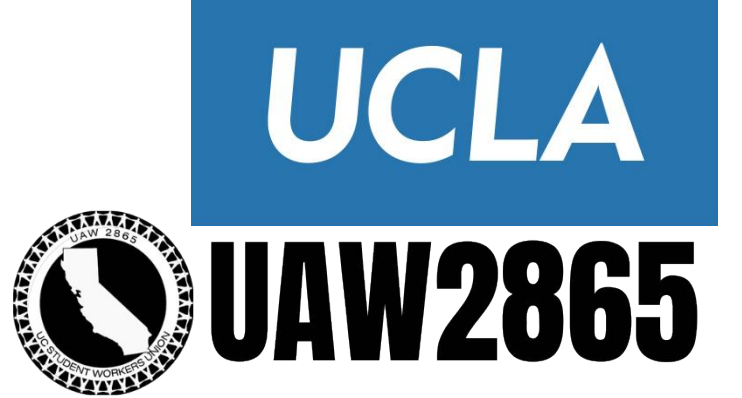


# Surveying hot Jupiter atmospheres with Keck/KPIC



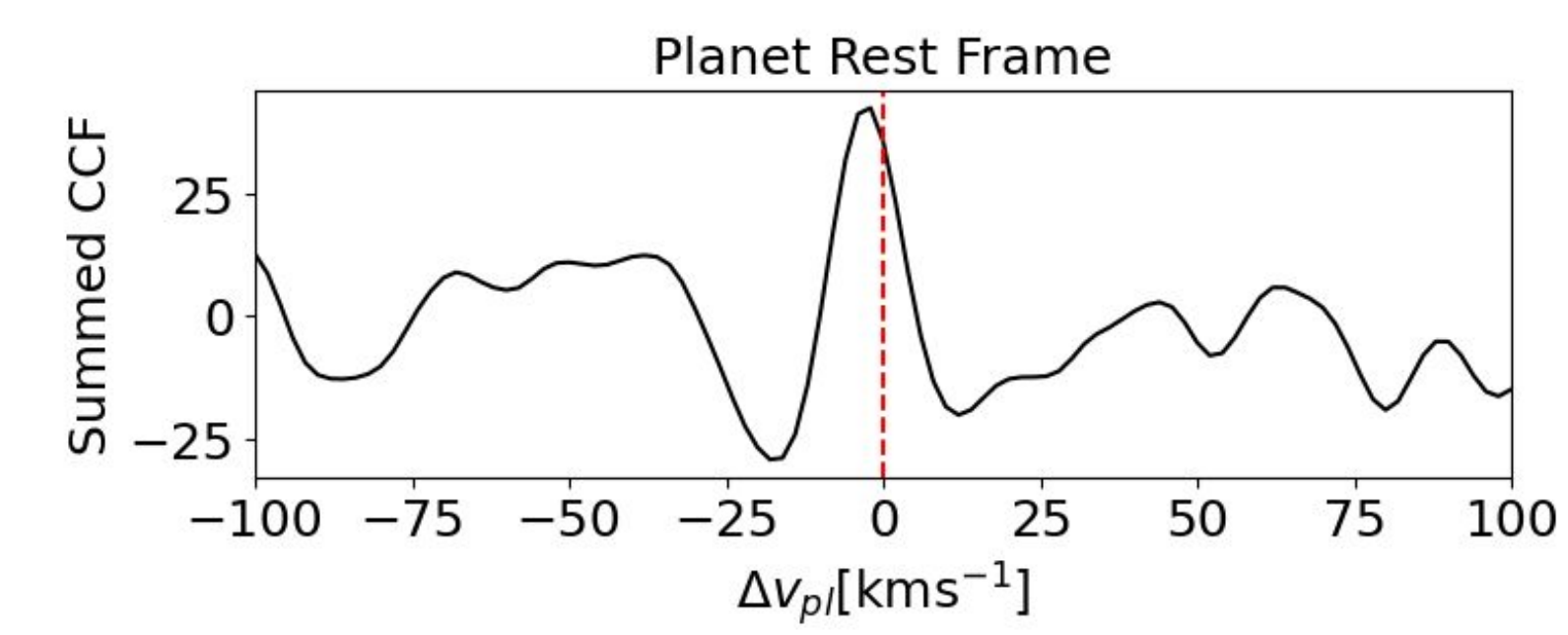
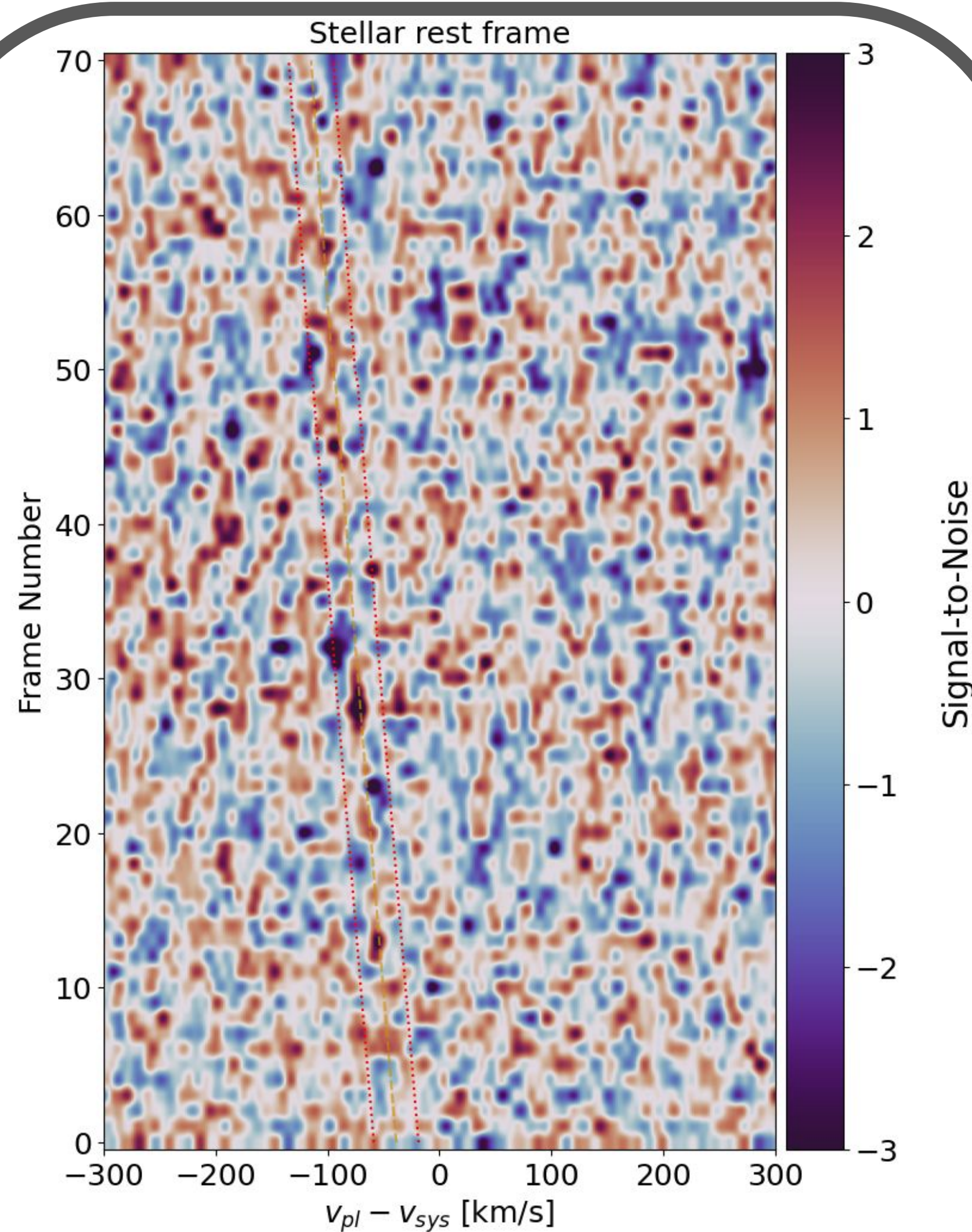
Luke Finnerty<sup>1</sup>, Michael P. Fitzgerald<sup>1</sup>, Jerry W. Xuan<sup>2</sup>, Yinzi Xin<sup>2</sup>, Daniel Echeverri<sup>2</sup>, Julie Inglis<sup>2</sup>, Geoffrey A. Blake<sup>2</sup>, Nemanja Jovanovic<sup>2</sup>, Dimitri Mawet<sup>2</sup>, Chih-Chun Hsu<sup>3</sup>, Jason J. Wang<sup>3</sup>, and the KPIC team  
 (1) UCLA (2) Caltech (3) Northwestern



