

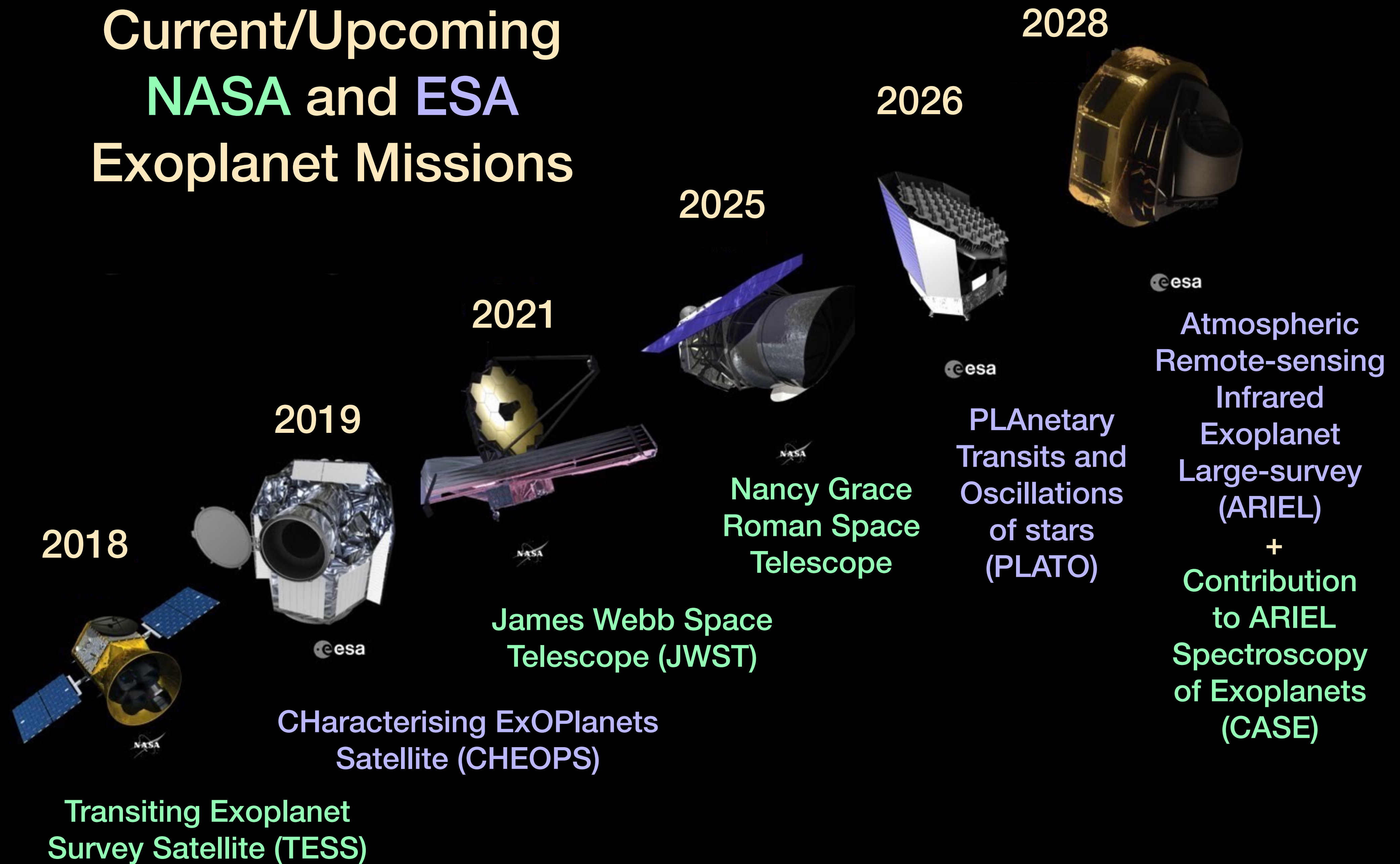
The background of the slide is a deep space scene. It features a dark blue and black sky filled with numerous small, bright white stars. On the right side, there is a large, bright, glowing orange and yellow nebula or star cluster. In the lower center, a large, detailed planet is visible, showing a mix of green, blue, and brown colors, suggesting a rocky or gaseous world with a complex atmosphere. The overall lighting is dramatic, with the bright nebula providing a strong light source on the right.

