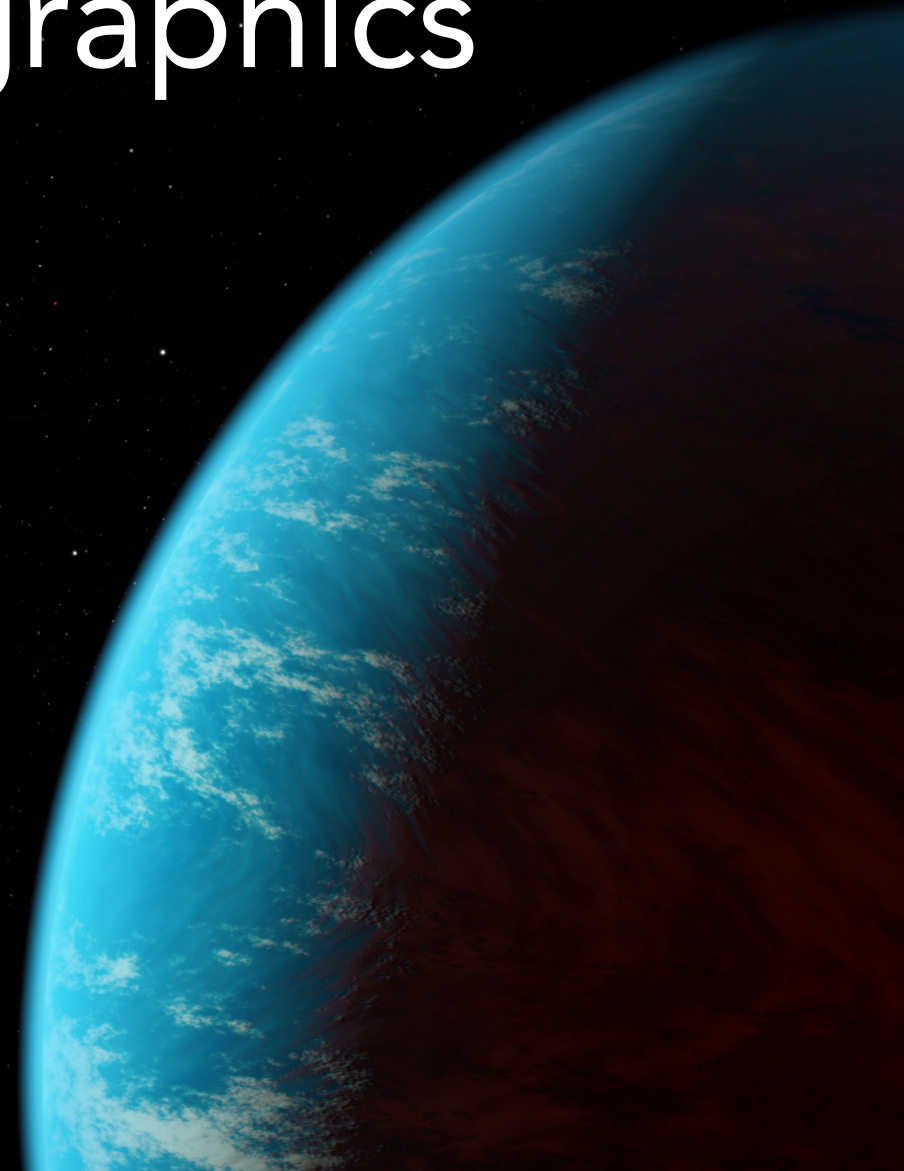
ExoPAG SIG#2 Exoplanet Demographics Update



Jessie Christiansen
ExoPAG 27 meeting, Jan 7th, 2022

SIG#2 steering committee: Jessie Christiansen (co-chair), Michael Meyer (co-chair), Gijs Mulders and David Bennett

SIG#2 goals

To extend the SAG#13 work over a wider parameter space, by bringing together groups in the community to discuss their cross-technique and cross-population results, and identify work needed to move forward

(i) Members prepared an Astro2020 white paper outlining a road map for furthering the census of exoplanets (May 2019, closed)

(ii) Hosted a demographics mini-symposium at ExoPAG 21 (January 2020, closed), which ultimately became the Exoplanet Demographics conference (November 2020; closed)

(iii) Created a demographics "gap list" (January 2021; closed)

(iv) Analyzing what is needed to enable meta-studies (report nearly (!) complete)

(v) Analyzing the need for a public demographics repository (planned)

(vi) Facilitating a Kepler data challenge across multiple teams in the community with controlled inputs (planned)

SIG#2 Report – Final Report (Nearly!) Complete

"Enabling Exoplanet Demographics Studies with Standardized Exoplanet Survey Meta-Data"

Our report finds that demographics re-analyses or meta-analyses are stymied by the lack of survey meta-data

It presents a list of data and products that would be valuable to include when publishing exoplanet survey data