## High-resolution cross-correlation spectroscopy

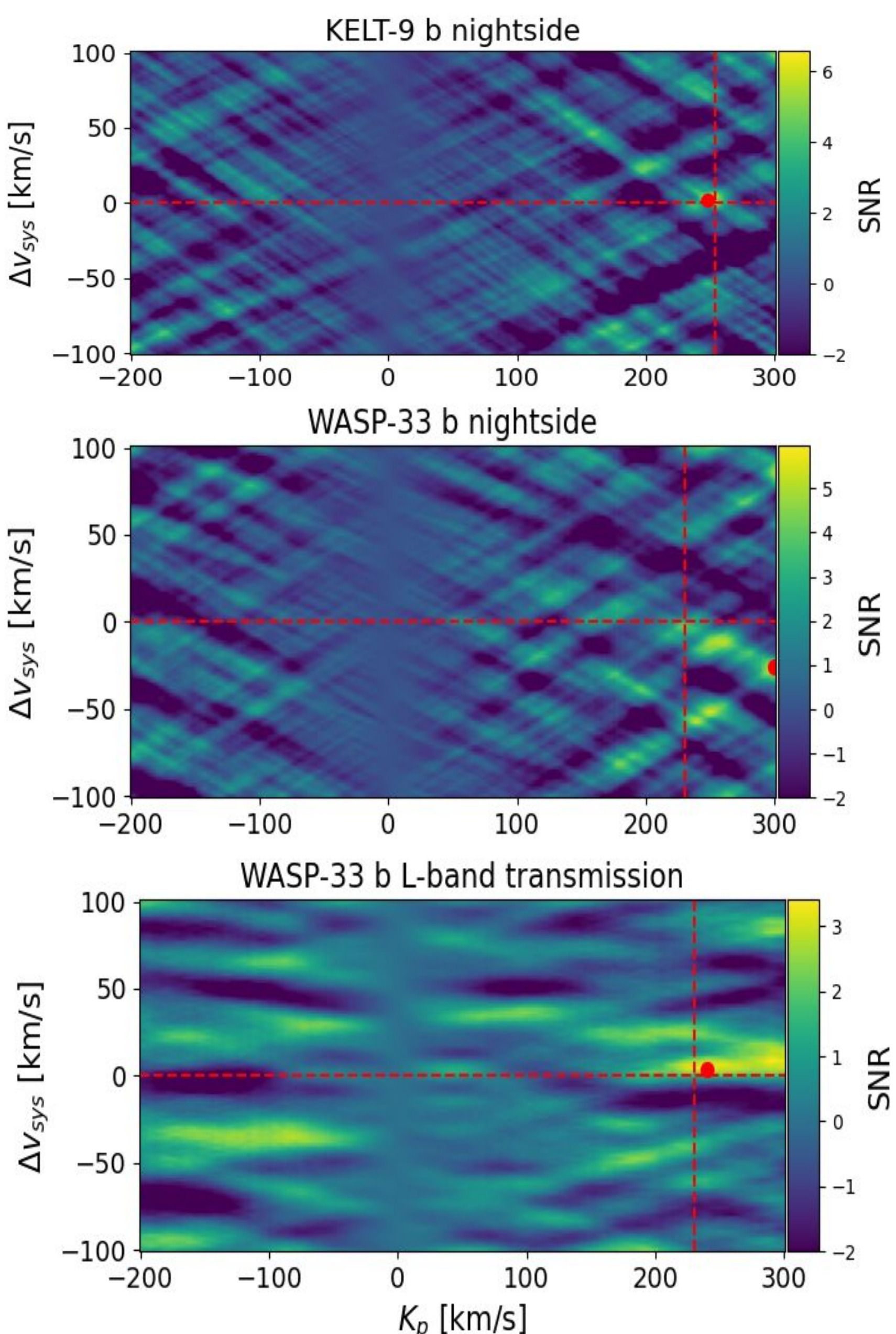
The large radial velocity shift of a hot Jupiter over a few hours enables atmospheric detection in a high spectral resolution time series by cross-correlating with a template.

