TRAPPIST-1 Flares from JWST NIRSpec PRISM Observations

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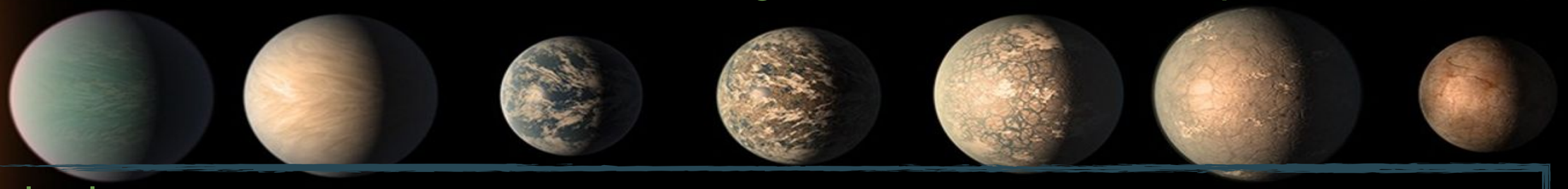
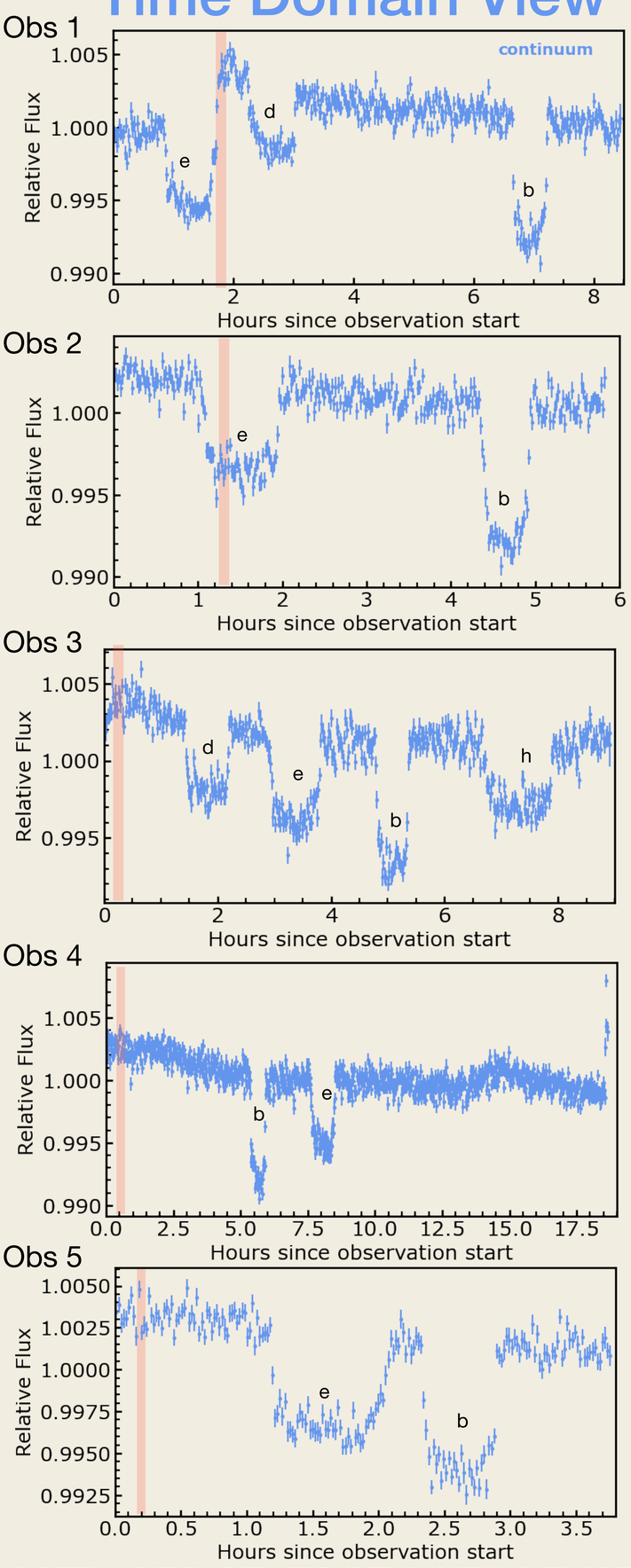
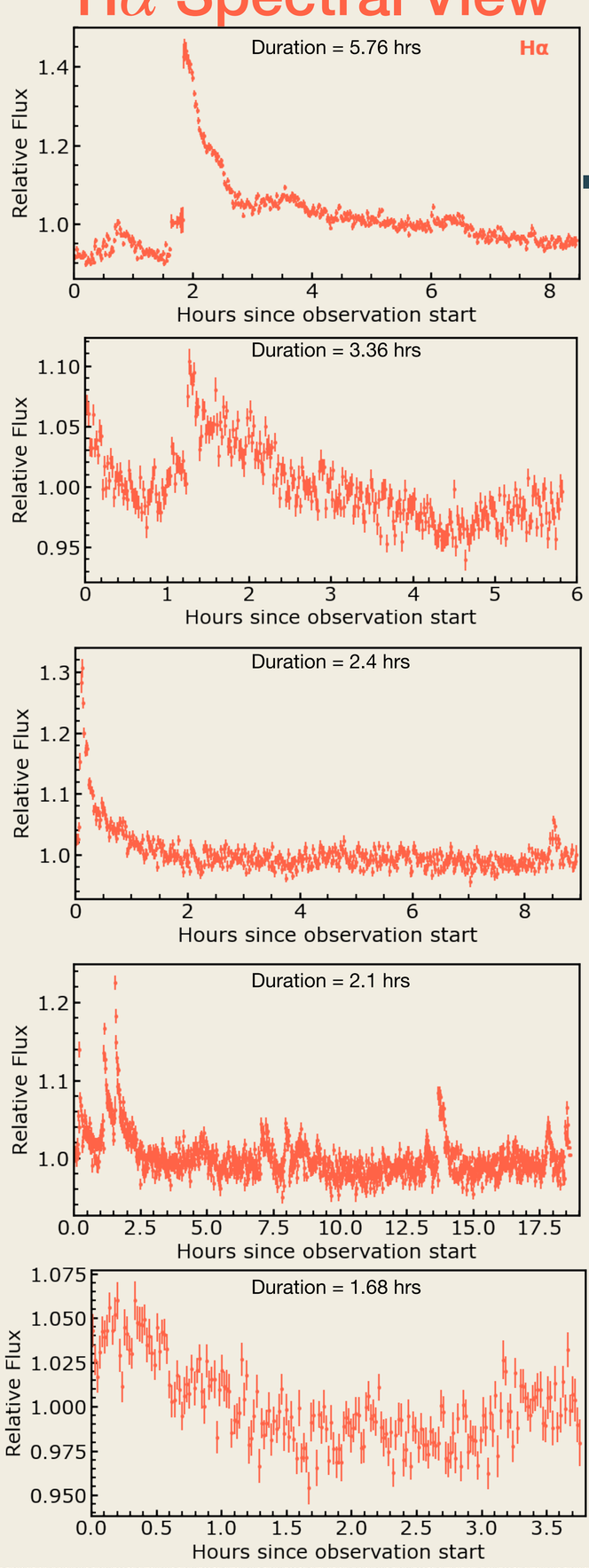