# Update to SAG22: A Target Star Archive for Exoplanet Science

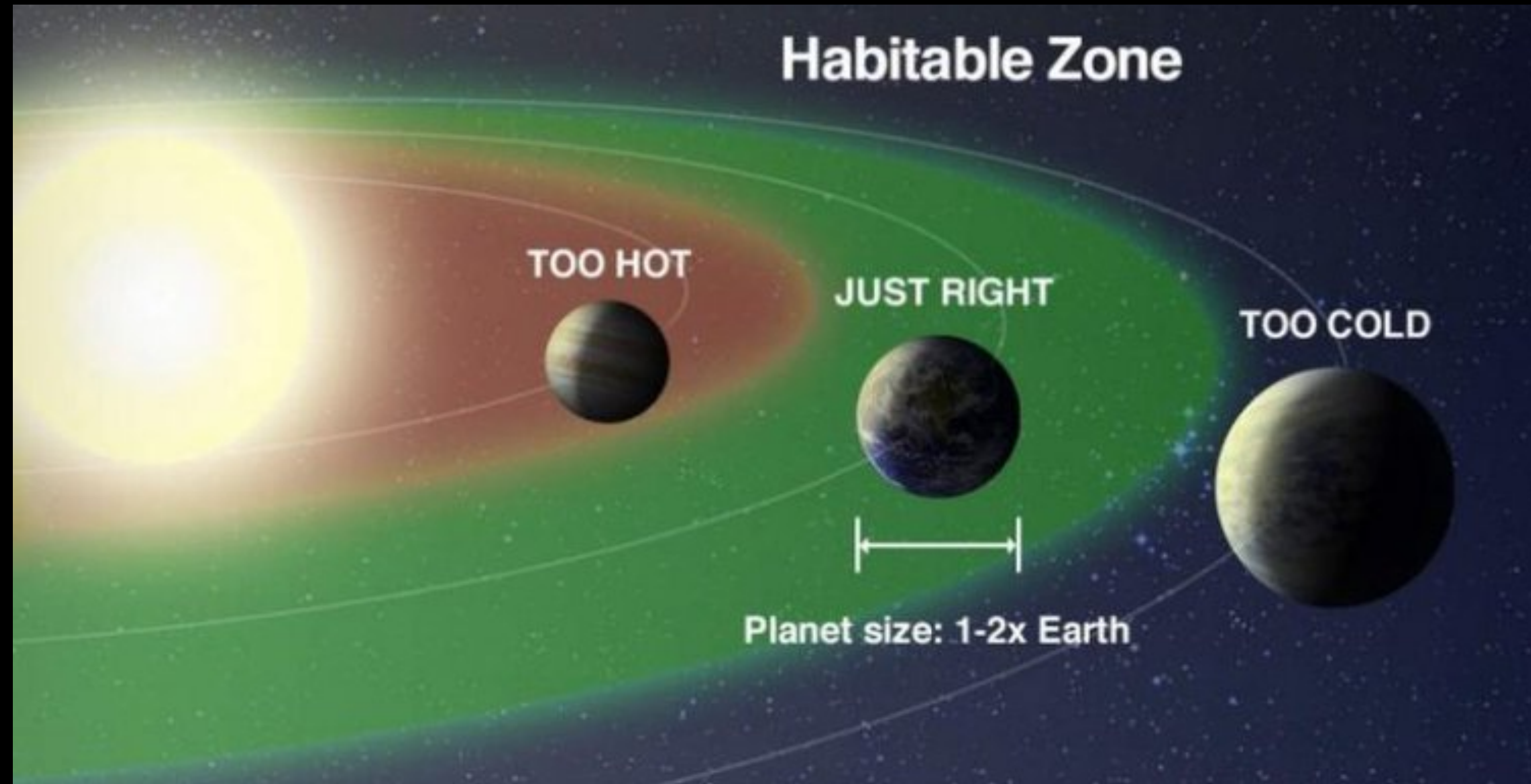
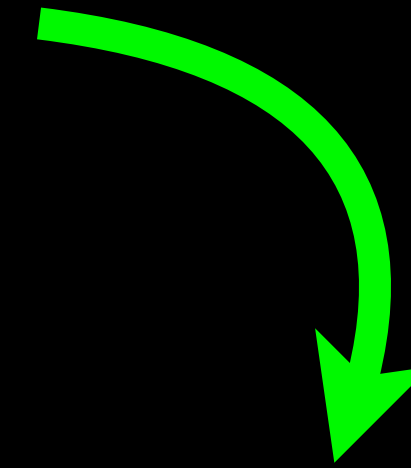
Natalie Hinkel, Josh Pepper, Chris Stark