In the *K*-band, this technique can measure CO and H<sub>2</sub>O abundances to constrain atmospheric composition (e.g., Line *et al.* 2021, Finnerty *et al.* 2023, 2024), and can also directly measure wind speeds and global circulation.



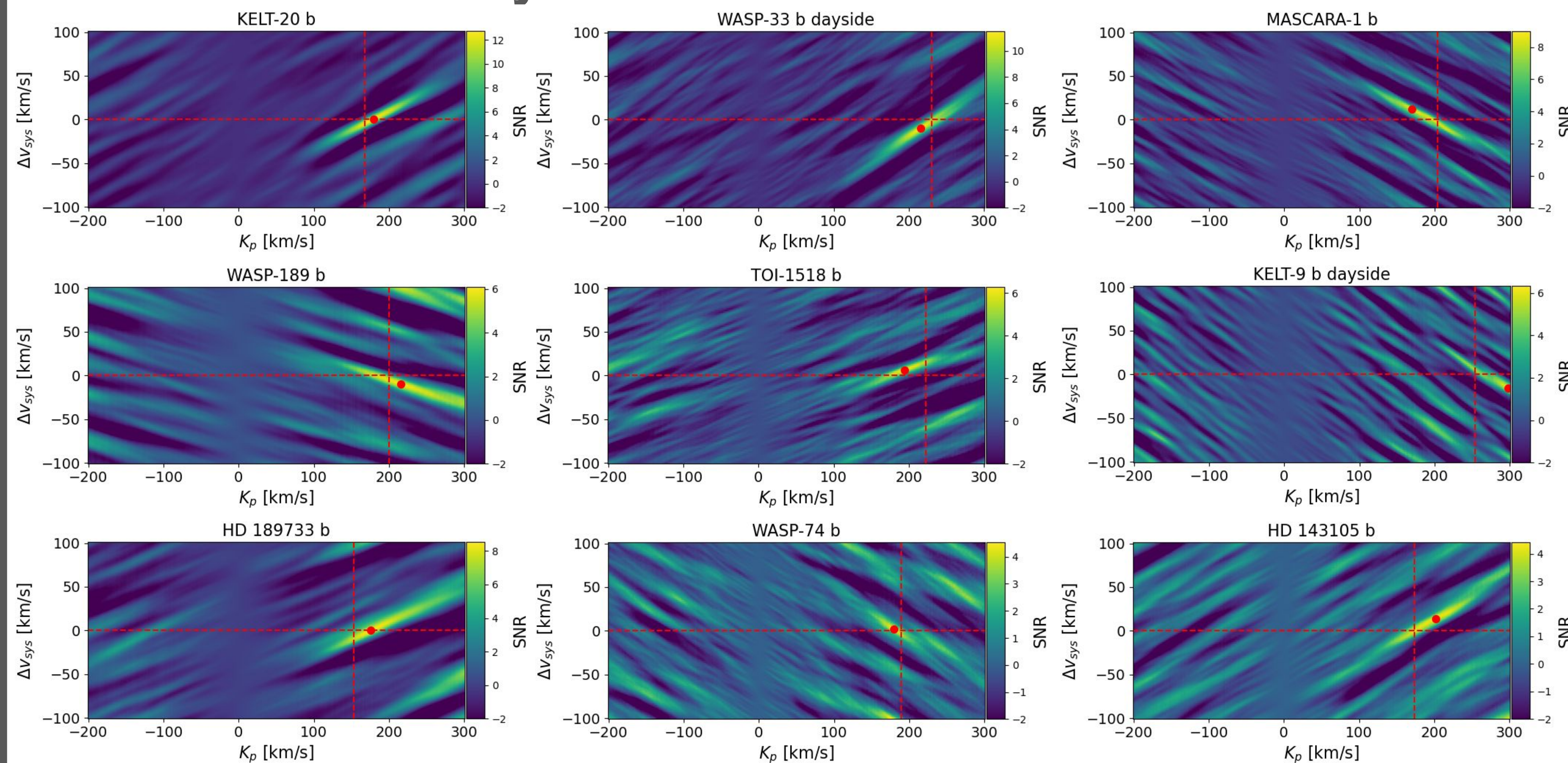
Cross-correlation time series for KELT-20 b (top). While the planet signal is not clear from an individual exposure, shifting to the planet reference frame and stacking the CCF (bottom) produces a clear peak near the expected velocity (Finnerty *et al.*, submitted)

