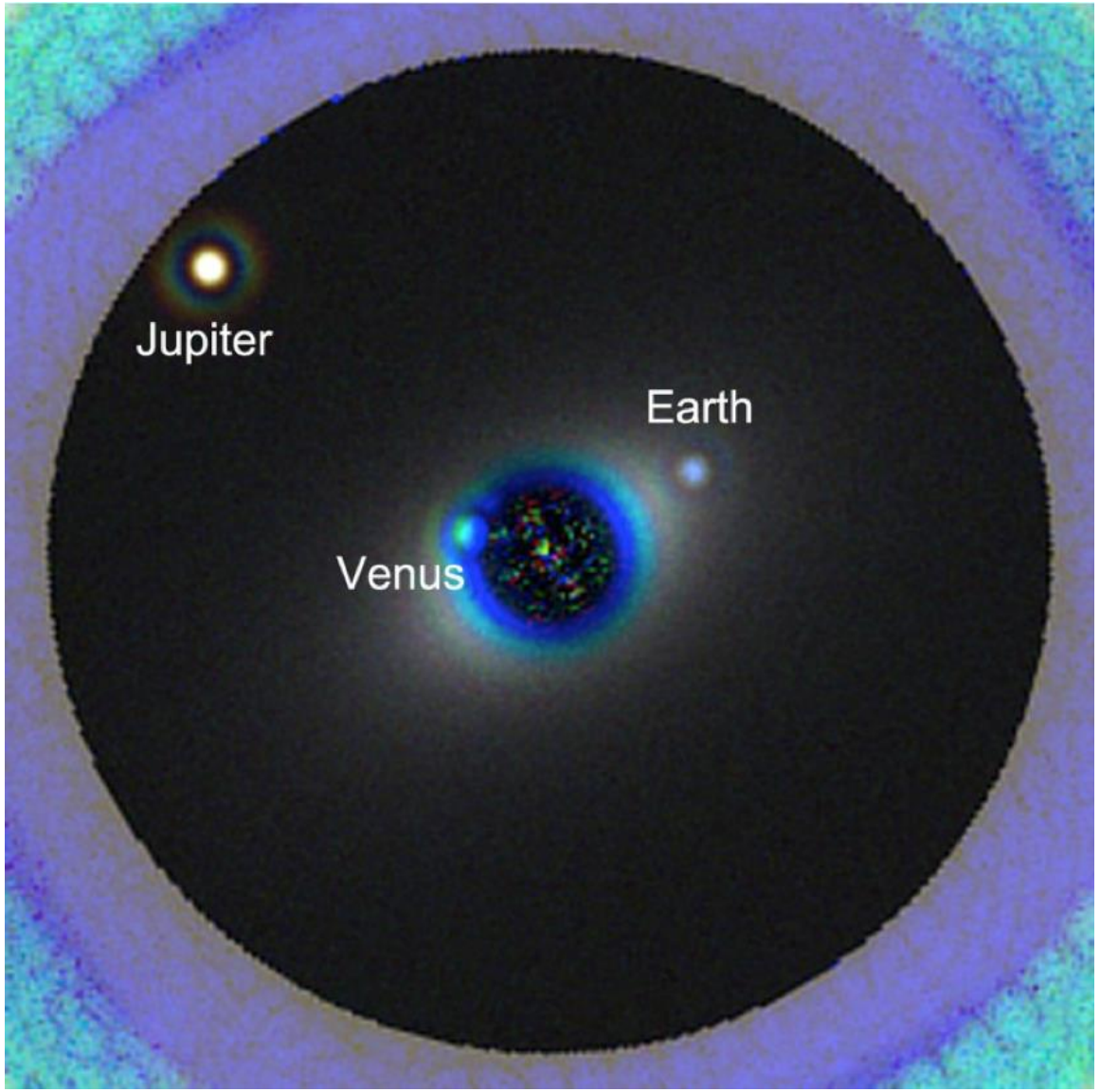



Credit: L. Pueyo / M. N'Diaye / A. Roberge

Suzanne Aigrain, Jo Barstow, Beth Biller, Jayne Birkby, Sasha Hinkley, Annelies Mortier, Hannah Wakeford, Vincent Van Eylen

# UK Exoplanet Community HWO survey

# The goal of the survey:

- Determine the interests and priorities of the UK exoplanet community with respect to HWO

- Assess the level of participation in the UK in the ongoing GOMaP-START efforts.

