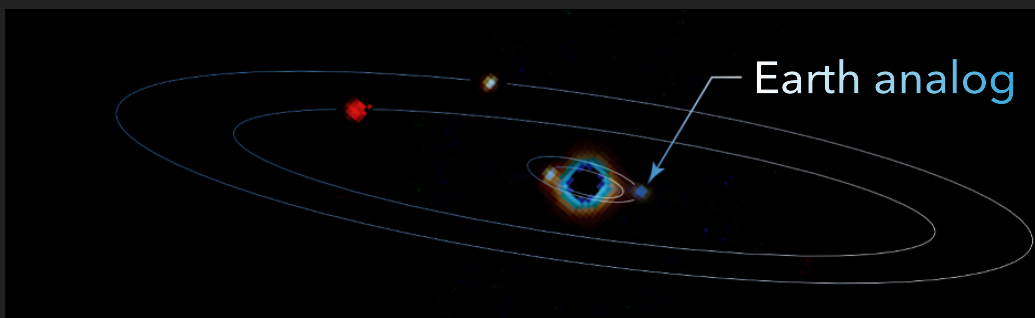


SPORES-HWO. II. *

ASSESSING SENSITIVITY LIMITS ON PLANETARY SYSTEM ARCHITECTURES WITH A UNIFORM ANALYSIS OF RADIAL VELOCITIES

Caleb Harada^{1,3} (they/them), Courtney Dressing¹, and Stephen Kane²

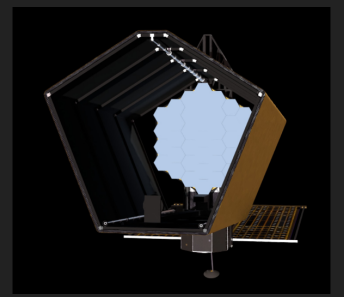
¹University of California, Berkeley, USA; ²University of California, Riverside, USA; ³NSF Graduate Research Fellow



Simulated image of a Solar System analog 30 light-years away, as captured by a large UV/O/NIR space telescope [STScI, NASA GSFC].

THE HABITABLE WORLDS OBSERVATORY (HWO)

is a NASA mission concept for a large UV/O/NIR space telescope that will directly image and spectroscopically characterize ~25 Earth-like planets orbiting nearby stars to search for evidence of life.



Notional HWO design.



SCAN ME

SPORES-HWO aims to maximize precursor knowledge of the most promising exo-Earth survey target stars for HWO. We have synthesized information about **164 promising HWO targets in the SPORES Catalog**[‡] [Harada et al. 2024], based on the NASA ExEP Mission Star List [Mamajek & Stapelfeldt 2023].

- ▶ UV to MIR photometry, stellar abundances, optical variability and flare rates, X-ray detections

[‡]The SPORES Catalog is complementary to the HPIC [Tuchow et al. 2024], which provides a larger list of potential HWO targets for exoplanet yield simulations.

WE ARE ANALYZING >84,000

archival RV observations of SPORES Catalog stars from HARPS/ESO and HIRES/Keck to:

- ▶ Place limits on **undetected planets**
- ▶ Refine properties of **known planets**
- ▶ Identify **false positives**
- ▶ Uncover **new planets**

THIS WORK IS CRITICAL

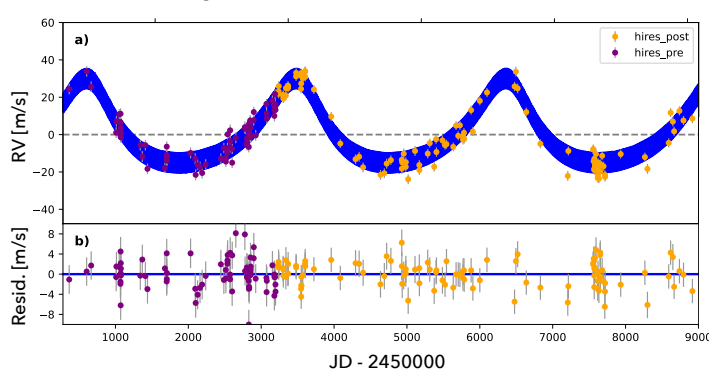
to informing **mission design trade studies** for HWO and improving **target selection** for the future exo-Earth survey.

Paper coming soon...