## Hints of nightside emission



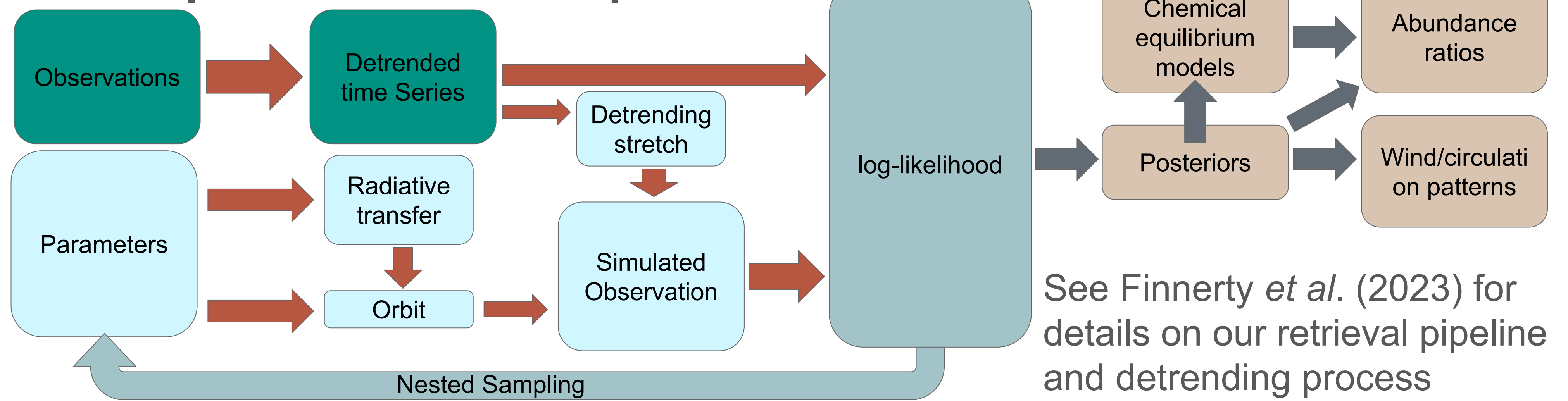
Our transmission pipeline is less developed, but shows a tentative detection of WASP-33 b in the L-band.

