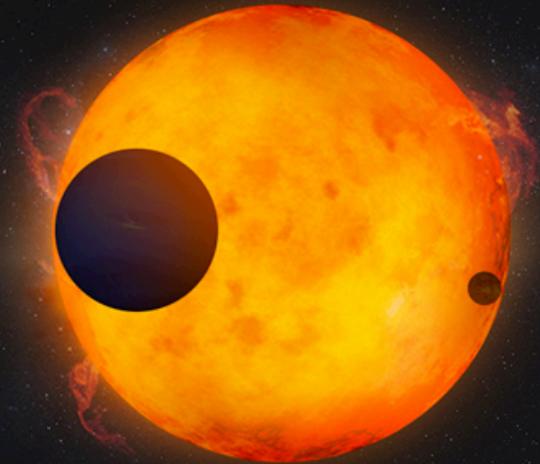
EXOPLANETS in our backyard

# Exoplanets in Our Backyard

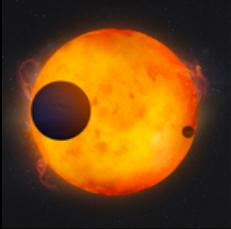
Solar System and Exoplanet Synergies on  
Planetary Formation, Evolution, and Habitability

Feb 5-7  
**2020** Houston, Texas

A joint Assessment Group meeting by VEXAG, OPAG, and ExoPAG



Organizing/Program Committee (w. primary representation):  
Noam Izenberg, Giada Arney (VEXAG)  
Kathleen Mandt, Abigail Rymer, Lynnae Quick (OPAG)  
Victoria Meadows (ExoPAG)  
Stephen Kane (ExoPAG, VEXAG)



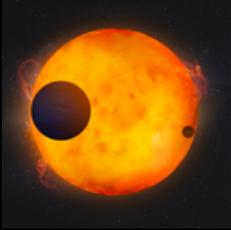
# Premise



Grown out of concept for 'off season' VEXAG meeting

Venus is “the exoplanet next door” but all solar system planets are “the exoplanets in our backyard” – immediate synergies with OPAG and ExoPAG, and eventually other AGs.

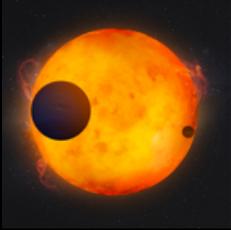
Turn opportunity into an Inter-AG workshop to examine exoplanet-solar system synergies on planetary properties, formation, evolution, and habitability.



# Major Topics & Goals



- Comparative planetology on worlds near and far
- Solar system studies as a baseline to inform studies of exoplanet properties and evolution
- Lessons learned on planetary statistics, architectures from extrasolar planetary systems.
  
- Foster new collaborations among scientists in the solar system and exoplanet communities
- Help guide the direction of future exploration and observations.



# Format

Standard Session (90 min):

- Invited talk (20 min)

- 3 Contributed talks (15 min each)

- 25 minute panel of all 4 speakers

Special Sessions

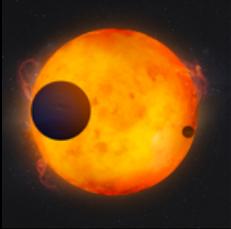
- NASA HQ Town Hall

- Unconference

- Poster Lightning Talks (25 1-minute flash previews)



Plus: Working Lunches,  
Final Day review



# Program



Wed., 02 05 2020

S1: Overview Talks

S2: NASA HQ Town Hall

S2b: Success Stories  
Integrating Solar System  
and Exoplanet Research

S3: Formation and  
Evolution of Planets

S4: Interior and Surface  
Processes

Thurs., 02 06 2020

S5: Planetary  
Atmospheres Thin and  
Thick

S6: Star-Planet Interactions

S7: Unconference

S8a: Posters Lightning Talks

S8b: Posters (~50  
presented)

Fri., 02 07 2020

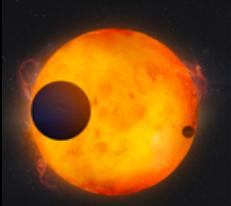
S9: Habitability and  
Astrobiology Near and  
Far

S10: Missions

Review, Discussion,  
Findings, Future Plans —  
Working Lunch



PUBLIC TALK: Wednesday evening, Emily Lakdawalla at Space Center Houston "Exoplanets In Our Backyard"



