GPI 2.0

Characterizing Self-Luminous Exoplanets Through Low-Resolution Infrared Spectroscopy

Aleman et. al.

About GPI

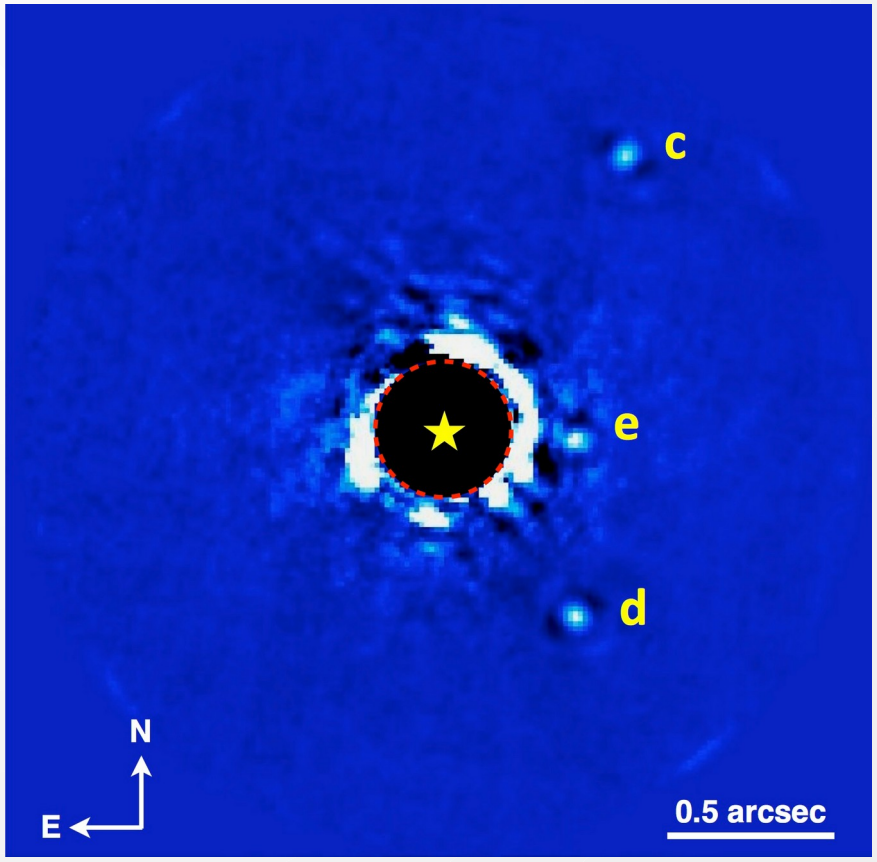
- Gemini Planet Imager
- Uses direct imaging
- Obtains spectra of planets
- Spectra have 16 pixels each
- Uses 4 IR bands (YHJK)
- Getting an upgrade