Areas of consensus across the community in the survey may identify scientific / technical areas where the UK could provide a substantial national contribution and thus serve as a basis for organisation of the community.

# Who we are:

We are a group of people interested in exoplanet science with HWO, and we want to ensure that the UK Exoplanet Community is well represented in the current ongoing discussions, as this may be important for potential future UK hardware/science contributions to the mission.

This survey is designed to ensure we capture the opinions of the whole community and at all career stages, rather than the subset we represent.

# Survey details:

- Designed to take <5 minutes to respond, with 4 questions regarding important science questions and required instrumentation, 3 questions regarding participation in GOMaP-START working groups, and a chance to share any addition comments.

- Open from late August until 15 November, received a total of 30 responses

# Some sample survey responses

## 1) What is the most important science question to answer with HWO?

30 responses

Confirming unambiguous biosignatures on an Earth-like planet.

Biosignatures on 'Earth-twin' exoplanets?

How common are biosignature gases in the near and mid-range galaxy.

Does life exist on other planets?

To look for biosignatures in exoplanet atmospheres

Can we detect the reflected light spectrum from exo-Earths? Will this show evidence of biosignatures?

What is the nature and prevalence of life on terrestrial exoplanets in habitable zones of their host stars?

What is the atmospheric composition of long-period Earths?

Whether we can detect significantly detect biosignatures

## 2) What is the second most important science question to answer with HWO?

29 responses

Occurrence of biosignatures

Examine the concept of biosignatures as a way to determine life on other planets

How many real "Earths" are there? How many planets could we truly live on?

Probing the atmospheric composition of near-Earth-like twins to try and understand the evolution of atmospheres around Earth-like planets.

More broadly, what are the atmospheric characteristics of other solar system analog planets (e.g. Jupiter, Saturn) and how does this depend on star spectral type, system architecture etc

Characterising the wide range of exoplanet atmospheres, across the full range of exoplanet masses.

Atmospheric characterisation and biosignatures on worlds different to our own?

Examining differences in biomarker occurrence across different exoplanet stellar hosts.

## 3) What wavelength range would you need to achieve these goals?

29 responses

Biosignature detection would require the detection of multiple biosignature gases that should not exist together in equilibrium -- I think the current thinking is this requires coverage from UV to at least 2.5 um. Further coverage into the Mid-IR would be very helpful to unlock additional potential biosignature.

There are better people to ask this, but typically lines for the commonly accepted biomarkers can be seen all across the UV-VIS-NIR-MIR.

Ideally simultaneous multiple wavelength ranges with multiple transitions in CH4, O2, H2O, etc would be ideal in confirming biomarkers and eliminating effects intrinsic to one or the other. Encompassing Ozone features (e.g. around 0.8 or/and 10 micrometers would be ideal.

Ideally both optical and IR: 0.3-5 microns

0.5 - 5.0 micrometres

300-1000 nm

0.2 to 20 micron

4) What technology requirements are necessary to achieve these goals (e.g. do you need a coronagraph, polarimeter, and what are the technical requirements for these instruments)? Note: if you are not sure, also ok to skip this questions.

26 responses

Difficult to answer without determining the science requirements.

Again, not really my expertise, but a coronagraph would seem important.

Corongraph with inner working angle allowing for direct imaging of temperate Earths around sun-like stars. Optical spectropolarimetry would be useful for identifying cloud species.