# Overview Talks

**Why Studying the Solar System Terrestrial Planets is Absolutely Critical for the Future of Exoplanet Characterization and Understanding Habitability**

Stephen Kane

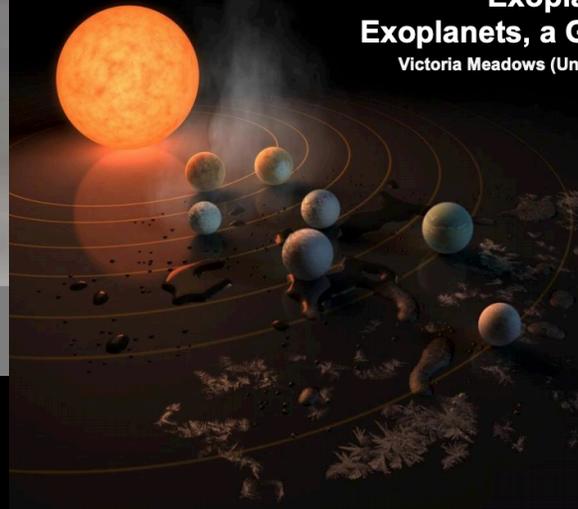


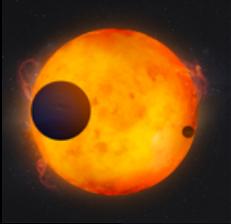
## Synergies between the Outer Planet and Exoplanet Communities

**Kathleen Mandt (@mommascientist) and the OPAG Steering Committee Representatives**

Exoplanets in our Backyard  
Houston/LPI  
Feb 5-7, 2020

**Exoplanet/Solar System Synergies:  
Exoplanets, a Guide for Planetary Scientists**  
Victoria Meadows (University of Washington/NExSS/ExoPAG Past Chair)

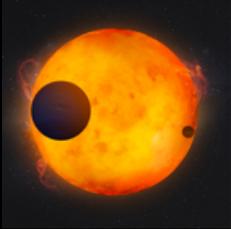




## By The Numbers



111 Total registrants  
80-100 in attendance throughout  
10-20 regularly online  
150-plus at public talk



# DEMOGRAPHICS



Abstracts accepted ~82

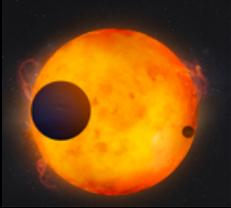
Approximate breakdown (extrapolated):

Women 1 <sup>st</sup> Author:	30%
1 <sup>st</sup> Authors of Color	30%
URM 1 <sup>st</sup> Author:	10%
Early Career 1 <sup>st</sup> Author	40%
Intersections (women/EC/URM):	20%

Skewed younger / more diverse than many meetings of its scale.



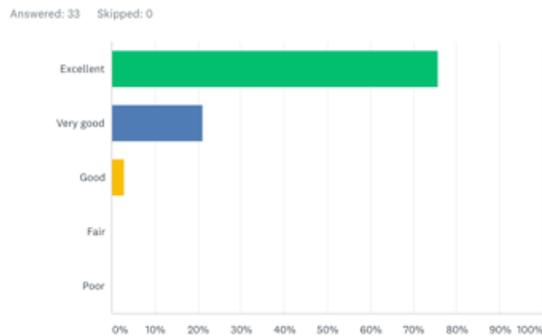
Friday Morning Question:  
“Who here generated new ideas or  
collaborations at this meeting?”



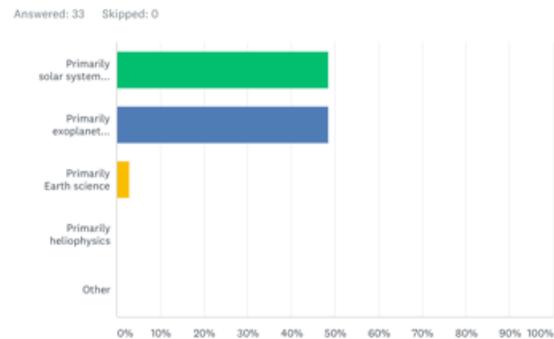
# After-Meeting Survey



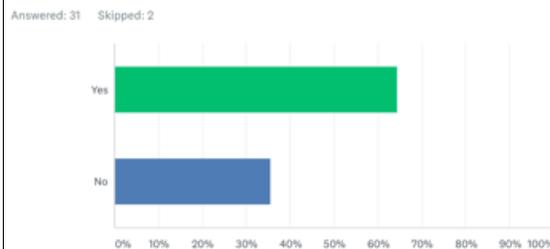
Q1 Overall, how would you rate the scientific content of the workshop?