planetimager.org

Direct Imaging

Taking Pictures of planets

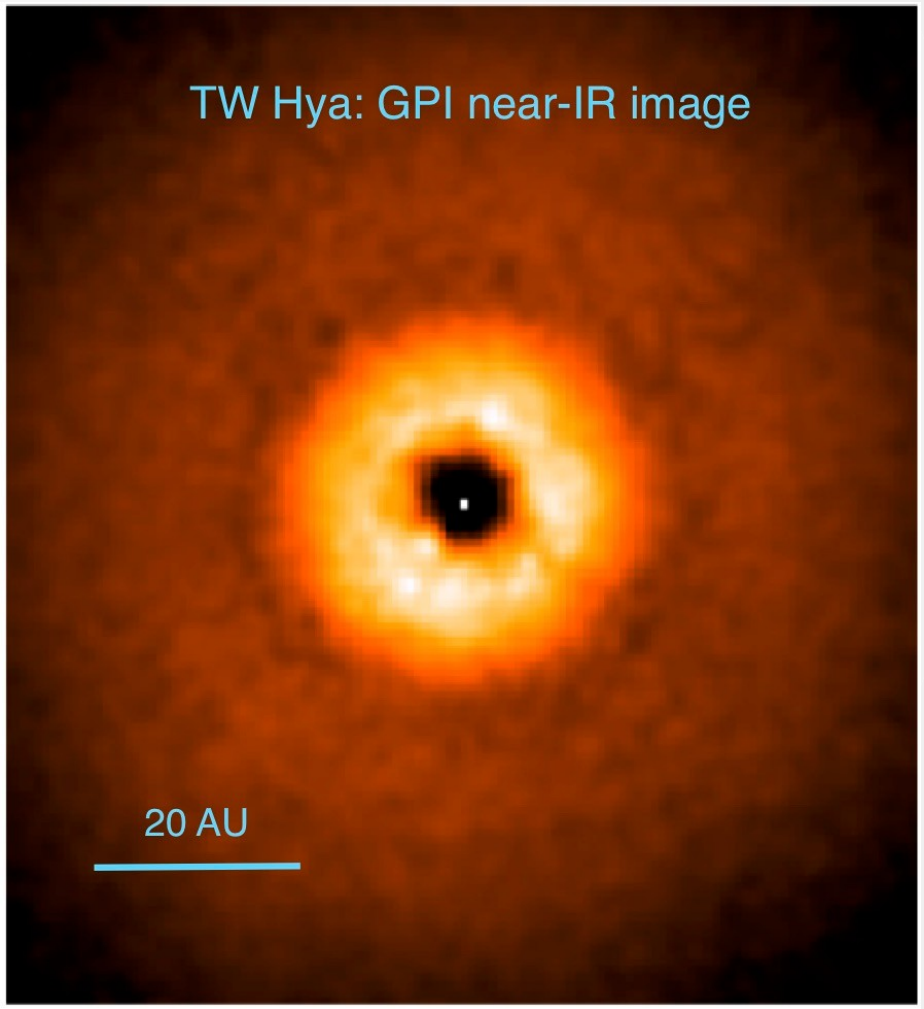
Shown here are 3 exoplanets



planetimager.org

Upsides?

- Generally applicable
- Unique bias
- Can constrain certain properties of exoplanets



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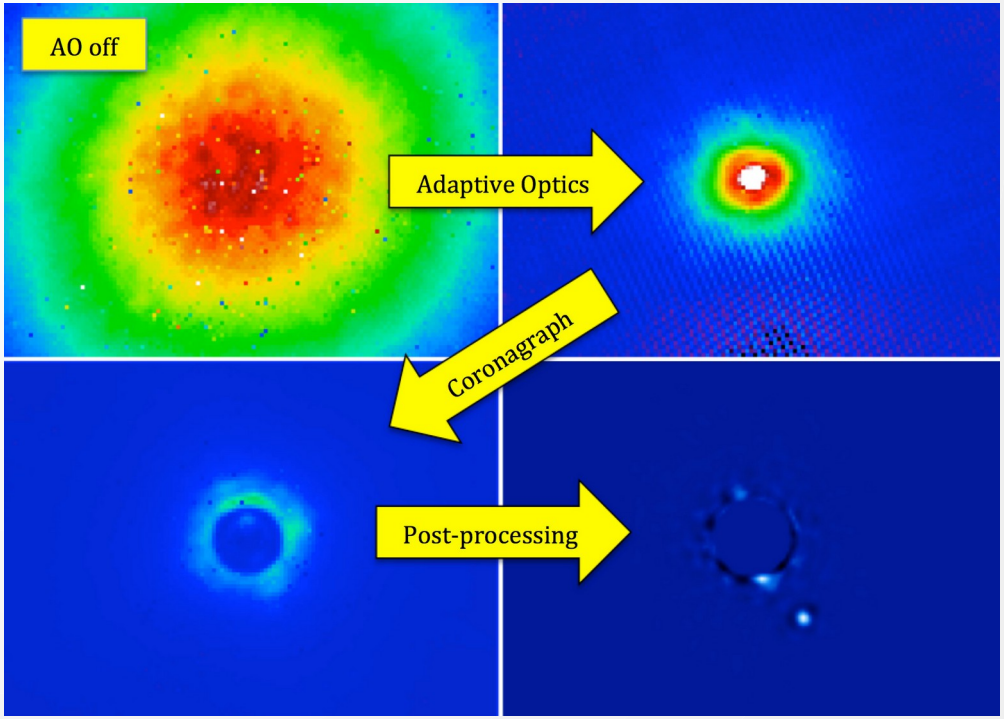
Downsides?

