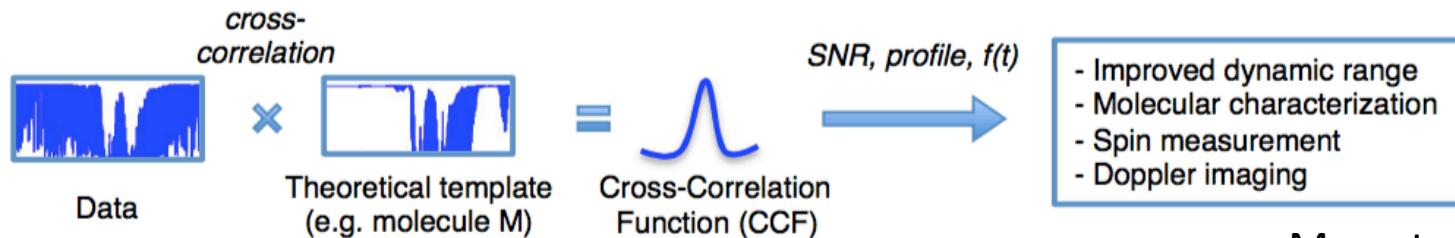
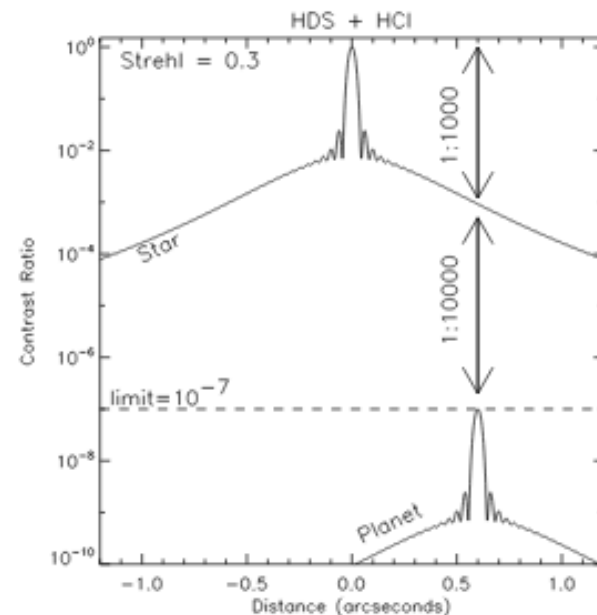
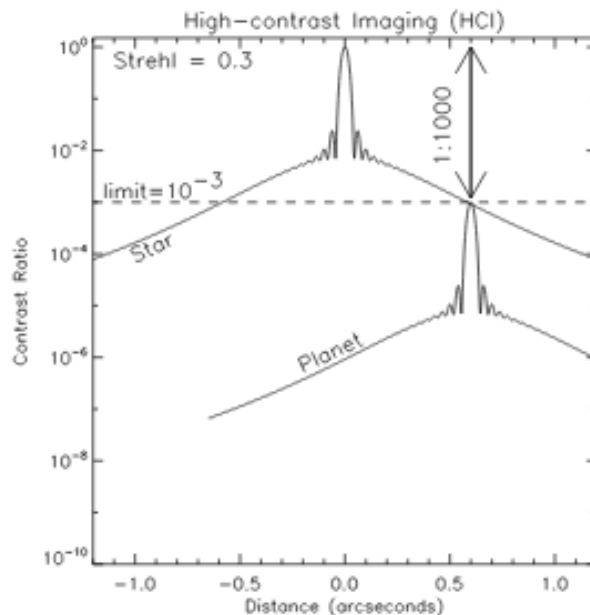
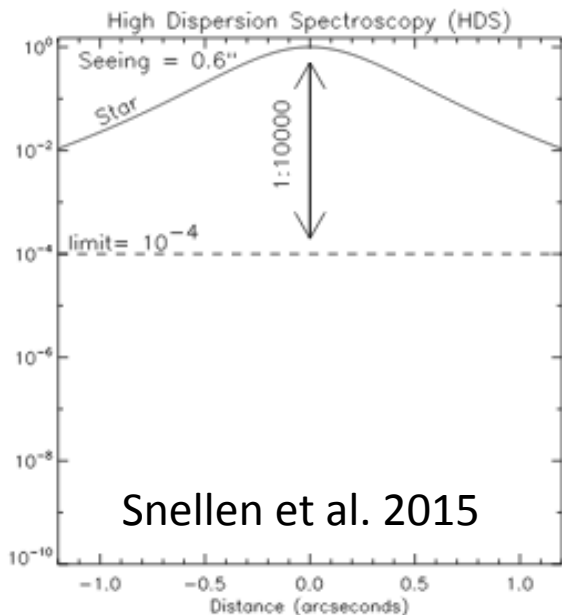


High Dispersion Coronagraphy (HDC)