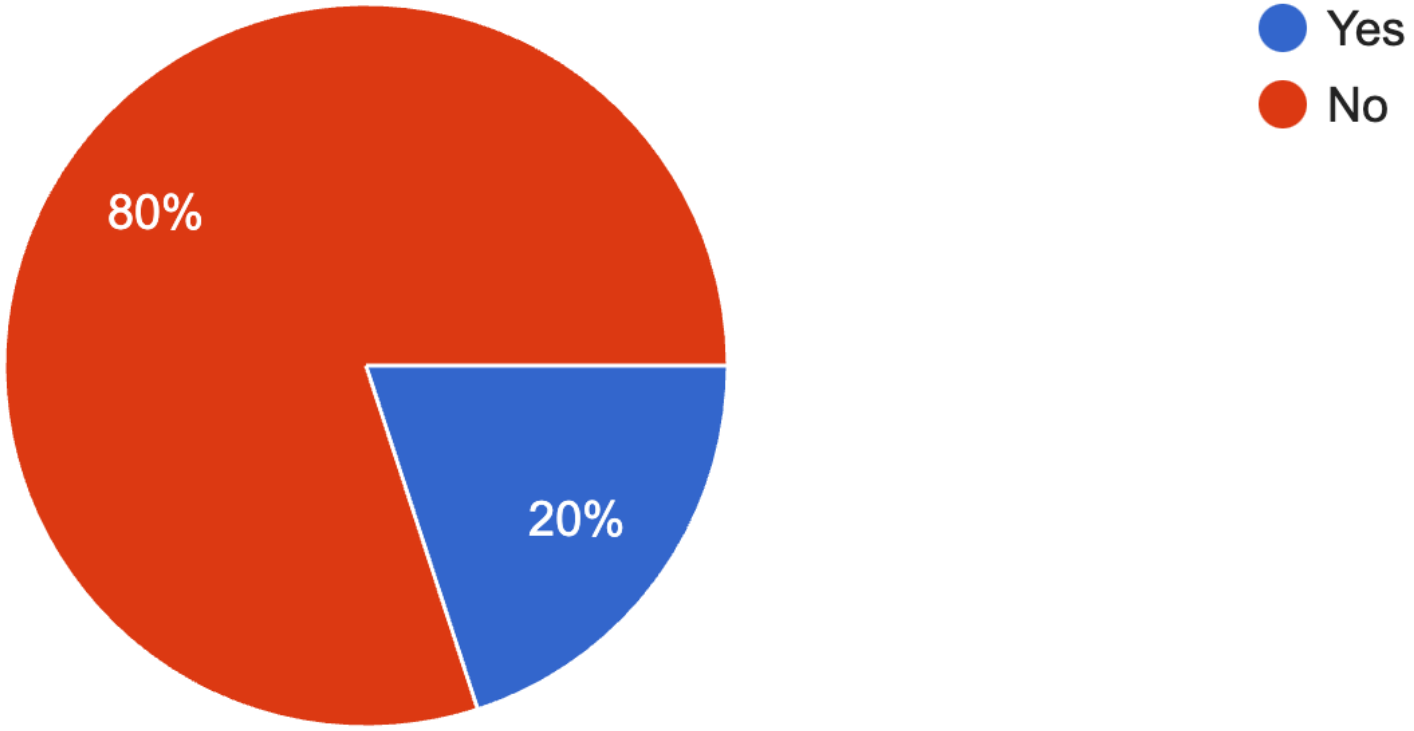
Coronagraph + spectrograph -- however, while higher resolution would be better, especially for molecular detection, that might be very tricky in reality, given just how faint Earth-like exoplanets are expected to be.

Again, there are better people to ask, but a high contrast imager able to achieve near to 10^-10 contrast or better, with spectrographs either 'JWST-like' specifications or if a feasibility study shows it is possible with sensible aperture sizes/ exposure times; a wide-band spectrograph/series of high-resolution spectrographs (possibly even in IFU configuration) with stability sufficient for cross-correlation atmospheres.

A polarimeter would be ideal in inferring atmospheric structure.