It’s hard:

- Needs a decent telescope
- There’s literally a star right there!
- Background stars



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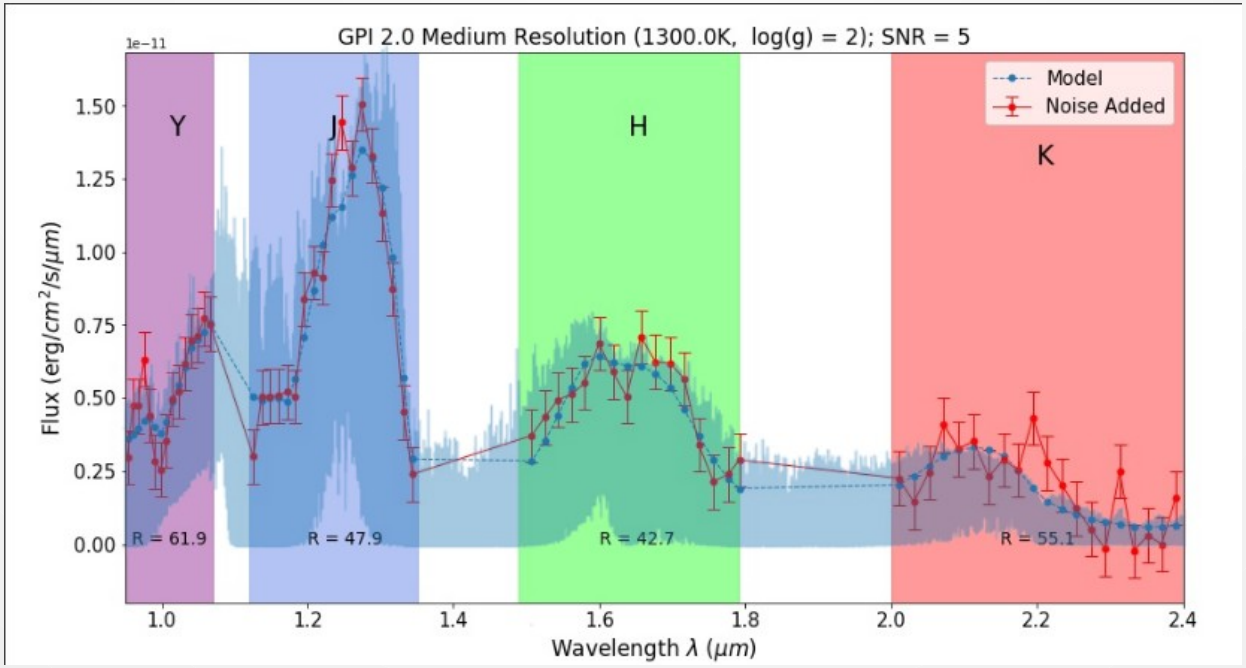
Now the Paper

- How to make measurements?
- How accurate are they?
- Can it distinguish an exoplanet from a background star?

Methods

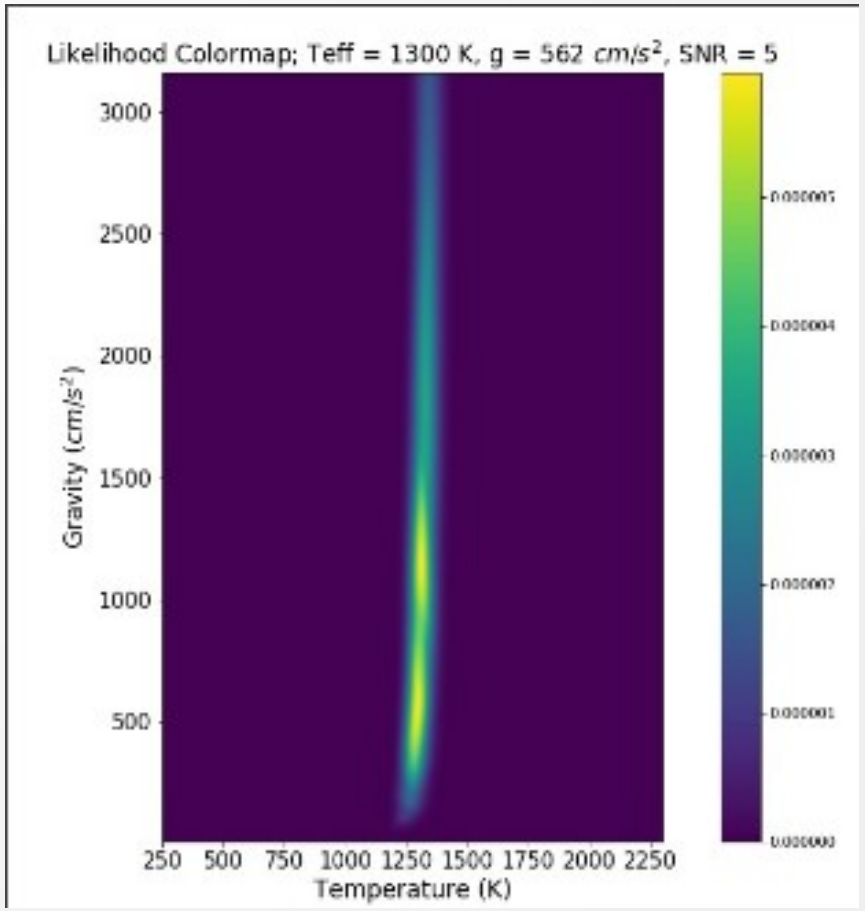
- Generate model spectra
- Make the real world happen