Ji Wang

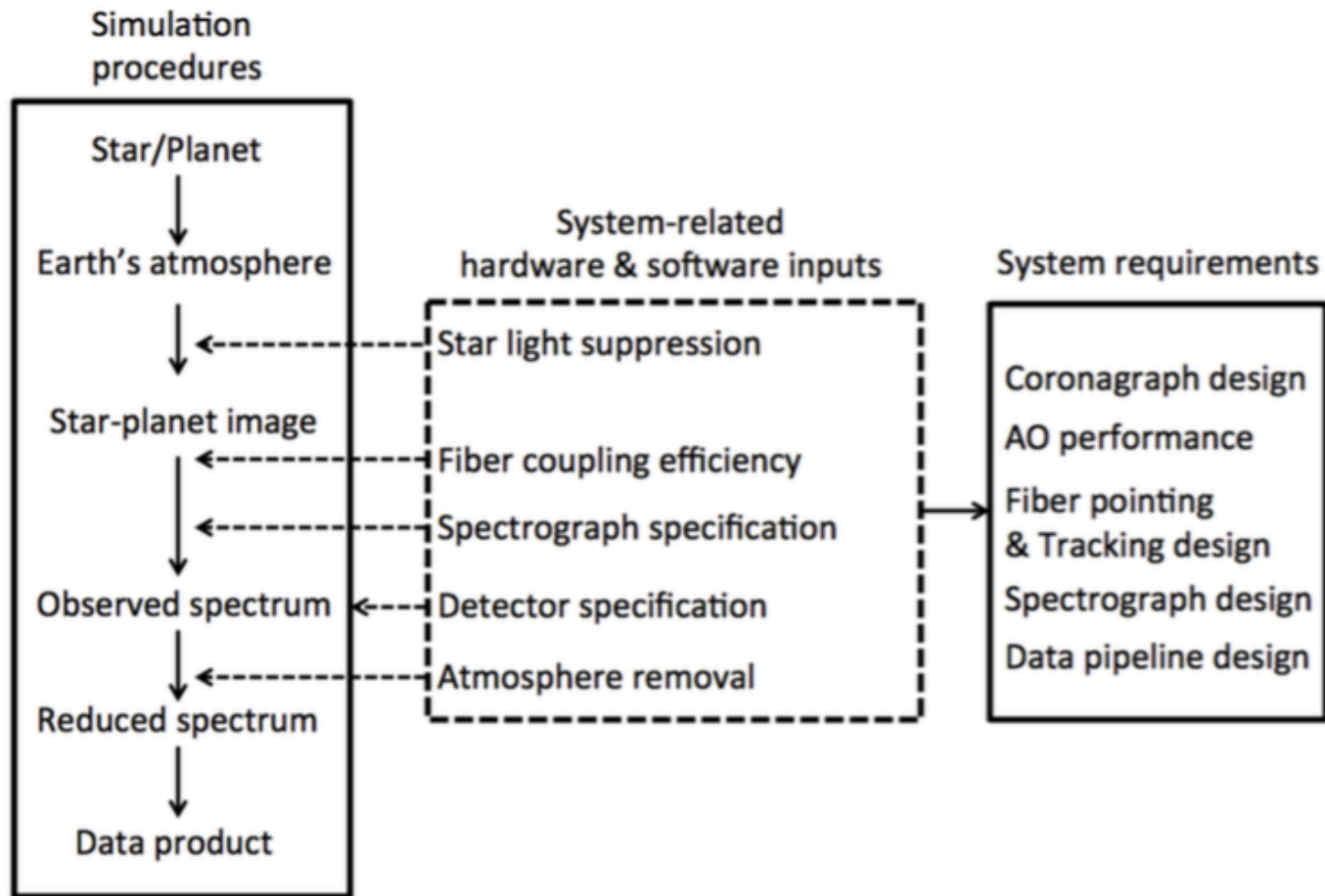
Caltech

High Dispersion Coronagraphy



Mawet et al. (2016)
Submitted to ApJ

HDC Simulator



Observation and Reduction

- Fibers: planet, star, sky
- $(f_{\text{planet}} - f_{\text{sky}}) / (f_{\text{star}} - f_{\text{sky}})$ or $f_{\text{planet}} / f_{\text{star}}$ (if f_{sky} is negligible) to remove telluric lines and continuum
- Photon-noise and detector noise
- High-pass filter to further remove continuum
- Template matching (find significance of CCF)
- Use of orbital modulation to discriminate false positives