## Dayside Emission Detections

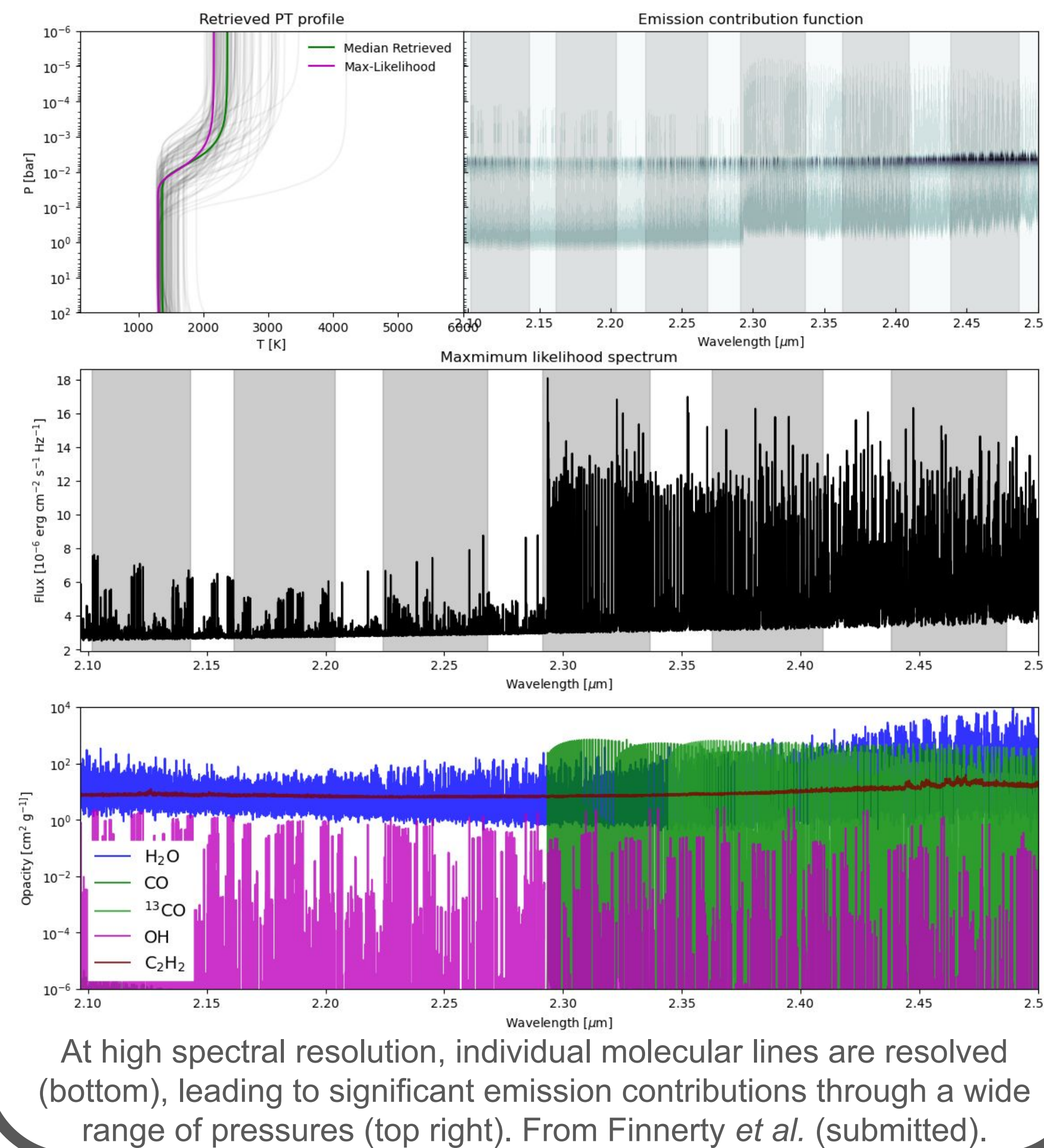


By varying the planet velocity semi-amplitude,  $K_p$ , and the systemic velocity,  $v_{sys}$ , we can determine whether a template is a good match for a planetary atmosphere. Offsets can constrain winds and global circulation. Our retrieval of WASP-33 b was presented in Finnerty *et al.* (2023) and HD 189733 b in Finnerty *et al.* (2024).

