A SAG Proposal on ExoZodiacal Disks

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It’s been 10 years…

• First SAG: Debris Disks and ExoZodis
ExoZodis: Opportunity and Adversity

V=5 star
3e-9 Companion at 2.5 AU
5 Zodi disk at 3 AU

Convolved with CGI PSF
Cold Debris Disks

Debes et al. 2019, BAAS, 51, 566
Surveying Nearby Stars

The next 10 years will see us probing the terrestrial planet forming region of nearby stars in an unprecedented way.
Research Vignette: Beta Leo

L’ imaging for giant planets

N’ imaging/interferometry for dust

55+/−10 Zodis at ~0.3”

Also:
Planet searches around Alpha Cen in the mid-IR
Future JWST observations
ELT mid-IR imaging

Defrere et al., 2021
Research Vignette: Juno

Also:
- Parker Solar Probe
- New Horizons
- Others?

Jorgensen et al., 2020
Research Vignette: Roman/CGI

SNR~5/resol detection limit
Current best estimates
Requires successful tech demo

95% confidence intervals for number of detections of exozodis in HabEx target list as function of median zodi level

Douglas et al., 2021
A new SAG Proposal

- Review the current state of knowledge for warm zodiacal dust in the Solar System and around nearby stars—is it scalable to all stellar masses?
  - i.e. studies of IDPs, dust scattering phase functions, polarimetry of dust

- Report on the current state of knowledge on the average exozodi level of nearby stars as determined by current measurements
  - Opportunities for existing observatories such as ALMA, HST, ground-based interferometers?
  - Reconciling hot dust seen in 2 micron interferometric surveys vs. mid-IR surveys

- Identify any gaps in knowledge for the Solar System Zodiacal Cloud that may be useful for understanding exozodi systems

- Identify any gaps in our physical knowledge of dust that, if addressed, could help predict scattered light from dust in visible wavelengths
  - Improved empirical, theoretical, or lab studies?
A New SAG Proposal

- Identify extended source detection and image post-processing methods that may be relevant for detecting exozodi disks with future missions or archival data
  - Optimize detection of disks
- Provide findings on whether an empirical method for predicting scattered light from thermal emission that is sufficiently robust to encompass the uncertainties of dust properties exists and determine the effects of such uncertainties on exoplanet imaging survey yields
- Identify high priority disk systems that could help to better understand exozodi systems
- Provide findings for future work to better retire risks to direct imaging exoplanet surveys, such as whether exo-zodi disks add more than photon noise in background limited observations.
Join me!

• If approved, will advertise for scientists to join in this endeavor
• All are welcome, including planetary scientists, dust enthusiasts, and debris disk researchers
• Hope to release a report/publication as warranted
Full draft text

https://stsci.box.com/v/ExoPAGSAGToR