(Aleman et. al. 2022)

Preliminary Results

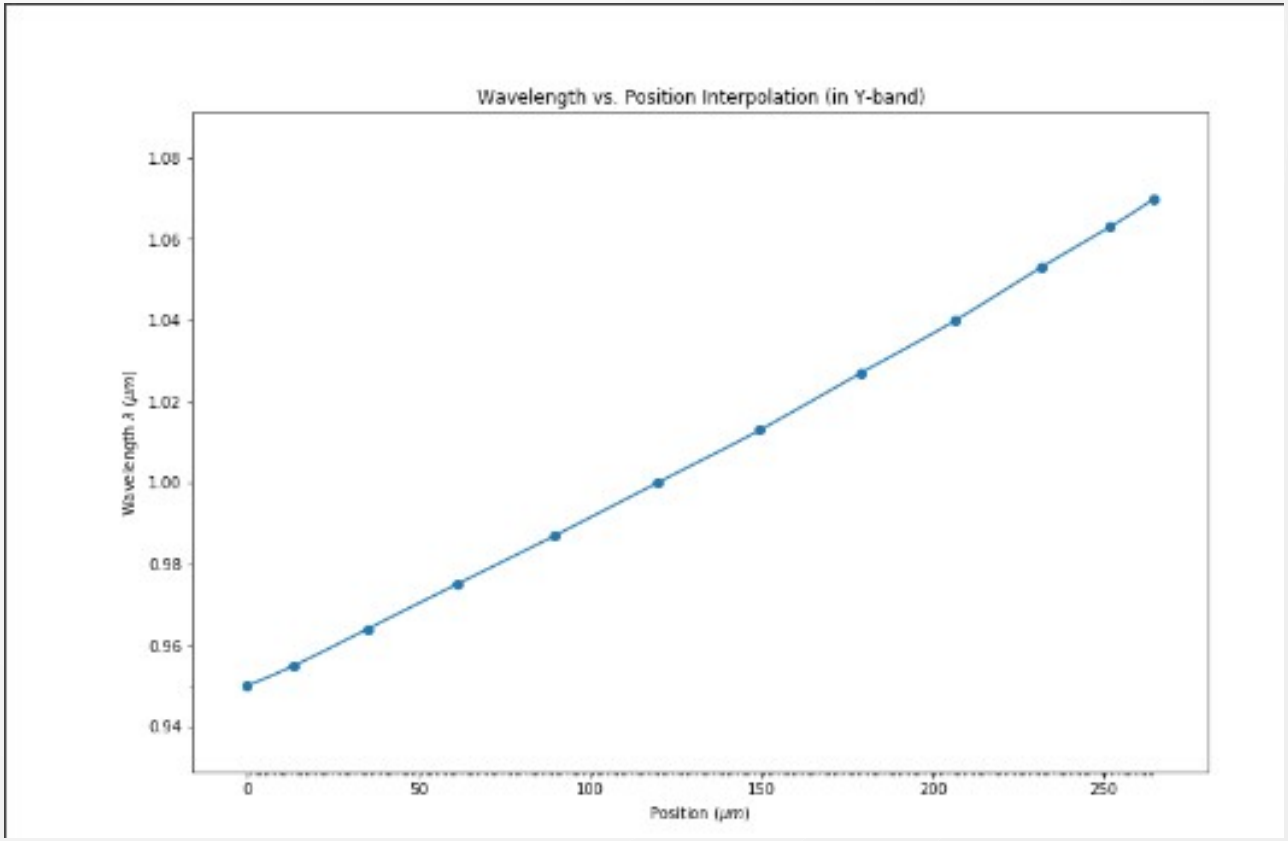
- Temperature ✓
- Surface Gravity ✗



(Aleman et. al. 2022)