# Are you involved in HWO GOMaP-START working groups?

30 responses



# Take-aways:

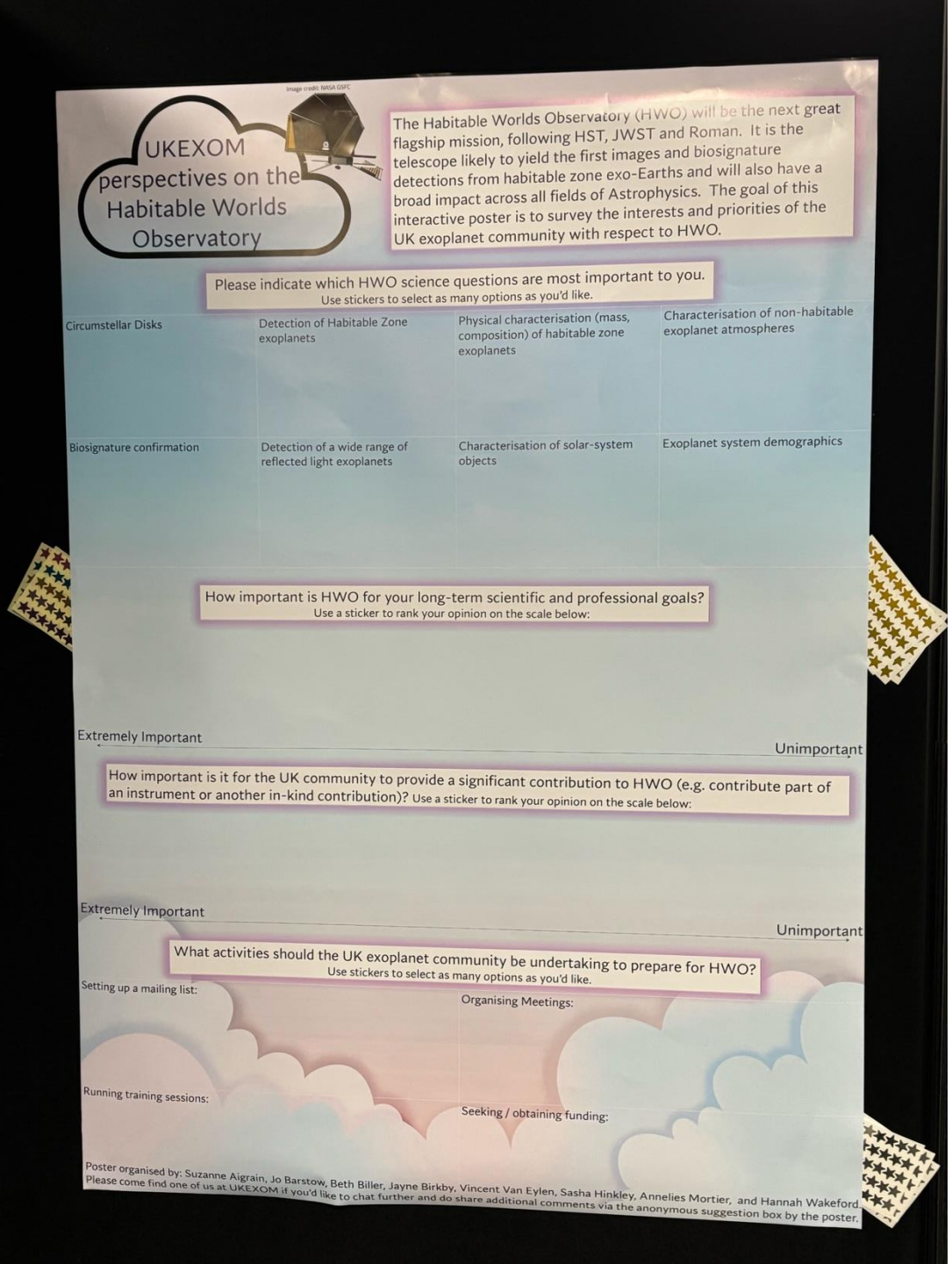
- Most common top science question: detection of biosignatures in reflected light spectra of exo-Earths.

- Most common second science question: also biosignatures, but some responses suggested also characterising a wider range of exoplanet types.

- The UK community is relatively uninvolved with the GOMaP-START working groups.