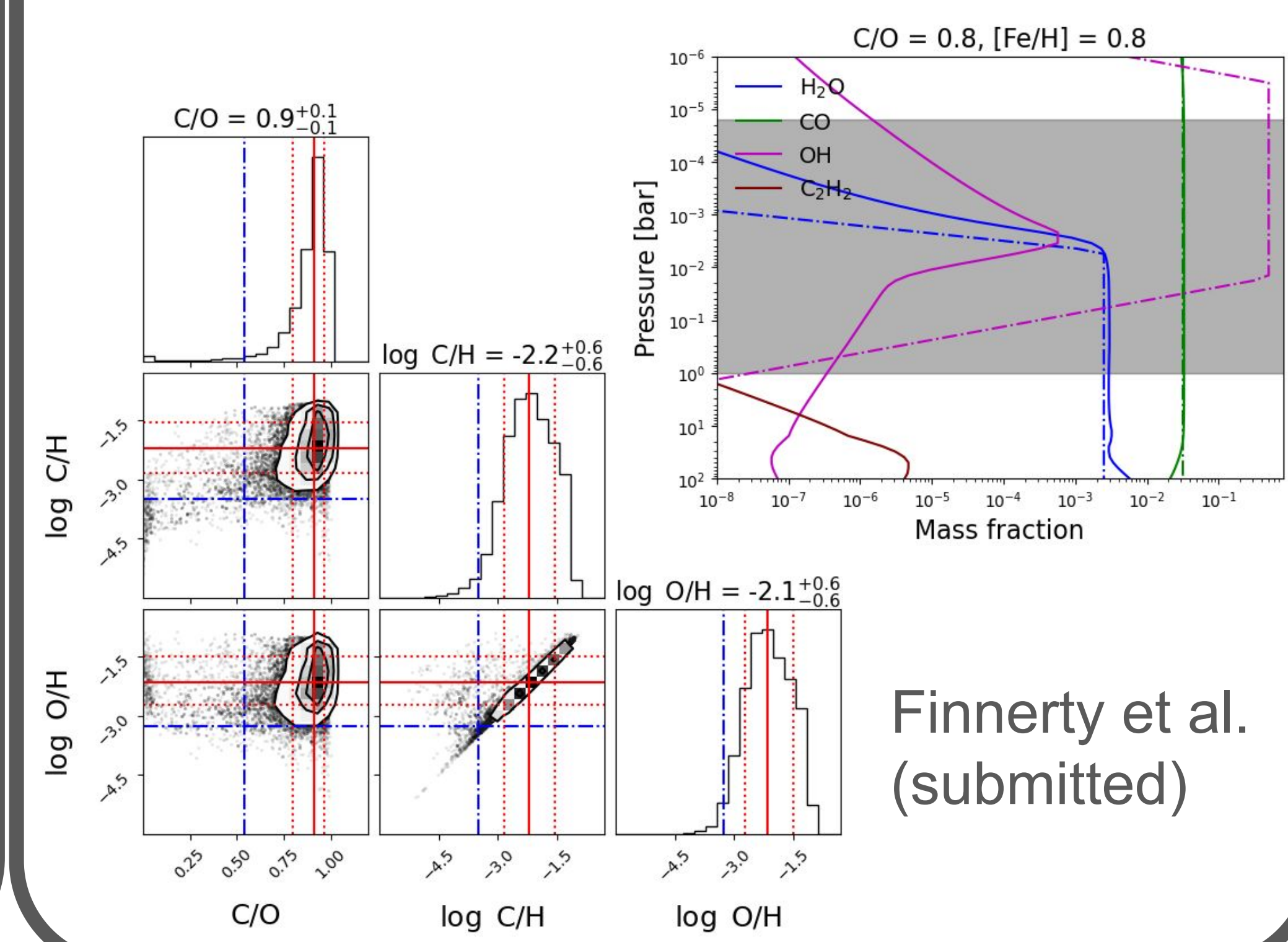
## Atmospheric Retrieval Pipeline



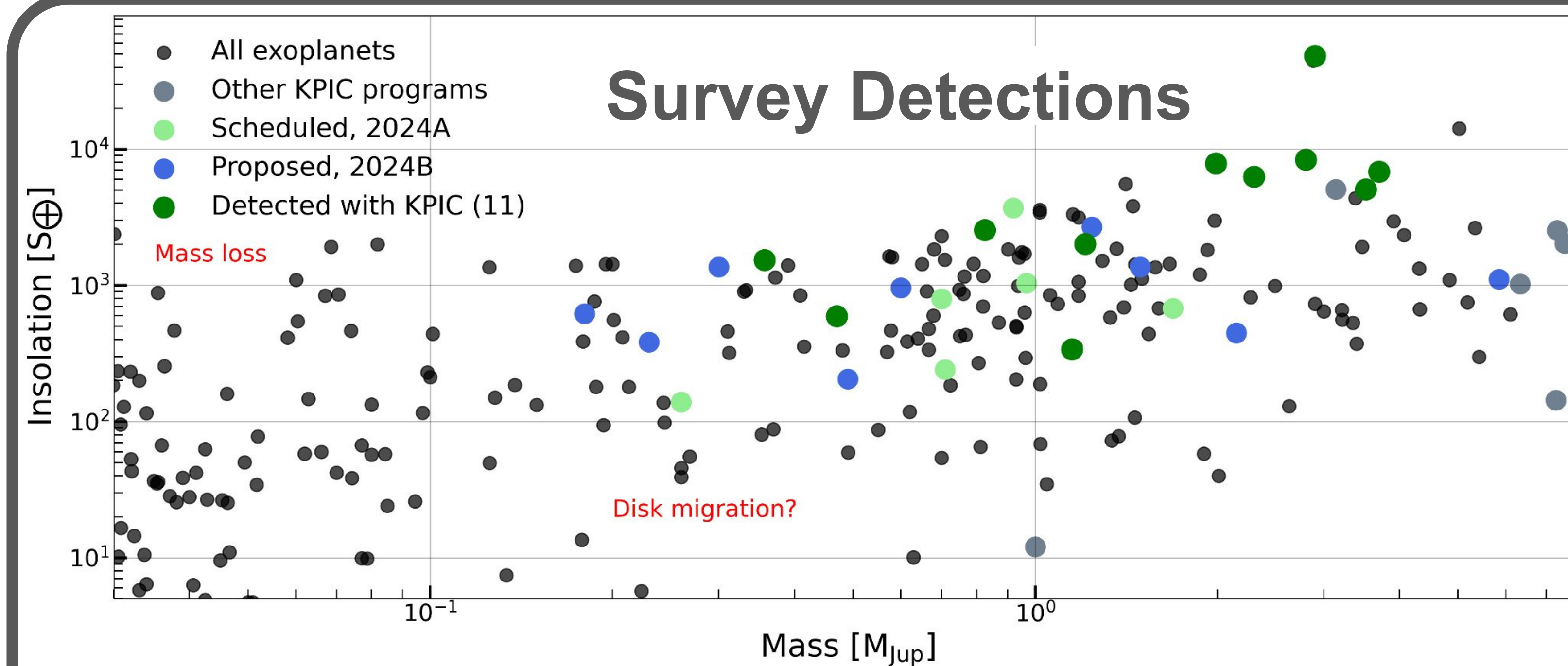
## Retrieval Results



**KELT-20 b appears to have atmospheric C/O~0.8, as well as 3-10x solar metallicity. Dissociation is consistent with chemical equilibrium**



## Survey Detections



This survey will explore trends in C/O, metallicity, and global circulation patterns. Scan below to see Finnerty *et al.* 2023, 2024 for more details