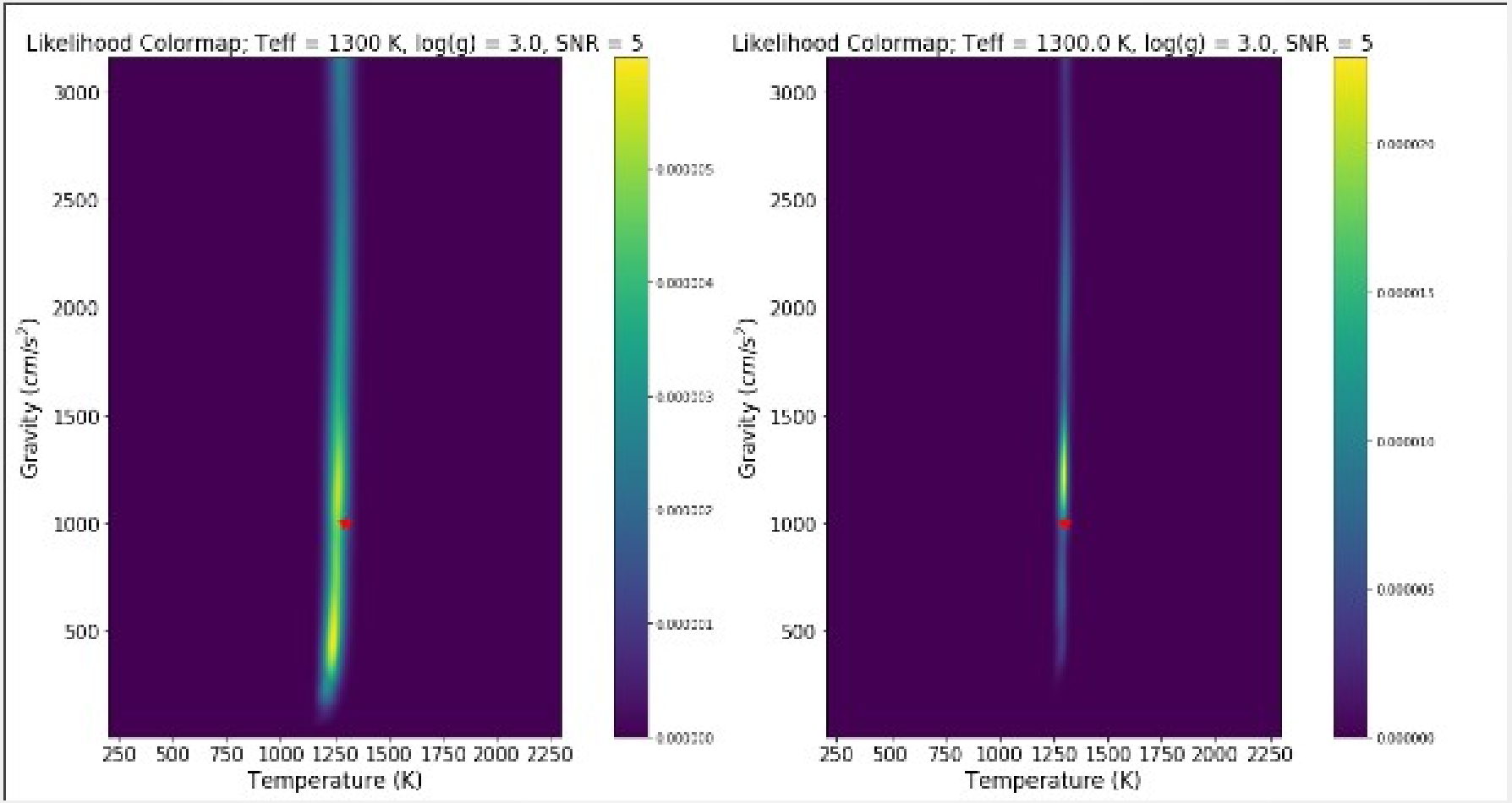
Better "Real World"

- Nonlinear dispersion
- Line spread (blurring)



(Aleman et. al. 2022)

Results 1



(Aleman et. al. 2022)