# Results from survey presented at UK HWO workshop

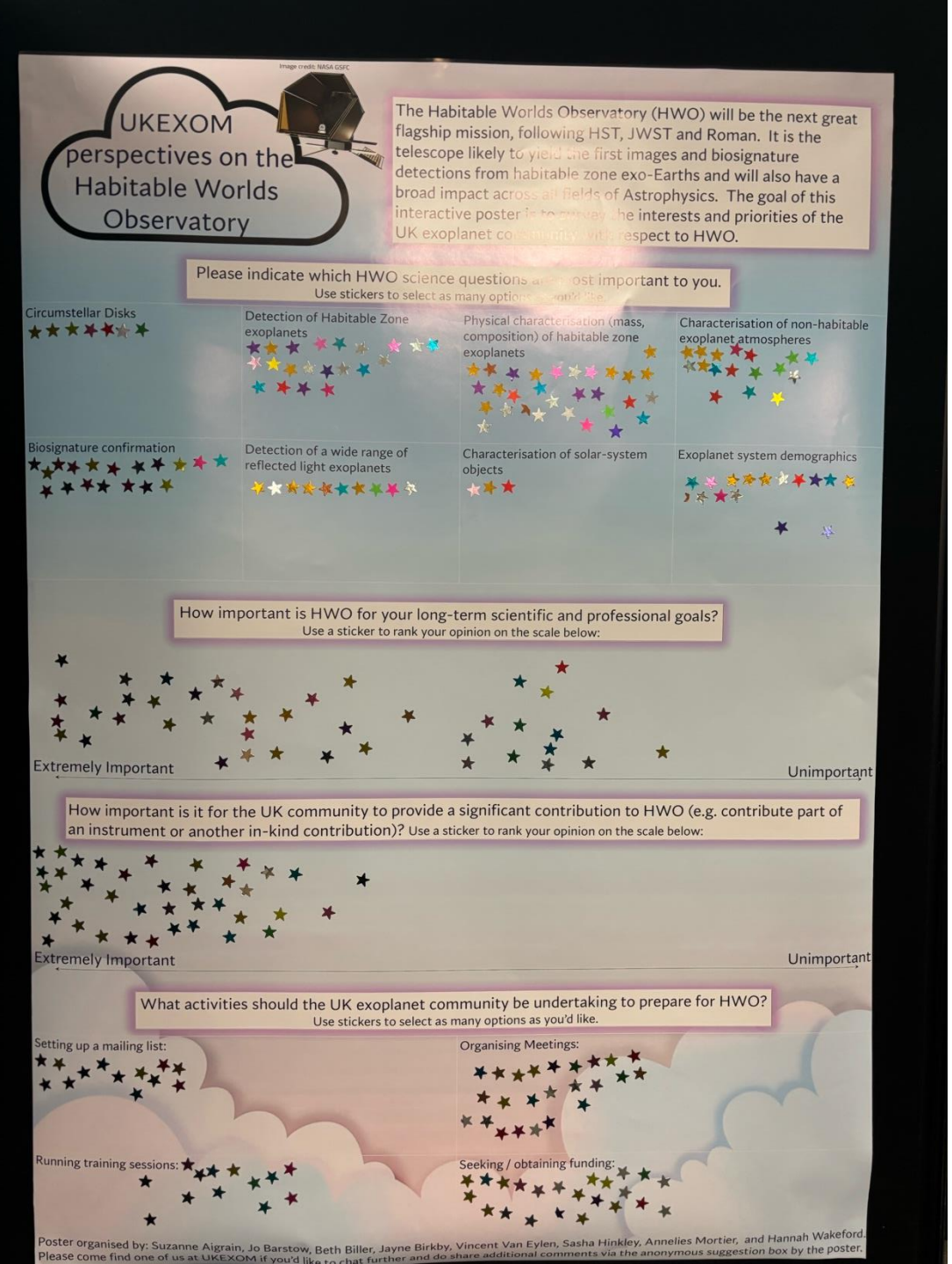
- Workshop at Milton Keynes in Autumn 2024, with participants from UKSA, NASA, and from across the UK.




# The goal of the UKEXOM interactive poster:

- Survey the interests and priorities of the UK exoplanet community with respect to HWO

Areas of consensus across the community may identify scientific / technical areas where the UK could provide a substantial national contribution and thus serve as a basis for organisation of the community.