ExoPAG23 — 6 Jan 2021

# Current/Upcoming NASA and ESA Exoplanet Missions



Liquid  
Surface  
Water



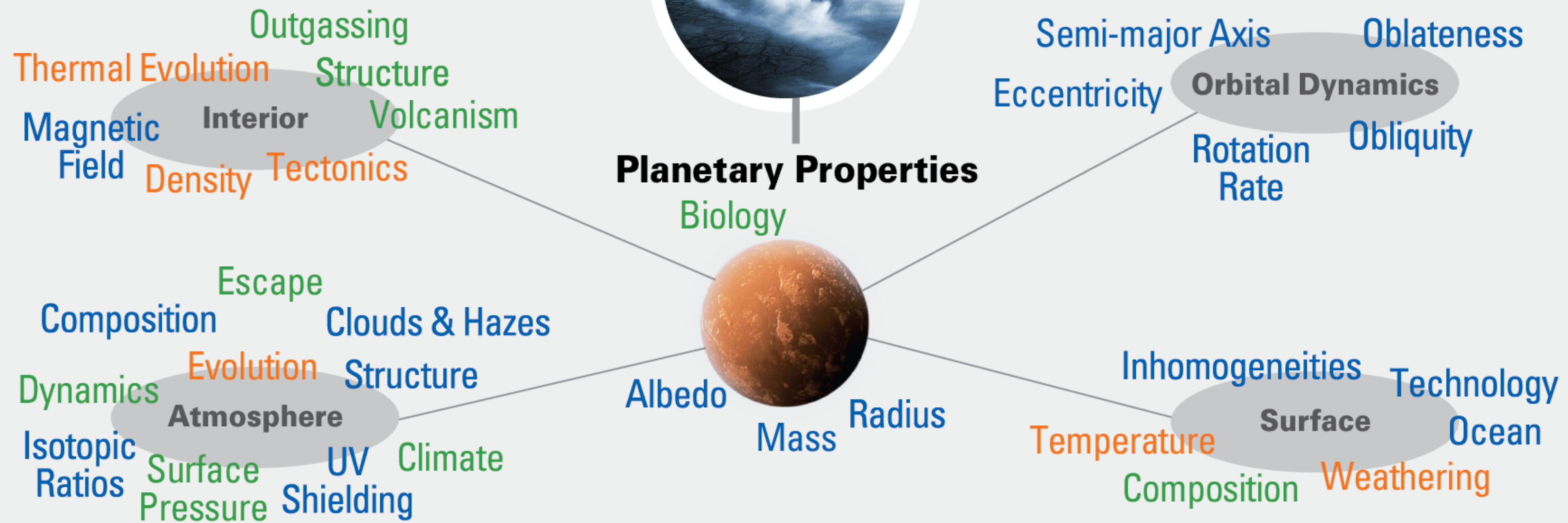