Results 2

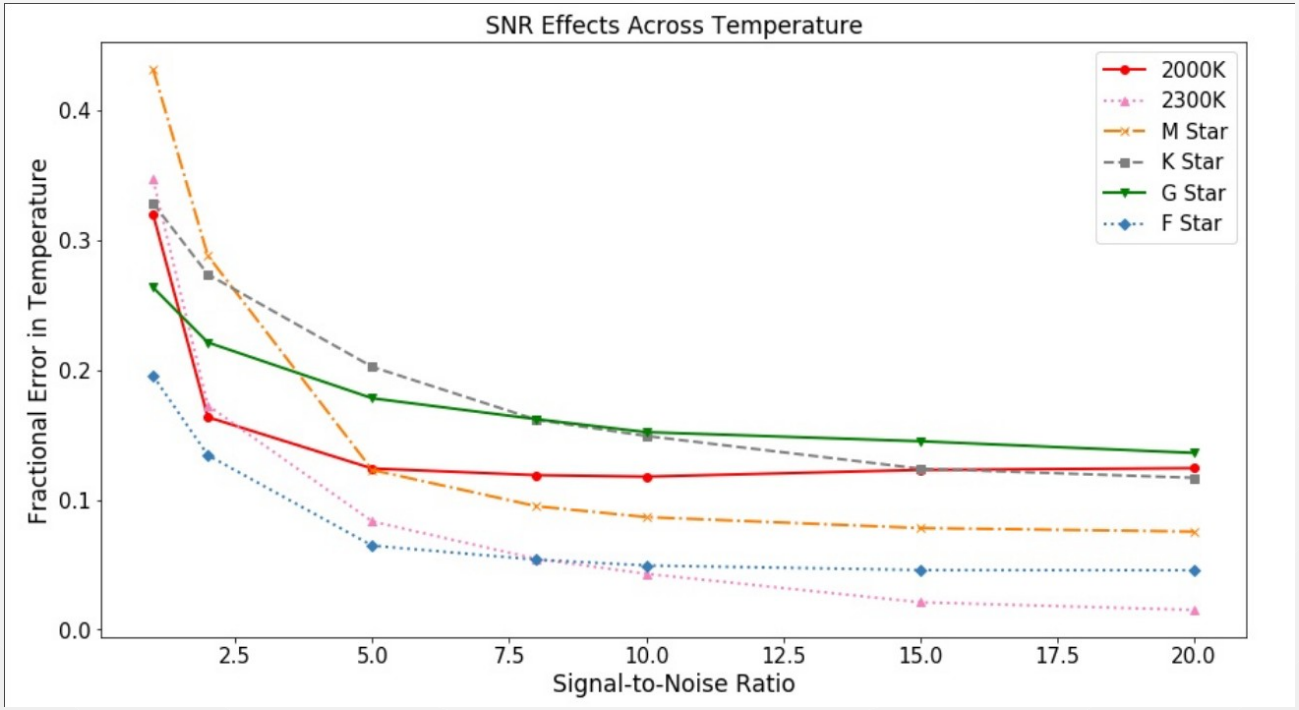
Table 4. GPI 2.0 Medium Resolution Cases Summary

	500 K			1000 K			1300 K		
Cases	**68% Conf.**	**95% Conf.**	**99.7% Conf.**	**68% Conf.**	**95% Conf.**	**99.7 Conf.**	**68% Conf.**	**95% Conf.**	**99.7% Conf.**
H (t_{exp} = 4 hrs)	5.1	21.1	35.7	7.9	30.7	49.7	31.1	113.3	192.5
H+Y (t_{exp} = 2 hrs each)	2.4	10.6	18.4	9.5	36.3	61.6	35.1	128.8	215
H+J (t_{exp} = 2 hrs each)	1.2	6.9	12.2	6.3	26.1	44.3	21.5	77.7	130.4
H+K (t_{exp} = 2 hrs each)	7.9	30.1	51.3	11.6	43.5	73.5	26.7	96.9	163.1
Y+J+H+K (t_{exp} = 1 hr each)	1.8	8.7	14.8	9	34.3	58	24.2	87.1	146.5

(Aleman et. al. 2022)

Results 3

- <25% error when SNR>5
- 2 hours exposure



(Aleman et. al. 2022)

Conclusions

- GPI 2.0 can constrain temperature
- Not really surface gravity
- Best bands are H and J
- It can tell stars from planets