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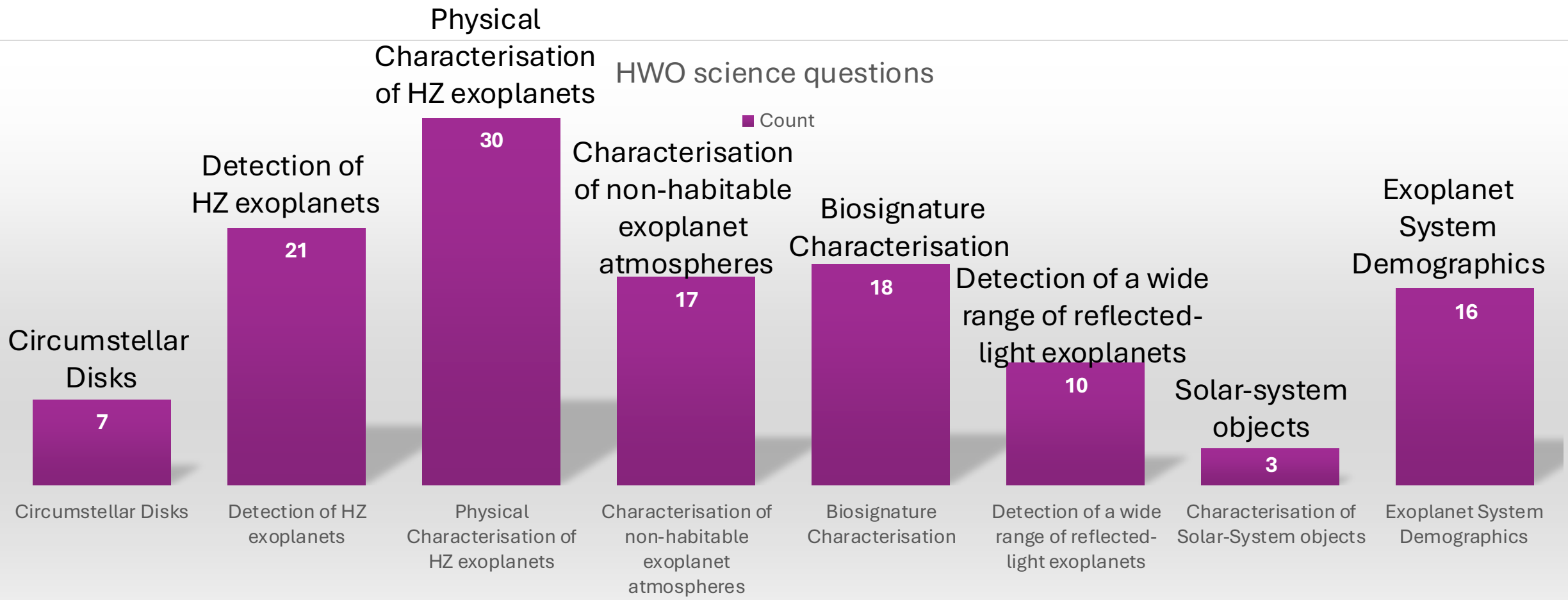
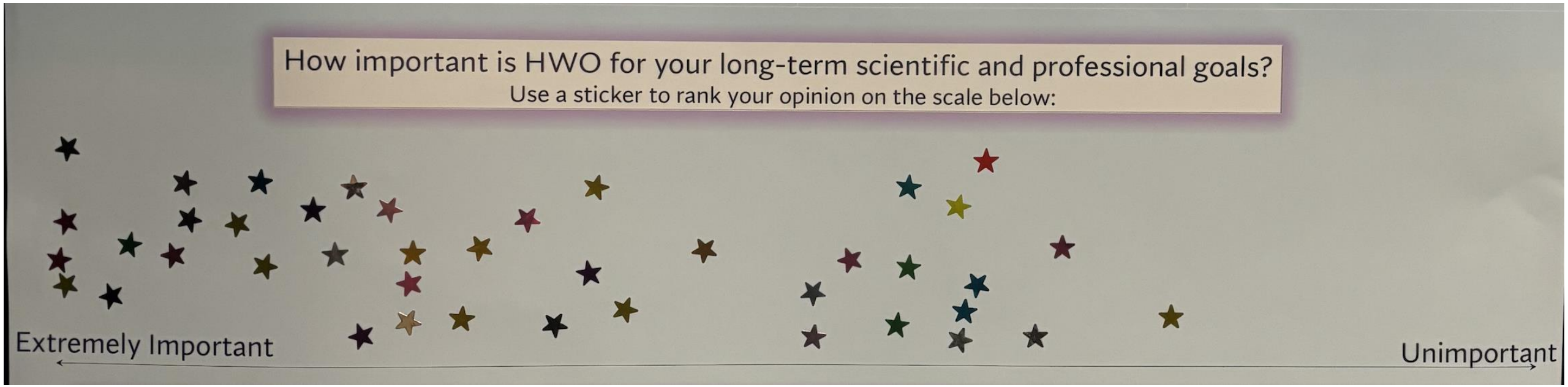