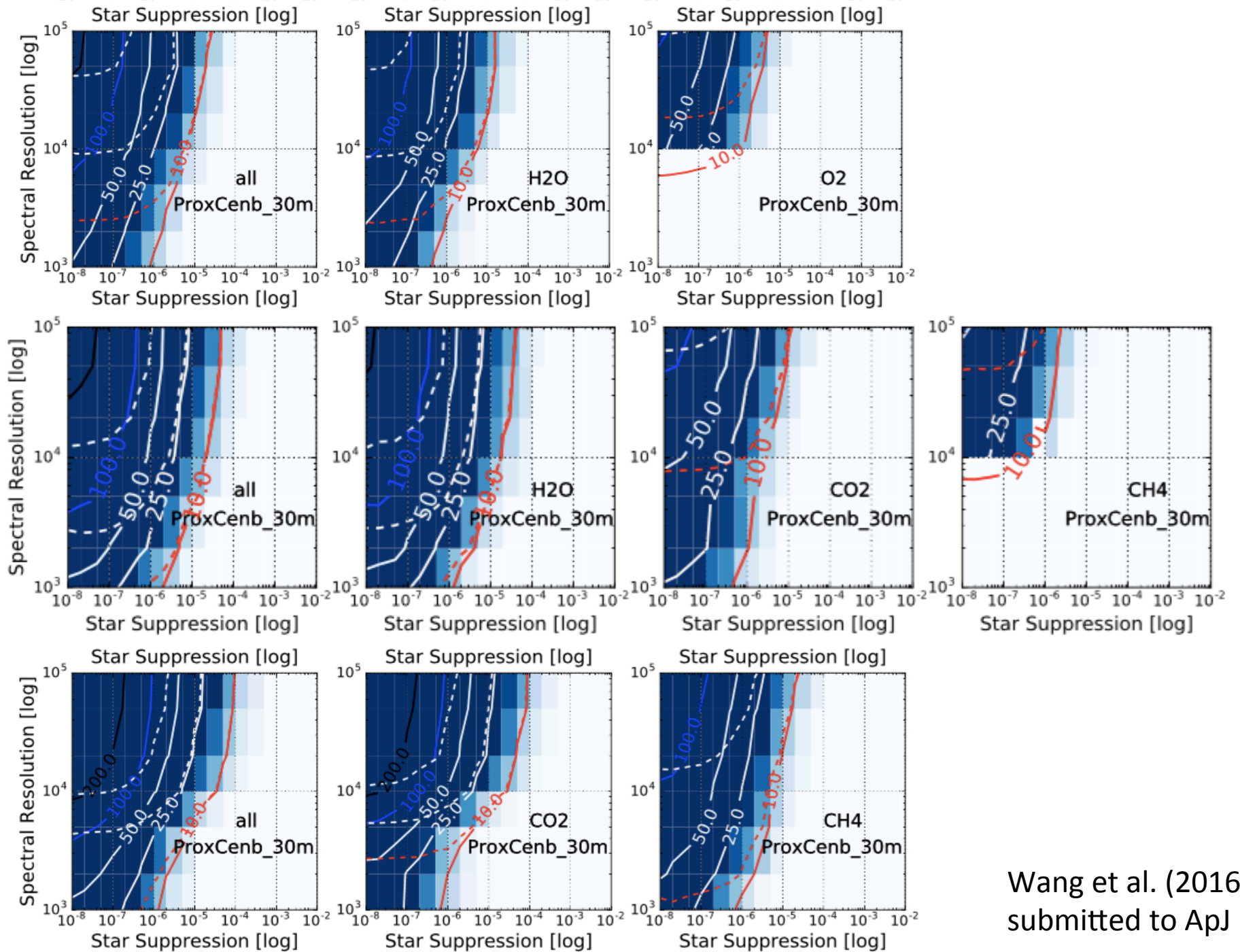
NIR HDC Observation of Prox Cen b with 30-m Class Telescopes

Parameter	Value	Unit
Telescope aperture	30.0	m
Telescope+instrument throughput	10%	...
Wavefront correction error floor	200	nm
Spectral resolution	varied	...
<i>J</i> band spectral range	1.143 - 1.375	μm
<i>H</i> band spectral range	1.413 - 1.808	μm
<i>K</i> band spectral range	1.996 - 2.382	μm
Exposure time	100	hour
Fiber angular diameter	1.0	λ/D
Readout noise	0.0 or 2.0	e^- *
Dark current	0.0 or 0.002	$e^- \text{ s}^{-1}$ *

Note. — *: Based on H2RG detector specification (Blair et al. 2012)