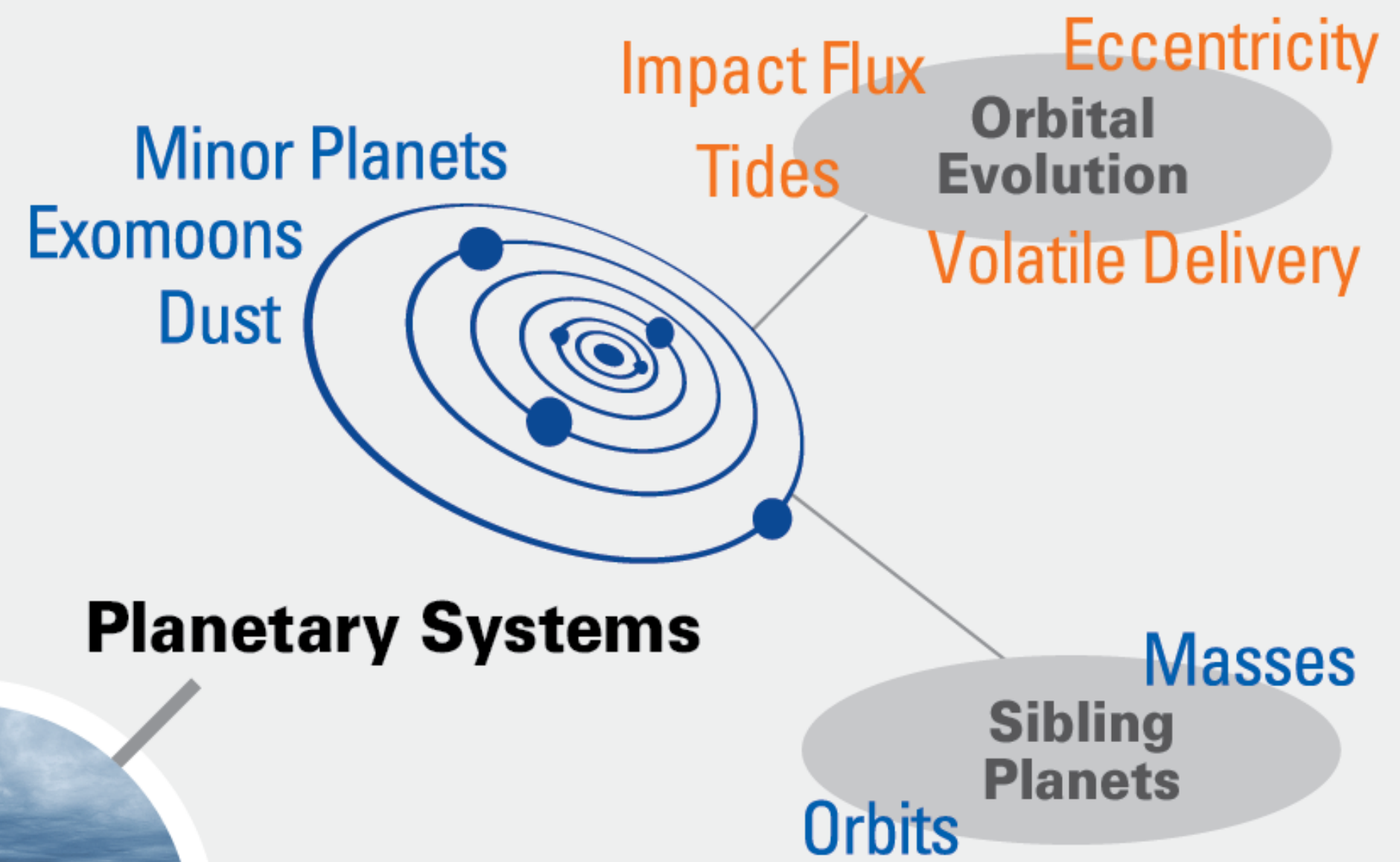
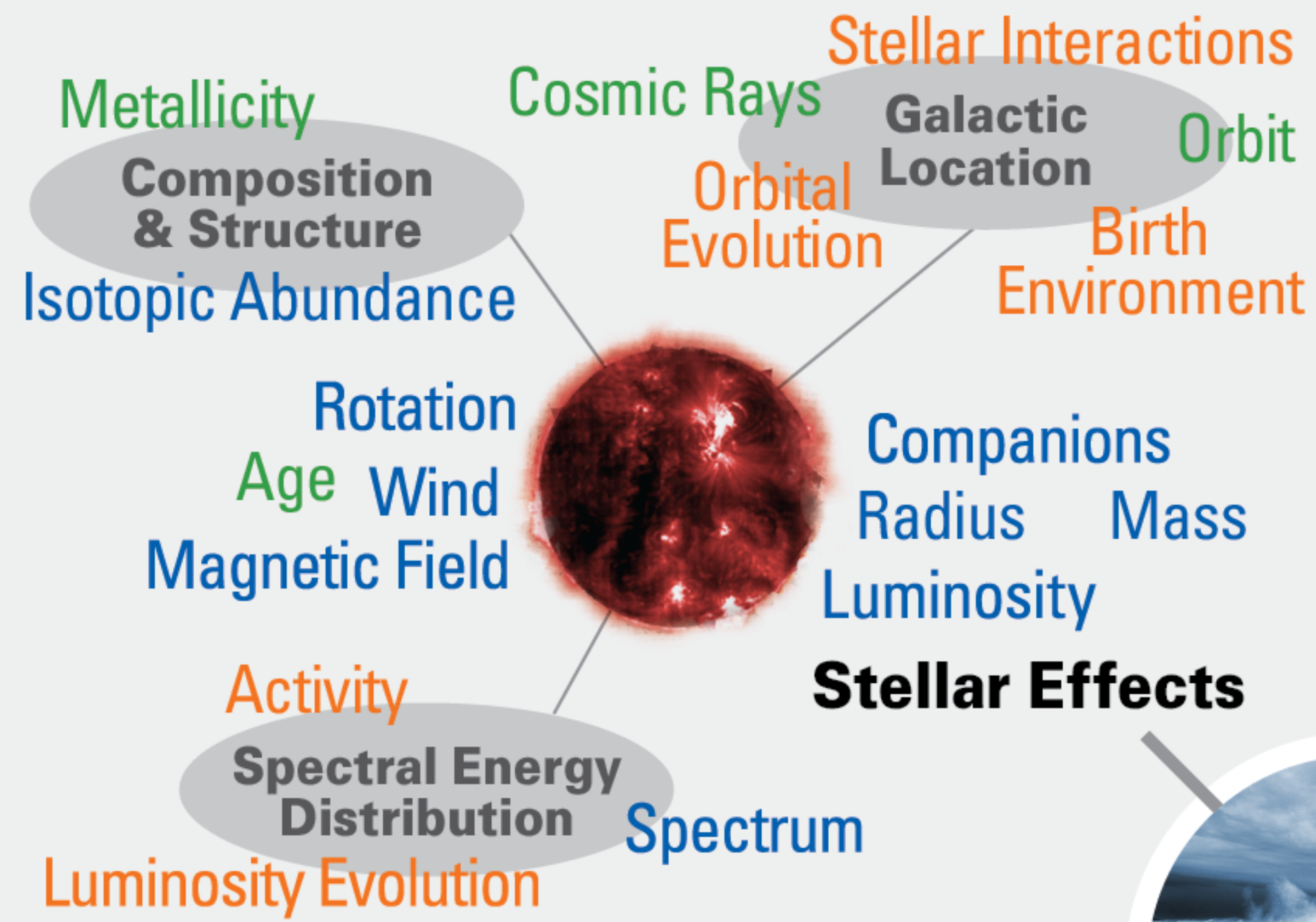


