





Exploration of the Dynamical Phase Space of Stars with Known Planets

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WFIRST CGI Needs Targets!

Fortunately, we know where to find some:

4,031 confirmed exoplanets!



WFIRST CGI Needs Targets!

Except, these are mostly too far and too faint.

Only 60 currently known exoplanets that are potentially visible to WFIRST CGI



Classes of Target



Remember: It's All About Orbit Geometry and Photometry







The Photometry is Insanely Hard



Just because you know something is there, doesn't mean you'll see it

Batalha et al. (2018) To the Rescue



Batalha et al. (2018) Color Classification of Extrasolar Giant Planets: Prospects and Cautions, AJ 156 7

Clouds Make Huge Differences



Blind Search Targets: Depth of Search



See: Garrett, Savransky & Macintosh (2017) A Simple Depth-of-Search Metric for Exoplanet Imaging Surveys, AJ 154

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Blind Search Prioritization



Followup Targets: Orbital & Photometric Uncertainty



47 UMa c, Assuming 90° Inclination



Followup Targets: Completeness 47 UMa c



47 UMa C





$$\rho \triangleq \frac{a_2(1-e_2)}{a_1(1+e_1)} > \begin{cases} 1.15 + 2.4 \left[\max(\mu_1, \mu_2)^{1/3} \right] \left(\frac{a_2}{a_1} \right)^{\frac{1}{2}} \text{Petrovitch (2015)} \\ \left\{ \frac{1}{1-\delta} & a_2 = a_k \\ 1+\delta & a_1 = a_k , \end{cases}$$
Giuppone et al. (2013)

$$\gamma \sqrt{\alpha} (1 - \sqrt{1 - e_1^2} \cos i_1) + (1 - \sqrt{1 - e_2^2} \cos i_2) <$$

$$\gamma \sqrt{\alpha} + 1 - (1 + \gamma)^{3/2} \sqrt{\frac{\alpha}{\gamma + \alpha} \left(1 + \frac{3^{4/3} \epsilon^{2/3} \gamma}{(1 + \gamma)^2}\right)}$$
Petit et al. (2018)
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Gascon, Savransky, and Sureda (submitted) "Analytic stability maps of unknown exoplanet companions for imaging prioritization," ApJ

GJ 649 Companion Search



Gascon, Savransky, and Sureda (submitted) "Analytic stability maps of unknown exoplanet companions for imaging prioritization," ApJ

We Can Do This For All Known Single-

Planet Systems



100% of the Code and Data I've shown here is available for public use

- <u>https://plandb.sioslab.com</u>
- <u>https://github.com/SIOSlab/DoS</u>
- <u>https://github.com/CarlosGascon/NumSim</u>
- <u>https://github.com/CarlosGascon/StableDoS</u>
- <u>https://github.com/dsavransky/plandb.sioslab.com</u>