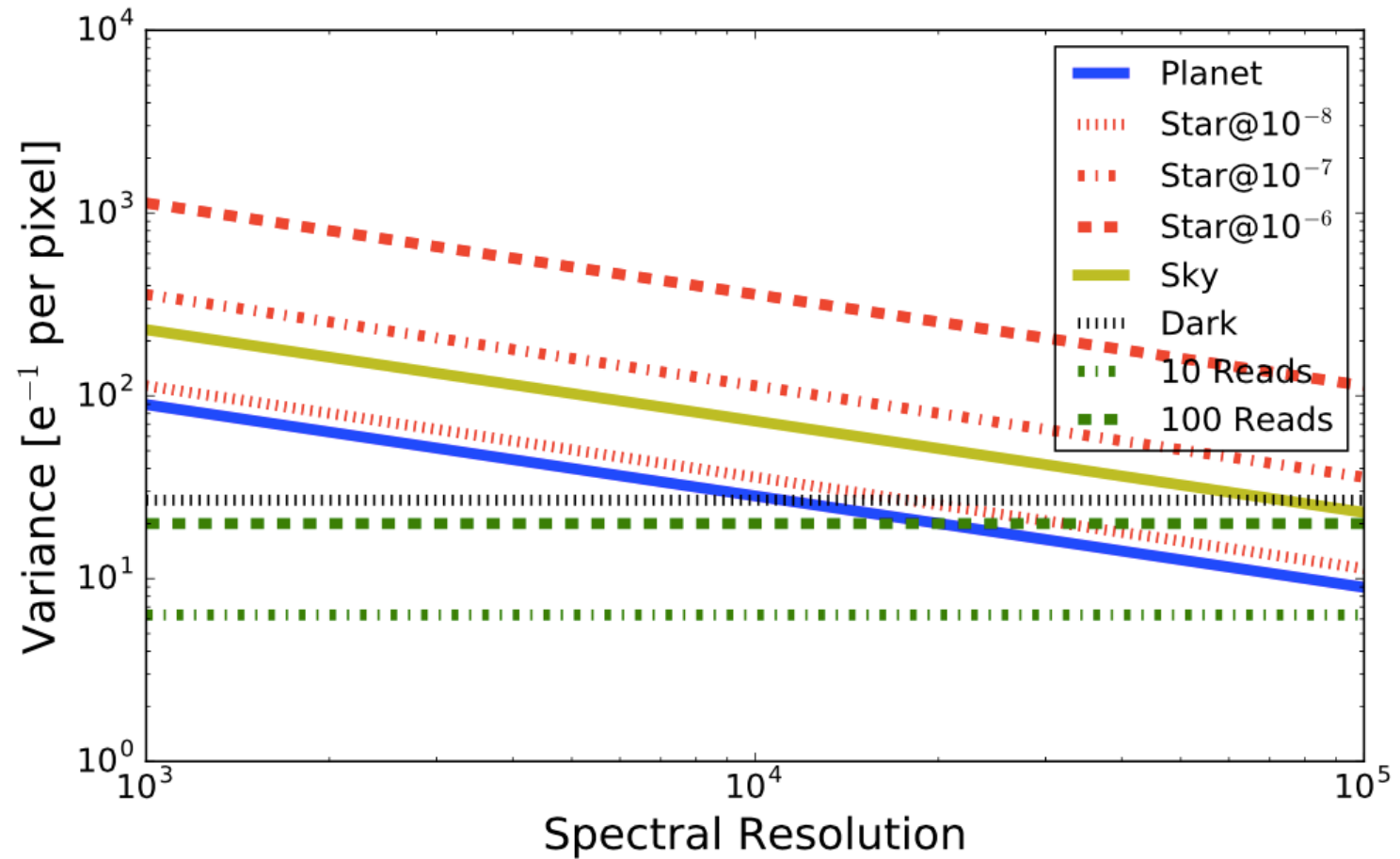
Parameter	Value	Unit
Star		
Effective temperature* (T_{eff})	3050	K
Mass	0.12	M_{\odot}
Radius	0.14	R_{\odot}
Surface gravity ($\log g$)	5.0	cgs
Metallicity ($[M/H]$)	0.0	dex
Distance	1.295	pc
$V \sin i$	<1	km s^{-1}
Inclination (i)	20	degree
Radial velocity	-22.4	km s^{-1}
Planet		
Effective temperature (T_{eff})	234	K
$V \sin i^{**}$	0.014	km s^{-1}
Inclination (i)	20	degree
Semi-major axis (a)	0.05	AU
Radius	1.0	R_{\oplus}
Radial velocity	22.2	km s^{-1}
Illuminated Area	0.5	...
Planet/Star Contrast	1.6×10^{-7}	...
Angular separation	38.6	mas
Angular separation in <i>J</i>	4.5	λ/D
Angular separation in <i>H</i>	3.5	λ/D
Angular separation in <i>K_S</i>	2.6	λ/D

Note. — *: All values are from Anglada-Escudé et al. (2016). We use 3000 K in simulation. **: We assume that the planet is tidally locked.



Wang et al. (2016)
submitted to ApJ

Sources of Noise



Questions

- How to make simulation more realistic
 - Stellar spots
 - More realistic data reduction
- What are the challenges in observation?
 - Positioning and tracking
 - Single vs. multi-mode fiber
 - IWA constraints on observable orbital phases