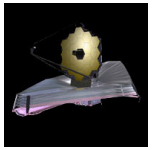

5263 - Observing the Atmosphere of a Pulsar Planet

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	PRISM phase curve	NIRSpec Fixed Slit Spectroscopy	(1) PSR-J2322-2650
	2	G235H day	NIRSpec Fixed Slit Spectroscopy	(1) PSR-J2322-2650

ABSTRACT

Pulsar planets were the first exoplanets ever discovered, but little is known about their atmospheres or formation processes. We propose to observe a NIRSpec/PRISM spectroscopic phase curve and a 2 h NIRSpec/G295H dayside snapshot of a pulsar planet with mass and temperature typical of hot Jupiters. The millisecond pulsar host to the planet is invisible at infrared wavelengths, allowing us to obtain brown dwarf quality spectra (SNR $\sim$ 200) for an externally irradiated hot Jupiter--a feat impossible for any other known object in the universe. These exquisite spectra will allow us to measure the radius, composition, heat circulation, and possibly outflow of this exotic planet, heated by an ultra-hard pulsar spectrum and a pulsar wind. The composition will constrain the planet's formation mechanism: did it form in a supernova fallback disk, or in an accretion disc born from the tidal disruption of a star? These observations would also help address long-standing questions in high-energy astrophysics. By measuring the radius of the planet, we will know whether it is currently overflowing its Roche lobe, shedding light on whether this companion could have spun up its millisecond pulsar host. By measuring the inclination and orbital velocity of the planet, we will measure the mass of the pulsar, which for other millisecond pulsars has sometimes been large enough to constrain the neutron star equation of state.

OBSERVING DESCRIPTION

We request to observe the planet with NIRSpec/PRISM for 9.25 h, slightly longer than the 7.75 h orbital period. The 1.3 h of extra time allows the detector to settle and gives us one hour of repeat observations, which we choose to situate on the night side. The observations should be done in Bright Object Time Series mode with the SUB512 subarray, the NRS readout pattern, and 20 groups/integration.

We also request to observe the planet with NIRSpec/G235H for 2 h on the dayside. Taking into account the 1 h scheduling uncertainty, this will give us at least 30 min of observations on either side of conjunction. These observations should be done in BOTS mode with the SUB2048 subarray, the NRS readout pattern, and 20 groups/integration.

Proposal 5263 - Targets - Observing the Atmosphere of a Pulsar Planet

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	PSR-J2322-2650	RA: 23 22 34.6386 (350.6443275d) Dec: -26 50 58.38 (-26.84955d) Equinox: J2000	Proper Motion RA: -2.37 mas/yr Proper Motion Dec: -8.20 mas/yr Parallax: 0.00125" Epoch of Position: 2020.92	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Pulsars]* *Extended=NO*				
(2)	acq_star	RA: 23 22 36.2857 (350.6511904d) Dec: -26 51 23.86 (-26.85663d) Equinox: J2000	Proper Motion RA: 6.5503 mas/yr Proper Motion Dec: -4.7632 mas/yr Parallax: 0.001885" Epoch of Position: 2016	
Comments: *Category=Star* *Description=[K dwarfs]* *Extended=NO*				

Observation

Proposal 5263, Observation 1: PRISM phase curve Thu Sep 26 22:00:12 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

Comments: The actual period is half the value I specified, but I get the error "the time gap between acceptable phase ranges APT is shorter than the visit scheduling duration" when I use the actual period.

Diagnostics

(PRISM phase curve (Obs 1)) Warning (Form): The slew between the acquisition exposure and the farthest science exposure is 45.720 Arcsec (larger than the recommended limit of 38.000 Arcsec) and may result in reduced or no schedulability. See more information in the diagnostic browser.

(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)	PSR-J2322-2650	RA: 23 22 34.6386 (350.6443275d) Dec: -26 50 58.38 (-26.84955d) Equinox: J2000	Proper Motion RA: -2.37 mas/yr Proper Motion Dec: -8.20 mas/yr Parallax: 0.00125" Epoch of Position: 2020.92	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Pulsars]
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 acq_star	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	165648

Template

Slit	Subarray
S200A1	SUBS200A1

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	NONE	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	S200A1	NRSRAPID	30	173	1	NONE	1	173	8359.097	
2	PRISM/CLEAR	S200A1	NRSRAPID	30	172	2	NONE	1	172	8310.779	
3	PRISM/CLEAR	S200A1	NRSRAPID	30	172	3	NONE	1	172	8310.779	
4	PRISM/CLEAR	S200A1	NRSRAPID	30	172	4	NONE	1	172	8310.779	

Special Requirements	Phase 0.044 to 0.109 with period 0.645927994 Days and zero-phase 2456130.85411 HJD

Observation

Proposal 5263, Observation 2: G235H day Thu Sep 26 22:00:12 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

Diagnostics

(G235H day (Obs 2)) Warning (Form): The slew between the acquisition exposure and the farthest science exposure is 45.720 Arcsec (larger than the recommended limit of 38.000 Arcsec) and may result in reduced or no schedulability. See more information in the diagnostic browser.

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	PSR-J2322-2650	RA: 23 22 34.6386 (350.6443275d) Dec: -26 50 58.38 (-26.84955d) Equinox: J2000	Proper Motion RA: -2.37 mas/yr Proper Motion Dec: -8.20 mas/yr Parallax: 0.00125" Epoch of Position: 2020.92	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Pulsars]
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 acq_star	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	165648

Template

Slit	Subarray
S200A1	SUBS200A1

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	NONE	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G235H/F170LP	S200A1	NRSRAPID	30	151	1	NONE	1	151	7296.09	

Special Requirements	Phase 0.555 to 0.685 with period 0.322963997 Days and zero-phase 2456130.85411 HJD