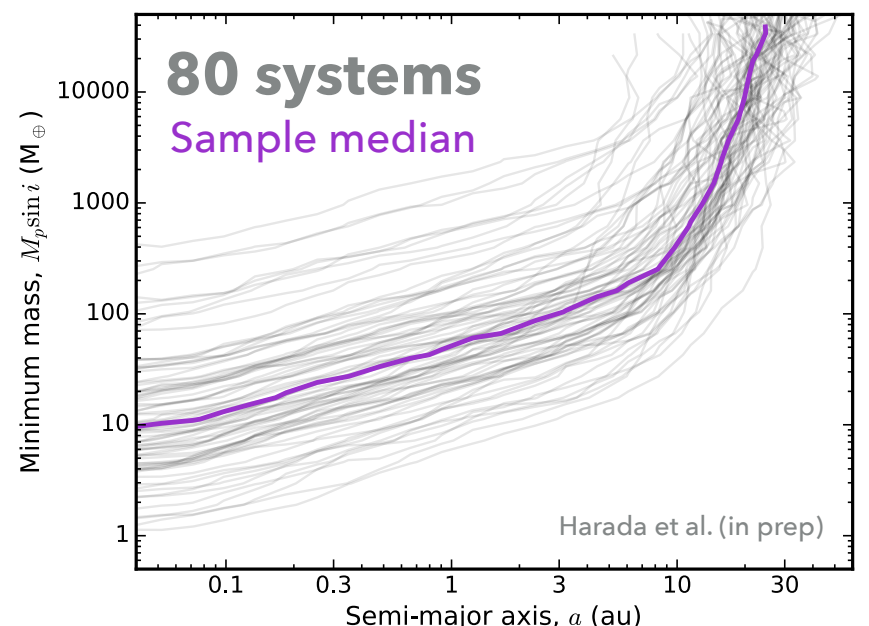
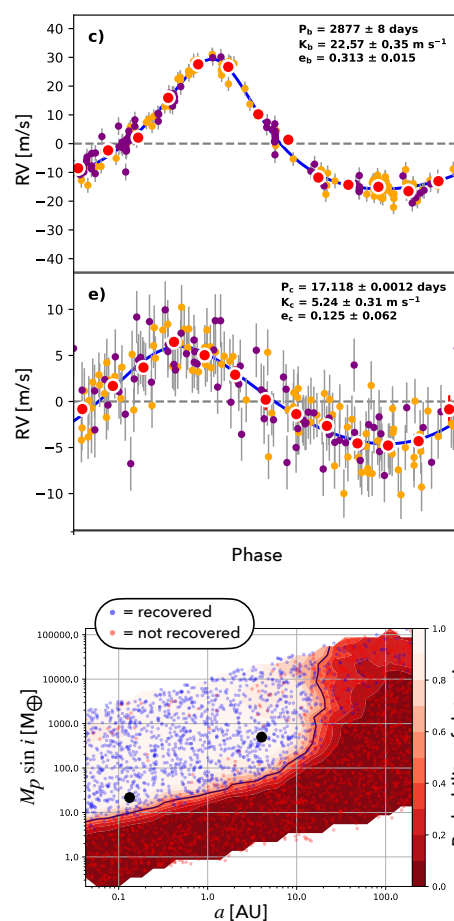
- ▶ **Search RVs, fit models, and determine empirical search completeness** with the RVSearch package [Rosenthal et al. 2021].

- ▶ **Build upon earlier analyses** of potential direct imaging mission target stars [e.g., Howard & Fulton 2016; Laliotis et al. 2023].

Example system: HD 190360



(Top) HIRES/Keck RV measurements of HD 190360, a G dwarf orbited by at least **two known planets**. The best-fit RV model with two planets is shown in blue, and residuals are shown in the lower panel. (Top right) Phase-folded RV plots for the two planets. (Bottom right) RV completeness determined by injection/recovery tests. The black line shows the 50% completeness contour, and the two detected planets are shown as black circles.



Contours showing 50% search completeness for each star in our sample with at least 25 nights of RV observations (gray lines), and the median 50% completeness contour (purple line). For a typical star in the sample, current RV measurements are **sensitive to a ~50 M_⊕ planet orbiting within 1 AU**. In the worst case, a Jupiter mass planet would not be detectable at 0.1 AU. Notably, these **80 systems comprise only about half of all SPORES systems**, highlighting the need for **additional RV observations** of the most promising HWO target stars.