The report is aimed at survey architects, authors, referees and funding agencies

Report process

- Small tiger teams for each of 5 detection techniques (transit, RV, microlensing, imaging and astrometry) assembled preliminary lists of data products they thought would be useful
- These lists were then evaluated by the other teams, each trying to imagine how they would incorporate those data in their calculations
- Several rounds of feedback were held to refine the lists
- Full report drafted by tiger teams, open for internal feedback by SIG#2 membership
- Full report available for community feedback 2022A
- Feedback incorporated 2022B
- Final report to be circulated in the coming weeks

Report structure

Two data 'tiers':

- ***Tier I products*** enable rudimentary incorporation of published exoplanet survey data into other analyses, using either the same or different detection techniques
- ***Tier II products*** greatly enhance the community's ability to incorporate published exoplanet survey data into their analyses, using either the same or different detection techniques

Three data 'types': Stellar sample properties, survey properties, planet catalog properties

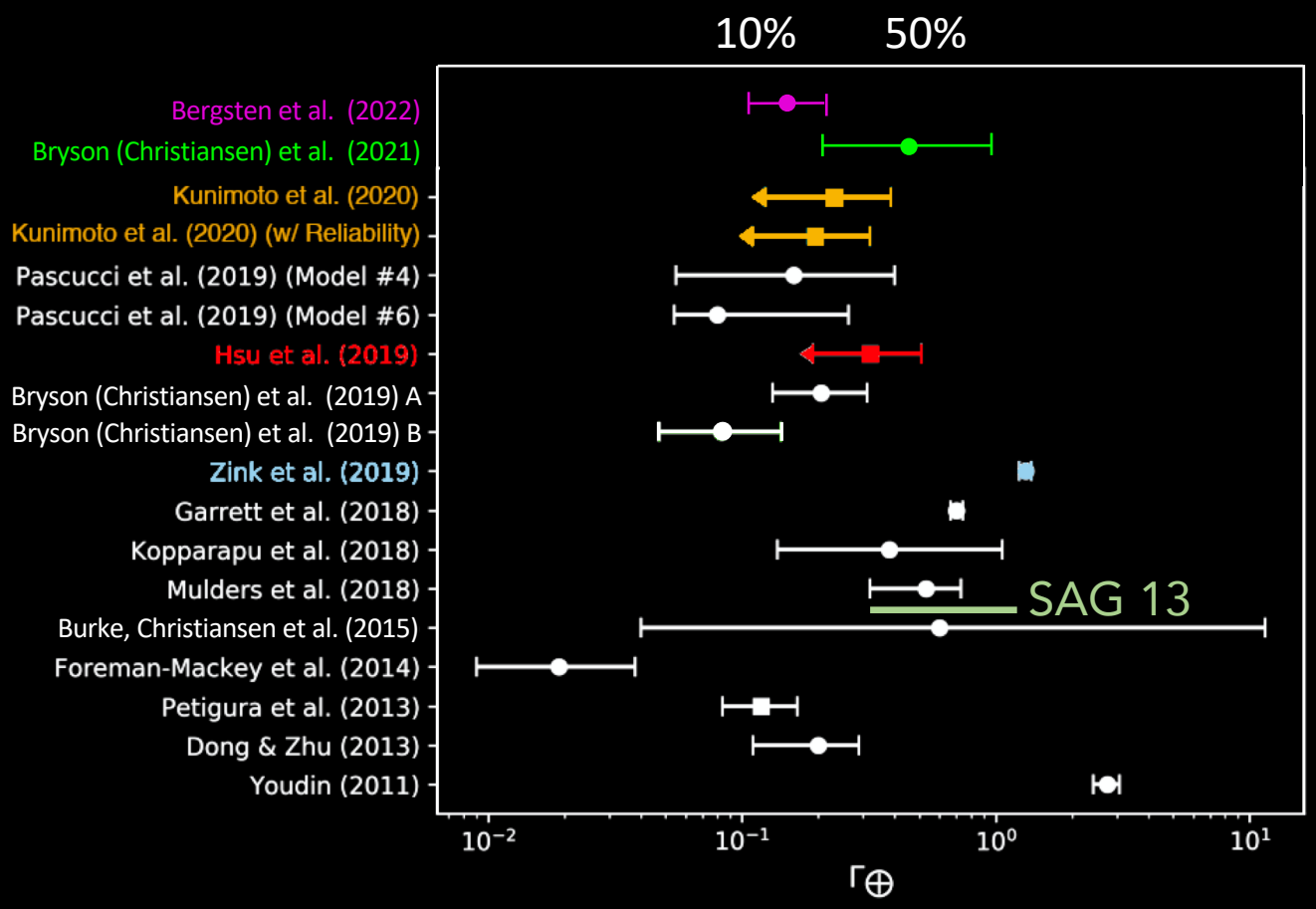
Finding: keep products as model-independent/close to the data as possible

- Keep products in native parameters (radius, mass, mass-ratio)
- Include any model assumptions (mass-radius relation to translate transit survey results to radial velocity space, luminosity function to translate microlensing results, etc)

Final Report (Nearly!) Available

Will be posted on the ExoPAG website in the coming weeks, and advertised in the ExoPAG announcements

