



2437 - Diamonds are Forever: Probing the Carbon Budget and Formation History of the Ultra-Puffy hot Jupiter WASP-127b

Cycle: 1, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
WASP-127b NIRSpec BOTS				
	1	WASP-127b - G379H	NIRSpec Bright Object Time Series	(1) WASP-127B

ABSTRACT

Hot Jupiters present an unprecedented opportunity to answer long-standing question regarding the formation processes of giant planets by measuring the carbon-to-oxygen ratio of their atmospheres. Precisely measuring a planet's C/O ratio however, requires simultaneously measuring the abundance of all major carbon- and oxygen-bearing species present in its atmosphere, which remains an extremely challenging task with currently available instrumentation. WASP-127b currently harbours both the strongest known water and carbon absorption features of any exoplanet to date as measured from HST and Spitzer. Unfortunately, those observations cannot distinguish between a CO₂-rich low C/O case, or a CO-rich high C/O case. Both of these scenarios would have drastically different implications not only regarding WASP-127b's atmospheric chemistry, but also in terms of what mechanisms are at play during giant planet formation. We propose to observe a single transit of the ultra-puffy hot Jupiter WASP-127b using NIRSpec BOTS to determine what is the dominant carbon species of its atmosphere. Especially when combined with already scheduled GTO NIRISS SOSS transit observations that will exquisitely constrain the H₂O abundance, the inferred precise C/O ratio will likely be able to pinpoint not only where in the protoplanetary disk WASP-127b formed, but also whether the metallic content of its envelope came from enriched gas due to

pebble drift or rather from planetesimal accretion. Distinguishing between these scenarios will provide invaluable information regarding the formation process not only of the intriguing population of hot Jupiters, but also giant planets in general.

OBSERVING DESCRIPTION

Observations are to be taken as a continuous time series when the targeted exoplanet (WASP-127b) transits in front of its host star. Baseline calibration observations are needed before and after the transit. Observational must be taken during the phase range provided.

Proposal 2437 - Targets - Diamonds are Forever: Probing the Carbon Budget and Formation History of the Ultra-Puffy hot Jupiter WA...

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	WASP-127B	RA: 10 42 14.1035 (160.5587646d) Dec: -03 50 6.00 (-3.83500d) Equinox: J2000	Proper Motion RA: 0.0012844762003568792 sec of time/yr Proper Motion Dec: 0.017026 arcsec/yr Epoch of Position: 2000	
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.This object was generated by the targetselector and retrieved from the SIMBAD database. Category=Star Description=[Exoplanet Systems, Exoplanets, G stars]				
Fixed Targets	(2)	TYC4916-897-1	RA: 10 42 11.4176 (160.5475733d) Dec: -03 50 13.04 (-3.83696d) Equinox: J2000		
	Comments: Category=Star Description=[K stars]				

Proposal 2437 - Observation 1 - Diamonds are Forever: Probing the Carbon Budget and Formation History of the Ultra-Puffy hot Jupit...

Observation	Proposal 2437, Observation 1: WASP-127b - G379H										Wed Mar 31 02:15:14 GMT 2021
	Diagnostic Status: Warning										
	Observing Template: NIRSpec Bright Object Time Series										
Diagnostics	(WASP-127b - G379H (Obs 1)) Warning (Form): Exposure Duration exceeds the limit of 10000.0 seconds. Above this limit it is possible that a High Gain Antenna move may occur during the exposure.										
	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous		
	(1)	WASP-127B	RA: 10 42 14.1035 (160.5587646d) Dec: -03 50 6.00 (-3.83500d) Equinox: J2000			Proper Motion RA: 0.0012844762003568792 sec of time/yr Proper Motion Dec: 0.017026 arcsec/yr Epoch of Position: 2000					
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.This object was generated by the targetselector and retrieved from the SIMBAD database.										
	Category=Star Description=[Exoplanet Systems, Exoplanets, G stars]										
Acquisition	#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	2 TYC4916-897-1	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	63901
Template	Subarray										
	SUB2048										
Spectral Elements	#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	
	1	G395H/F290LP	NRSRAPID	14	2754	1	1	2754	37318.022	63901	
Special Requirements	Phase 0.93958522 to 0.949557952945648 with period 4.178062 Days and zero-phase 2457248.741 HJD Time Series Observation No Parallel										