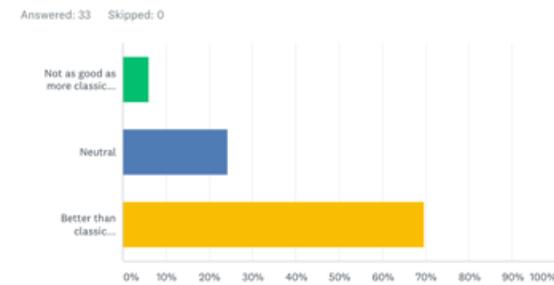
Q2 How would you describe your scientific background?



Q5 Have you made any new research or collaborative connections outside your field as a result of this workshop?



Q6 How did you find the session organization (i.e. 4 longer talks followed by a panel)?

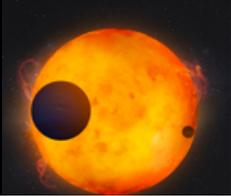


Science Content:  
**Excellent**

Science Background:  
**50/50 SS/Exo**

New  
Connections/Collabs:  
**Two Thirds**

Session Organization:  
**Better than classic**



# More Backyard Exoplanets?

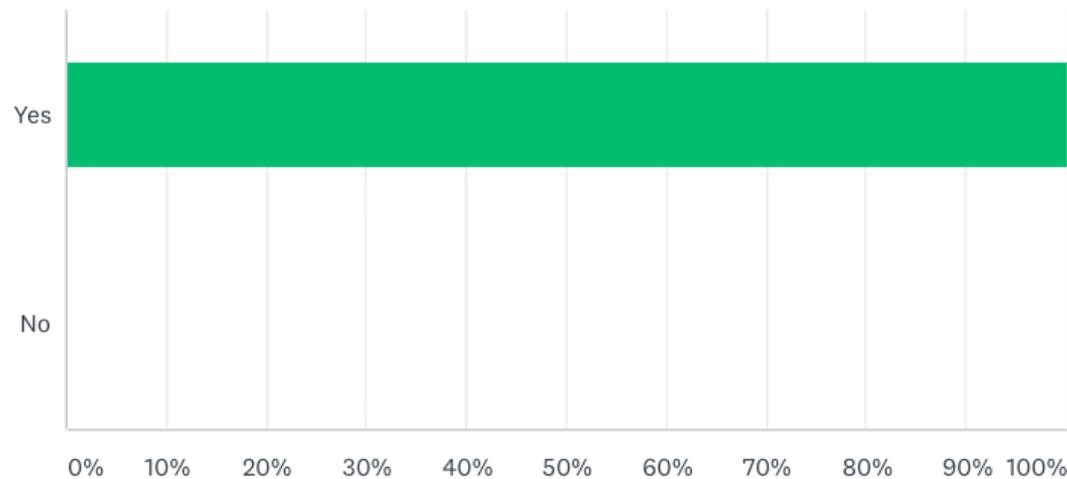


Q7



Are you interested in a follow-on related multidisciplinary conference in the next year or two?

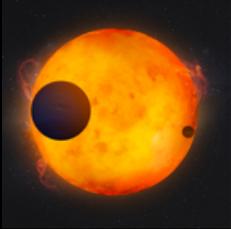
Answered: 32 Skipped: 1



**Yes.**

New committee in formation

Activities and workshop pending AG, NASA disposition



# Key Feedback



*Comments collected from Survey from participants*

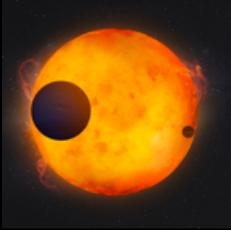
**The interdisciplinary mix** of presentations.

The opportunity to overlap with **scientists from other fields**

The poster presentations and the unconference were both **great experiences for research collaborations and networking.**

[H]aving the question **panels** at the end of each session was a great way of giving all of the presenters the ability to bounce ideas and opinions off of one another.

[Panels] helped solidify the complex concepts.