Image per Meadows & Barnes (2018)

# SAG22

To date, there does not exist a central repository or archive of comprehensive stellar *and* exoplanetary data, the absence of which leads to wasted time/effort. Therefore, SAG22 will:

- Define **attributes of a high priority stellar sample**;
- **Survey the broad exoplanet community** (e.g., including planetary scientists, geologists, and biologists) to determine data required for characterizing stellar and planetary systems;
- **Prioritize the most useful stellar properties**;
- **Identify categories of typical end users**; and
- Consider pros and cons of **various methods for archive implementation** and maintenance.



# SAG22

The goal of SAG22 is to put together a roadmap for a target star archive for exoplanet science based on the needs of the community.

## Phase 1: Information Gathering

Mission Observations & Deliverables  
Target Lists & Target Criteria  
Interdisciplinary Use Cases  
Existing Catalogs

Phase 2: Synthesis

Phase 3: Findings



# Mission Observations & Deliverables

Upcoming NASA facilities targeting stars with and without confirmed planets will gather a range of observational data, which will be used for a number of discovery and characterization investigations. **This Task Force has systematically developed a list of current and upcoming exoplanet missions, typical observing modes, and scientific outputs for the following missions:**

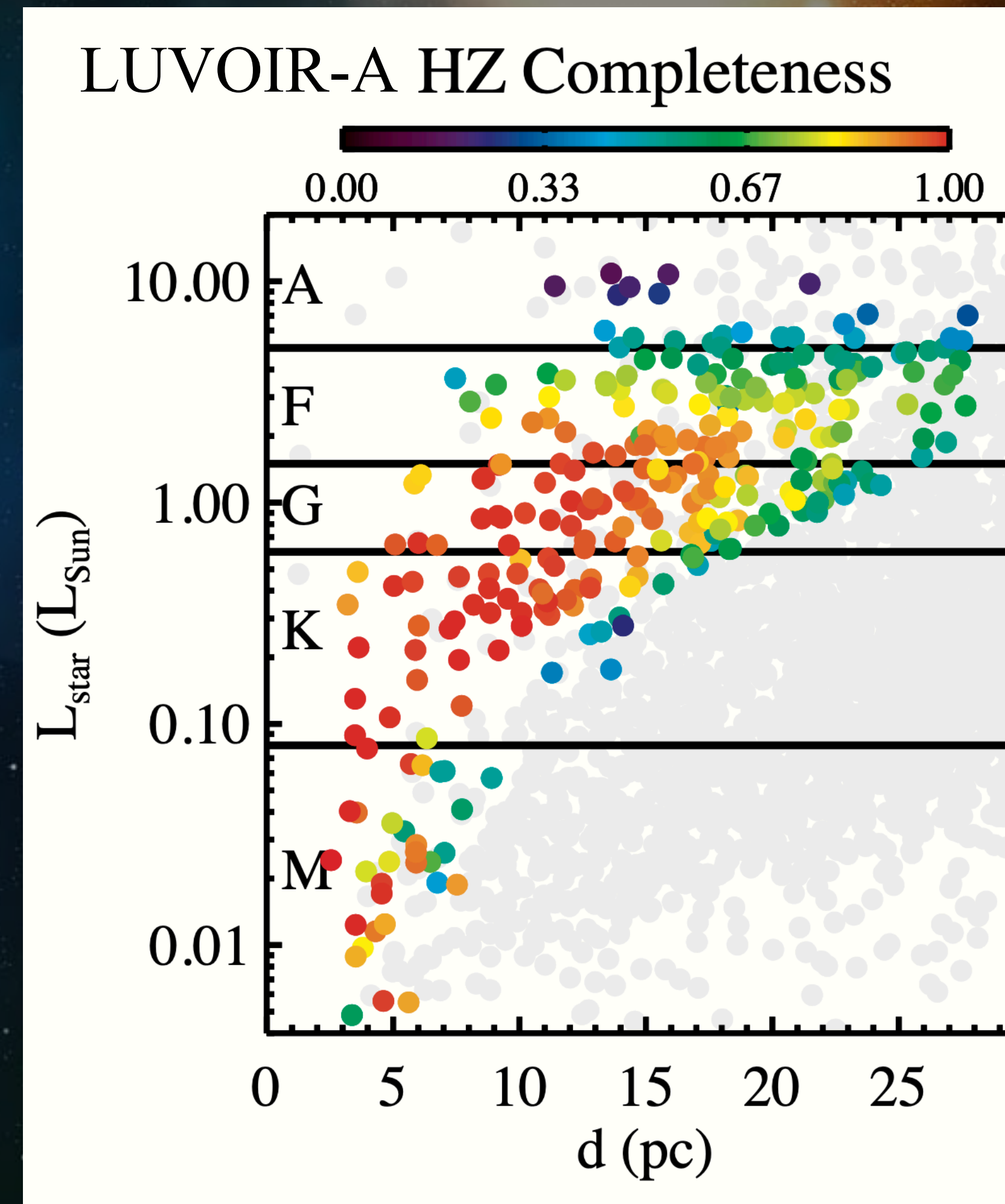
- Hubble Space Telescope
- Transiting Exoplanet Survey Satellite (TESS)
- Chandra X-ray Observatory
- James Webb Space Telescope (JWST)
- Habitable Exoplanet Observatory (HabEx)
- Large UV/Optical/IR Surveyor (LUVOIR)
- Origins Space Telescope (OST)
- Stratospheric Observatory for Infrared Astronomy (SOFIA)
- Atmospheric Remote-sensing Infrared Exoplanet Large-survey (ARIEL) + Contribution to ARIEL Spectroscopy of Exoplanets (CASE)
- Roman Space Telescope
- Extremely Large Telescopes such as TMT and GMT

Future work will focus on small modifications to this list and potentially a written summary, otherwise the work is largely complete.

