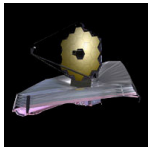

5022 - Probing the internal structure of WASP-103b

Cycle: 3, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dra. Susana Cristina Cabral Barros (PI) (ESA Member)	**Universidade do Porto**
Dr. Babatunde Akinsanmi (CoI) (ESA Member)	University of Geneva, Department of Astronomy
Gwenael Boue (CoI) (ESA Member)	Observatoire de Paris
Prof. Alexandre C. M. Correia (CoI) (ESA Member)	Universidade de Coimbra
Prof. Kevin Heng (CoI) (ESA Member)	Ludwig Maximilian Universitat of Munich
Dr. Alexis M. S. Smith (CoI) (ESA Member)	German Aerospace Center (DLR)
Dr. Matthew Hooton (CoI) (ESA Member)	University of Cambridge
Prof. Yann Alibert (CoI) (ESA Member)	University of Bern
Dr. Szilard Csizmadia (CoI) (ESA Member)	Deutsches Zentrum fur Luft- und Raumfahrt
Dr. Olivier D. S. Demangeon (CoI) (ESA Member)	Institute of Astrophysics and Space Sciences (IA) - Lisbon
Prof. Monika Lendl (CoI) (ESA Member)	University of Geneva, Department of Astronomy
Dr. Tiziano Zingales (CoI) (ESA Member)	Universita degli Studi di Padova
Dr. Luca Fossati (CoI) (ESA Member)	Space Research Institute, Austrian Academy of Sciences
Dr. Nuno C Santos (CoI) (ESA Member)	Institute of Astrophysics and Space Sciences (IA) - Lisbon
Prof. David Ehrenreich (CoI) (ESA Member)	University of Geneva, Department of Astronomy
Dr. Giovanni Bruno (CoI) (ESA Member)	INAF - Osservatorio Astrofisico di Catania
Dr. Daniel Kitzmann (CoI) (ESA Member)	University of Bern
Prof. Brice-Olivier Demory (CoI) (ESA Member)	University of Bern
Dr. Jake Turner (CoI) (US Admin CoI)	Cornell University
Nuno Miguel Rosario (CoI) (ESA Member)	Universidade do Porto

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	WASP-103PRISM	NIRSpec Bright Object Time Series	(1) WASP-103

ABSTRACT

We request 35.44 hours of JWST time to observe a phase curve of the ultra-hot Jupiter WASP-103b in order to constrain its internal structure and atmosphere. WASP-103b is a 2.0 Rjup planet in a 22 hour orbit. The close proximity to its host star leads to strong tidal forces which deform the planet. By observing both the transit and phase curve deformation signatures of WASP-103b with JWST, we can directly measure its deformation with a precision 5.7 times higher than current measurements. The higher precision will be crucial to constrain, the planetary internal structure differentiation, in particular, the planet's core mass fraction and the envelope's metallicity. This would be the first time that an unambiguous measurement of the core mass fraction of a giant exoplanet is made. WASP-103b is one of the rare exoplanets for which we can obtain this detailed information, up to now only available for solar system planets. Constraining the internal structure will provide valuable insight into accretion processes that form planets.

The same observations will also allow us to probe the atmospheric chemistry of WASP-103b as a function of orbital phase. We will be able to detect the spectral lines of important carbon, oxygen, and nitrogen compounds and to quantify the degree of cloudiness on the cooler nightside. This will provide carbon-to-oxygen (C/O) ratios and the identification of chemical equilibrium/disequilibrium as a function of orbital phase. We will not only obtain comprehensive understanding of the planet's atmospheric properties across different wavelengths and orbital phases but also establish WASP-103b as a valuable benchmark object for exo-atmospheric studies.

OBSERVING DESCRIPTION

We will use NIRSpec BOTS in prism mode to acquire a phase curve (1 transit and 2 occultations) of WASP-103b in order to probe its interior structure and atmosphere's composition. We choose the NIRSpec BOTS in prism mode to be able to achieve maximum precision in the white light curve and obtain the maximum precision of the Love number.

Our observation is time critical and should start before an occultation and finish after an occultation. The two occultations allow us to derive the uncontaminated stellar flux and correct the instrumental ramp observed in other JWST light curve observations or any residual stellar variability. WASP-103 is a very quite F-type star so stellar variability should be very low.

We used PandExo to simulate our proposed observations and determine the observing strategy which follows the phase curve observations of WASP-

39b (Rustamkulov et al. 2023). We will use the SUB512 subarray and the NRSRAPID readout pattern. We will use 5 groups per integration resulting in an exposure time of 1.356s. We divided our observations into 2 exposures with 38686 integrations each that results in a total of 77371 integrations lasting 35.44 hours.

WASP-103 is too bright for WATA, hence, we have selected a fainter nearby star for target acquisition.\\

Proposal 5022 - Targets - Probing the internal structure of WASP-103b

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	WASP-103	RA: 16 37 15.5766 (249.3149025d)	Proper Motion RA: -9.756 mas/yr	
		Dec: +07 11 0.11 (7.18336d)	Proper Motion Dec: 2.779 mas/yr	
		Equinox: J2000	Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the 2MASS database. *Category=Star* *Description=[Exoplanets, F stars]* *Extended=NO*				
(2)	WASP-103TA	RA: 16 37 16.1998 (249.3174992d)	Proper Motion RA: -0.8823273 mas/yr	
		Dec: +07 11 13.38 (7.18705d)	Proper Motion Dec: -4.1665231 mas/yr	
		Equinox: J2000	Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the 2MASS database. *Category=Unidentified* *Description=[Parallel field, Visible sources]*				

Observation

Proposal 5022, Observation 1: WASP-103PRISM Thu May 29 16:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(WASP-103PRISM (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-103	RA: 16 37 15.5766 (249.3149025d)	Proper Motion RA: -9.756 mas/yr	
		Dec: +07 11 0.11 (7.18336d)	Proper Motion Dec: 2.779 mas/yr	
		Equinox: J2000	Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the 2MASS database.
Category=Star
Description=[Exoplanets, F stars]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 WASP-103TA	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	139876

Template

Subarray
SUB512

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSRAPID	5	25791	3	1	77373	106576.665	171877

Special Requirements

Phase 0.1523 to 0.1748 with period 1.85109097 Days and zero-phase 2457511.944458 HJD
Time Series Observation
No Parallel Attachments