Abstract: The TRAPPIST-1 (T-1) system is one of JWST's most studied targets, with over 400 hours of telescope time focused on characterizing the atmospheres of its transiting exoplanets. The system provides a unique laboratory to study seven (currently known) Earth-sized exoplanets around an ultra-cool (M8V) host star. One ongoing JWST program is using T-1b as a stellar contamination proxy to search for an atmosphere on T-1e using close transit windows (<8 hours between transits, GO 6456 & 9256), with the idea that the contamination signal from unocculted surface features will be shared between the planets and therefore model-independently identified. However, flares are stochastic, short duration events (min - hrs) that continue to contaminate the transmission spectra. Here we present preliminary results of the NIRSpec PRISM flares that have been detected in the GO 6456 & 9256 programs. We showcase how the flares are changing as a function of time and wavelength. Future work (AR 11007) aims to develop a wavelength sensitive flare template to model the morphology of stellar flares in JWST infrared observations.

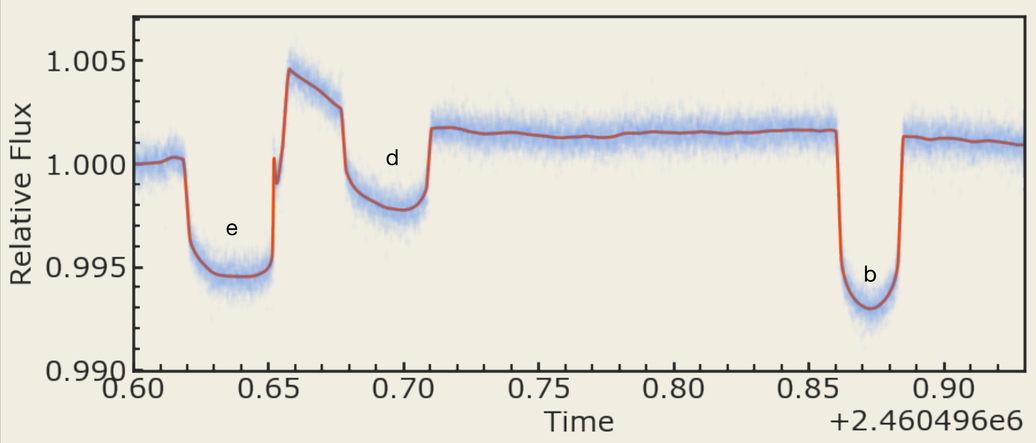
Time Domain View



Hα Spectral View



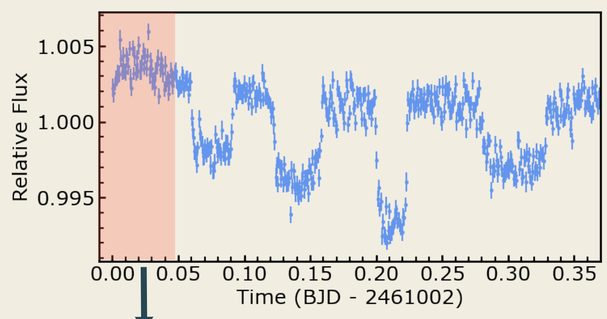
Flares + Planets Modeling

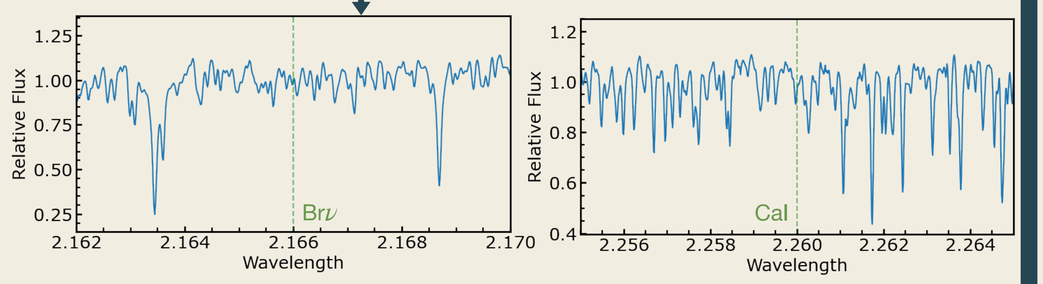


Joint flares + exoplanet transits fit of Obs 1. We use the flare template from Tovar Mendoza+ 2022 and juliet (Espinoza+ 2019) to account for both signals.

Gemini North IGRINS-2 + JWST

1.5 hours of simultaneous IGRINS-2 (R~45,000; K band) + JWST observations.





CaI traces photospheric heating, Brackett line traces flares.
If CaI weakens and Brackett line strengthens = flare
More multi-wavelength observations coming soon!

— TAKEAWAYS —

We present the largest catalog of IR flares on T-1 to date. We highlight the 5 largest flares in our dataset (~130 total hours of JWST time). We find 45 flares ranging in duration from ~5 minutes to ~6 hours. We identified both classical and complex flare events using Hα as a proxy.