What's next: Kepler Data Challenge



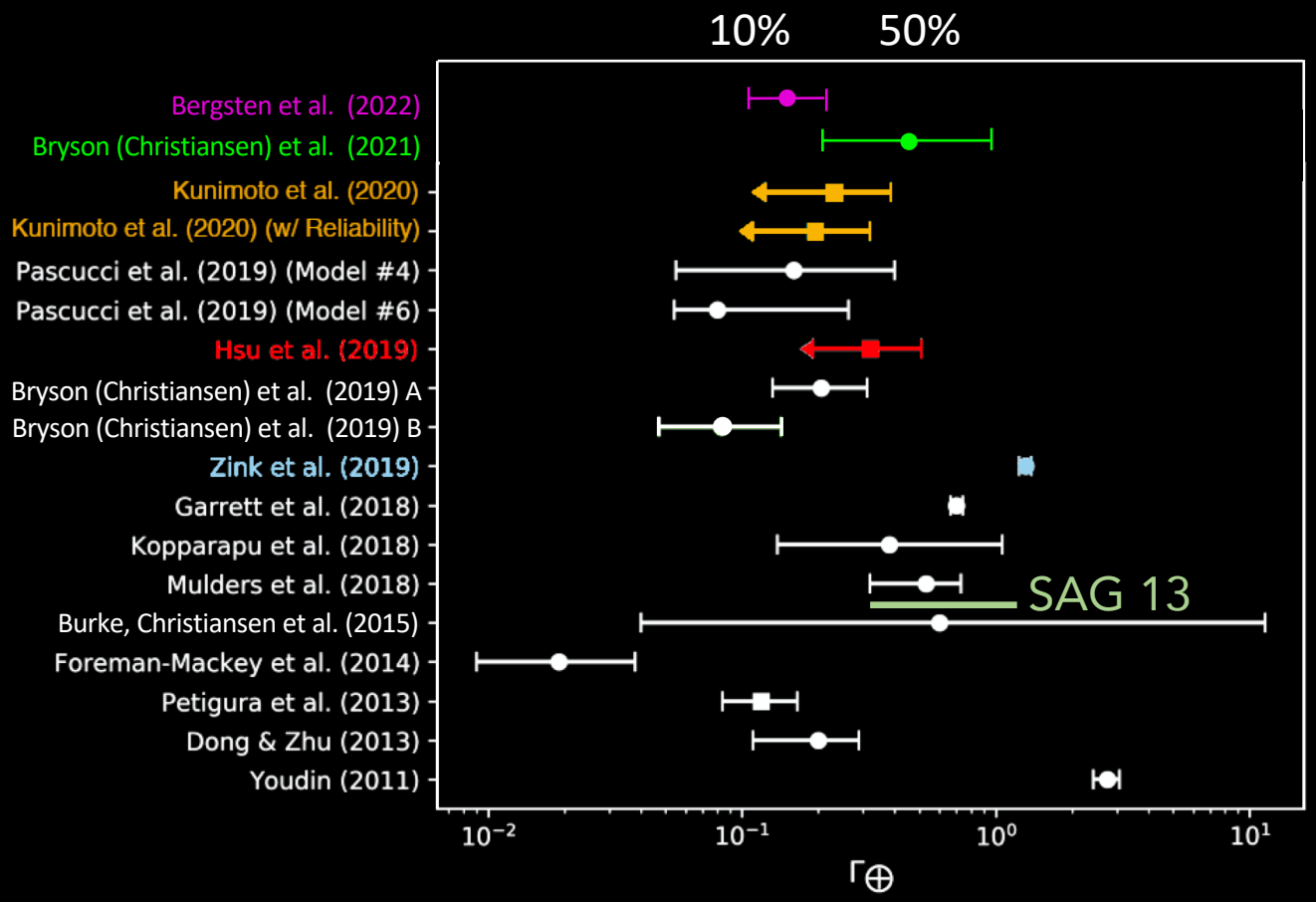
Challenge interpreting difference in $\eta_\oplus$ values due to differences in

- Stellar sample and parameters
- Planet sample and parameters
- Reliability corrections
- Methodology
- Assumptions (extrapolations, power laws, etc)

Goals:

- To identify the significant contributors in the spread in literature values for $\eta_\oplus$
- To identify the optimal methodology
- To understand where more data would be most helpful

What's next: Kepler Data Challenge



We need to start a new community group interested in tackling this problem, who would

- Decide whether that was the right set of goals
- Define the plan for the data challenge (Using a pre-defined stellar and planet catalog from Kepler? Using a simulated planet population injected into Kepler data? Doing both in two stages?)
- Decide the scope/duration/location of the data challenge
- Execute the data challenge!

SIG#2 can help initiate/organize but this would be a different group

How do we (ExoPAG/SIG2) support this?

This activity (especially the ‘execute’ stage!) is a non-trivial investment of time

What would be your/your students’ barrier for entry to participating?

What resources would you/your students need to be able to participate?

- Computing resources?
- Availability of code/notebooks that run out of the box?
- Funding?
- Dedicated location/time? A week-long hack-a-thon/workshop?