# Opinions on HWO science questions

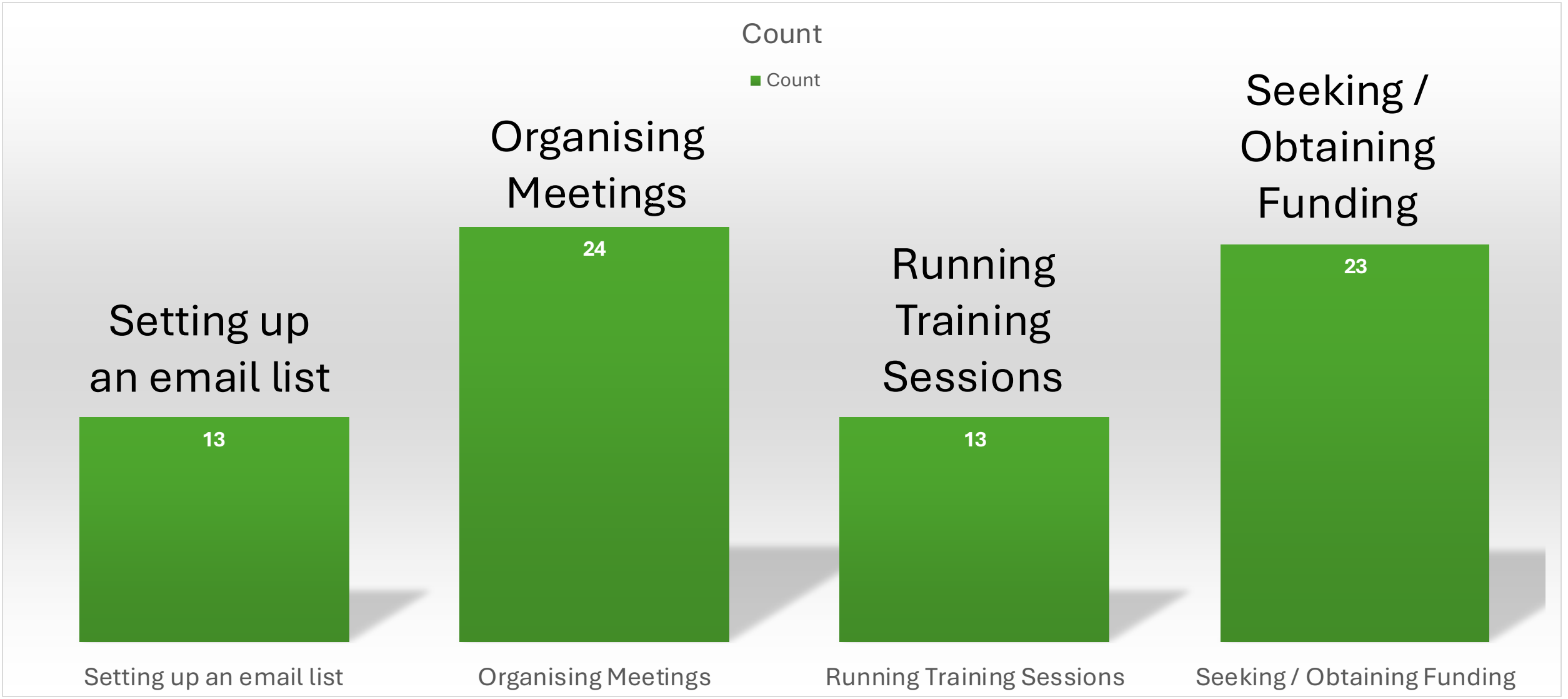

How important is HWO for your long-term scientific and professional goals?
Use a sticker to rank your opinion on the scale below:
Extremely Important
Unimportant

How important is it for the UK community to provide a significant contribution to HWO (e.g. contribute part of an instrument or another in-kind contribution)? Use a sticker to rank your opinion on the scale below:

Extremely Important

Unimportant

# Opinions on actions to take:



# Additional comments from the suggestion box:

- Much of the motivation for studying exozodiacal dust is to mitigate its effect on HWO searches for exo-Earths – we should talk!  -- Tim
- We have a strong terrestrial planet atmosphere modelling community in the UK – we should exploit that to prep/specs for HWO! (Catherine Walsh – Leeds)
- We need to understand clouds!  More UK labs!
- Work together with stellar people → let's characterize the targets! **
- Planetary enriched white dwarfs!!