# Target Lists & Target Criteria

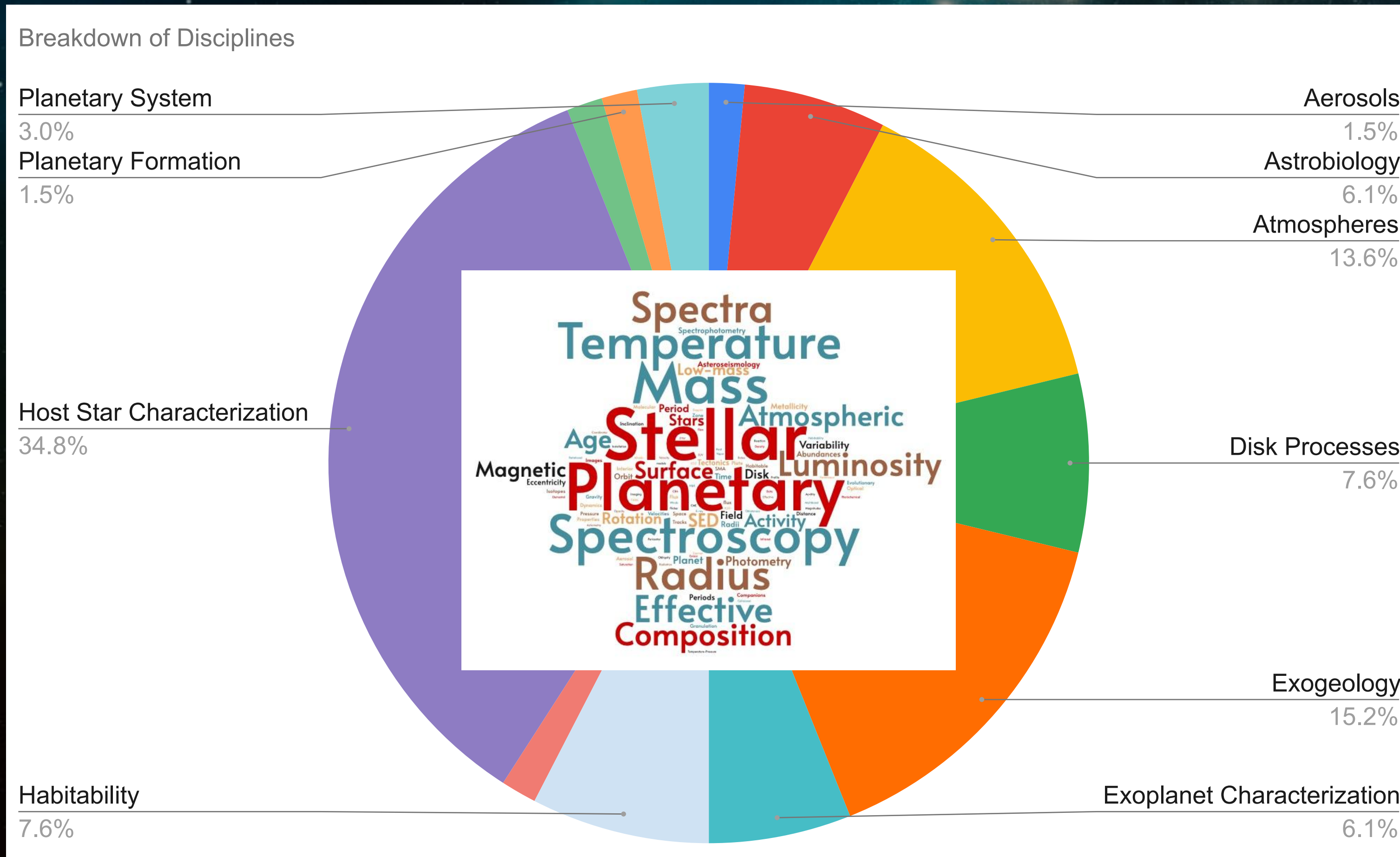
Several of the largest NASA exoplanet facilities/missions are planning to conduct intensive observations of stars and exoplanets. Given the requirements for such observations, most of the appropriate target stars will be drawn from the set of nearby bright dwarf stars, with additional possible restrictions based on stellar spectral type, activity level, stellar rotation, angular separation of star and planet, age, etc. **Ultimately, these selection criteria are likely to lead to a similar set of targets for multiple missions.**

**This Task Force has collected target lists for most of the upcoming exoplanet missions, which are currently being compiled to determine overlap.** The input from the previous Task Force will be taken into consideration in the coming weeks to create visualizations of the target lists' overlap.





# Interdisciplinary Use Cases



The proposed archive should serve a broad user base, from those designing future missions, to those conducting observations and analyzing observations. This Task Force sent a set of questions to 100s of interdisciplinary scientists to understand their scientific questions, what specific stellar and planetary properties were important, the necessary precision, etc. **This Task Force has produced a number of visualizations to illustrate the similarity and differences, as well as the gaps between different exoplanet-related fields.**

# Existing Catalogs

This Task Force is documenting existing catalogs of stellar physical and observational properties:

- Completeness of catalogs is not always well-documented, but having a compiled target list will be a good way to develop a testbed for completeness. Many large all-sky catalogs are especially incomplete for likely exoplanet targets, i.e. the nearest and brightest stars.
- This Task Force as documented ~35 individual original catalogs of observed stellar parameters, and a limited set of ~10 compiled catalogs.
- Properties missing from the literature are:
  - Volume-limited stellar samples with reliable distances, proper motions, and multiband photometry
  - UV data including broadband, spectra, variability, and activity indicators
  - Spectral types (as distinct from  $T_{\text{eff}}$ )
  - Comprehensive information on multiplicity and cluster membership