## Carrying Momentum Forward



The meeting was an unmitigated success.

Community outreach and cross-reach “two circles of friends meeting.”

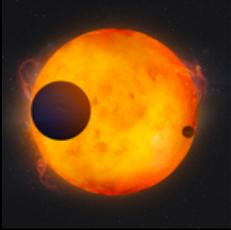
“Best meeting in years.”

- New content

- New collaborations

- Strong desire and action to engage communities

- Subset of outstanding questions.



## Carrying Momentum Forward

Value of an inter-AG meeting of this kind.

Cross-body

Cross-discipline

Cross-division

The next VEXAG “off season” meeting would like to be EioB-II

New Foci: Laboratory & Field studies, others



How to Follow-On?

➤ AG leadership

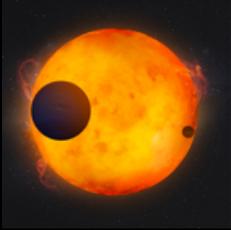
➤ HQ buy-in

➤ Venue, Time

➤ Reg. Fee Issue

Organizations

AGs, NExSci, AAS

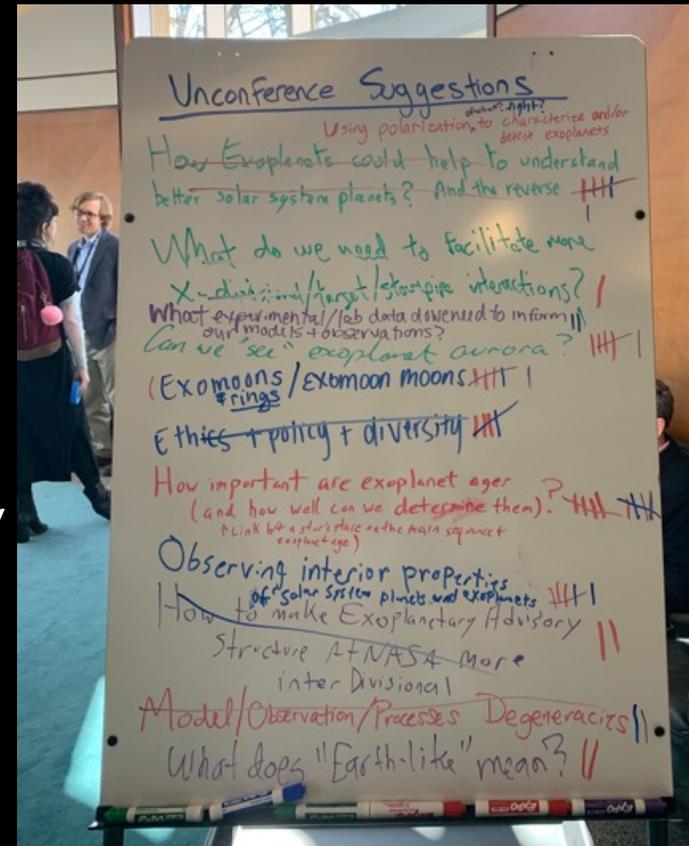


# Unconference

Unconference: Topics chosen by participants

- Exomoons/rings/moonmoons
- Importance of exoplanet/exosystem ages
- Policy, diversity
- How exoplanets help us understand solar system bodies and vice versa

Split sessions with summaries in final Friday session.



# Notes from the Unconference: What do solar system and exo need from each other?

SS	Exo
Core formation & interior structure in planets unlike ours & in SS and changes over time	High pressure experiments
"Validate" dynamical models for SS form.	- wide P-T range & comp.
SS to validate impact history	- more labs to explore parameter space
Ocean world rock interface	- Connect sci & lab community
Polluted white dwarf obs.	Impact history (for life?)
Habitability & inhabited	Interior structure of U+D
More r.v. obs to get density	Water vs Rock?
- R&A on stars	Fundamental processes
Models w/ more complexity (funded)	- Seismology
	- S.S. convection in ices
	What are new missions doing

SS	Exo
What Comp. of Stars <del>more useful for geochem. studies</del>	Archive SS papers where accessible
Validate dynamical	Oceans in IG? Need
Lab white papers	Eq of state for H <sub>2</sub> O - He - H mixture
Modeling assumptions and errors	Impact history (for life?)
More disk observations to connect to planet form.	Interior structure of U+D
Knowledge gaps	Water vs Rock?
Models w/ more complexity (funded)	Fundamental processes
	Seismology
	S.S. convection in ices
	What are new missions doing
	Early Earth results
	Volcanism signatures and outgassing rates
	Mag field & habitability radiation

Cross-community Slack

# Notes from the Unconference: What do solar system and exo need from each other?

Unconference (continued)

Are Uranus/Neptune "Rock Giants"  
not "Ice Giants" (4 Implications) |

## Topics

meadow@wedu

Laboratory studies

Gen & Maint. secondary atm.

Magma Ocean Lifetimes

Star-planet interaction

Evolution of terrestrial planets

## Top Priorities

Communication

SS Obs as Exo analogs

Stellar information

Stack papers  
Write papers  
Upload papers  
Base case  
Xim session  
Integrate datasets

SS

Exo

## Errors

Best results  
(most reliable)

Find young planets  
around young G dwarfs

Stellar activity

Full spectra

Mag. fields of planets

Terr. planets at various  
stages star age,  
uncertainty

Sun change over time

Aurora detections  
and characteristics

Review papers

Nondetections

Exo comets + Oort clouds

## Ice Giants

- Atm T, P, trace gases
- Seasonal changes
- Probe
- Diff btwn U & N and why

## Venus

- Clouds climate history
- Habitability of clouds
- SS obs converted to exo analogs (fundplz)

Theory of SS objects  
in exo conditions

Med. complexity cloud  
haze model, SS validated

Optical constants for  
exosols.

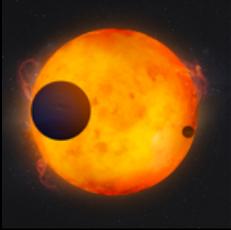
Lithium meas. in stars (age)

Rotation rate in Sun (deep) modeling

U & N phase curves

Small bodies

Rock-atm interaction (oceans)



# Findings, Products, After-Action



## Findings (preliminary)

- Value of small Cross-AG, interdisciplinary, interdivision meeting is exceptional, and these should be continued
- Planetary-Exoplanetary science discussion/coordination needs to grow

AGU Special Session (“EioB 1.5”) in the works

White Paper on Workshop in formulation

- Topics covered
- Cross disciplinary path forward (Unconference lists critical component)





**Emily Lakdawalla** @elakdawalla · Feb 5

Travel is exhausting but I am SO GLAD I came to this meeting. I feel like [#BackyardExoplanets](#) was one of those epochal meetings that's gonna define the field\* for a decade.

\*What do I mean by "the field"? That's the beauty of it. Could be Venus, or outer planets, or exoplanets.



3



4



55



**Monica Vidaurri** @AstroTraviesa · Feb 7

– and to all the awesome people I got to meet: I cannot wait to collaborate! Exploring all of these intersections, both within and outside of exoplanet science, is critical in the new age of space science, and let me tell you: the future is lookin real bright. [#BackyardExoplanets](#)



12



[Show this thread](#)



**Dr. L. C. Mayorga** @mayorgalc · Feb 7

As we leave [#BackyardExoplanets](#) I reflect on what the communities want from each other. I say to SS folk. I want to find your cool science thing. Make an observable prediction to guide us.



4



**Dawn Gelino** @DawnGelino · Feb 5

Proud to have the NASA Exoplanet Science Institute (NExSci) support both the astrophysics and planetary science communities! [#BackyardExoplanets](#)



1



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# #BackyardExoplanets



**Kara Brugman** @karabrug · Feb 6

Posters are still going on! Some super cool ones and I feel like I've never seen such an engaged poster session - I feel like I'm learning so much at this meeting 🎉 [#BackyardExoplanets](#)



🗨️ ↻ ❤️ 6 📤



**Michael Wong** @Miquai · Feb 7

Thanks for a fun few days, [#BackyardExoplanets](#)! And thanks, [@LPitoday](#), for making us feel so welcome! (Sorry I have to bail early...but teaching calls.)



**S. Gilbert** @exoplamets · Feb 5

Helping [@ExoCytherean](#) and [@mommascientist](#) to kick off [#BackyardExoplanets](#), [@AbVsm](#) says, "One day, there will be no exoplanet scientists or Solar System scientists, just planetary scientists."

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**David Wilson** @astrodave2 · Feb 7

My main takeaway from [#BackyardExoplanets](#)...



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