# Phase 2: Synthesis

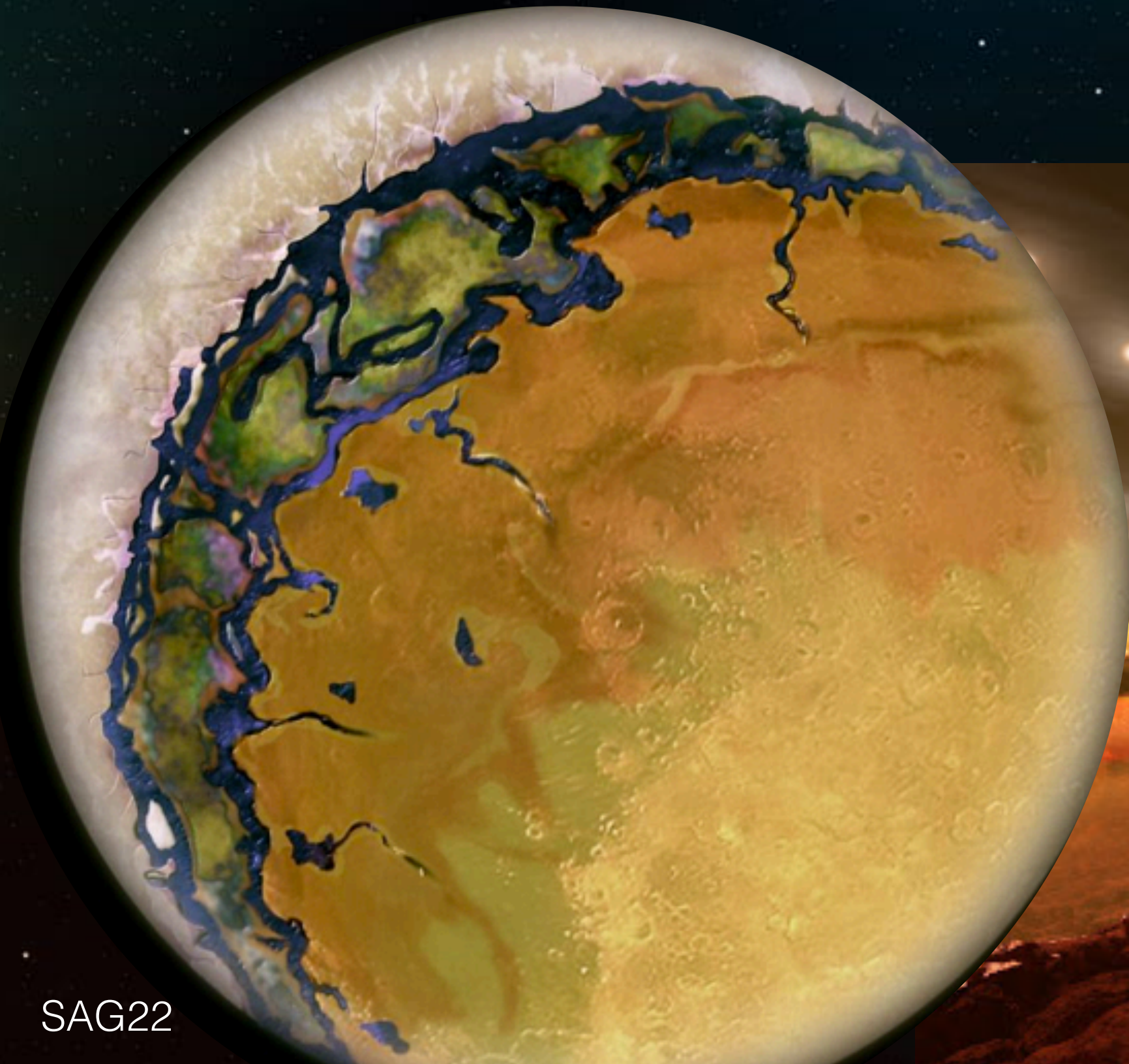
Beginning Feb 2021, SAG22 will take the information from the Phase 1 Task Forces and restructure the results in order to have a better perspective of the:

- Mission measurables on a common set of stars,
- Overlap and complementarity of high priority target lists,
- Anticipated science use cases that can be done with mission observables+existing data
- Missing data that will not be provided up upcoming missions but is necessary for the anticipated science
- The gaps in the current catalogs and databases

We anticipate that Phase 2 will be completed by ~May 2021.

# Phase 3: Findings

Report expected to be complete by ~Aug 2021, which will summarize the fact-based consensus from the community on their anticipated future needs, a summary of the current capabilities, a set of stellar and planetary properties, and **the scope for a “living” archive that could someday be housed and maintained through NASA.**



# Thank you!

For more info: [sites.google.com/view/sag22](https://sites.google.com/view/sag22)

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