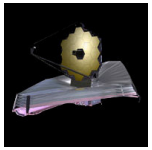

11087 - The first observation of H2 absorption in a protoplanetary disk through transmission spectroscopy

Cycle: 5, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	NIRSPEC_IFU_V4046_sgr_bkg	NIRSpec IFU Spectroscopy	(1) v4046_Sgr_bckg1
	2	Background_calib	NIRSpec IFU Spectroscopy	(3) Background

ABSTRACT

Observing molecular hydrogen represents a direct measurement of the bul of the gas reservoir in a protoplanetary disk. Here, we propose to use a bright background object shining through an extended gas-rich disk, V4046 Sgr, to measure the absorption of a H2 line. This spectroscopic observation will be the first of its kind and will be combined with high-resolution CO observations from ALMA to provide a direct comparison between H and CO abundances. The success of this proposal will serve as a pilot study, paving the way for similar measurements using multiple background sources that intersect protoplanetary disks in existing JWST/NIRCam programs. Studies through disk of multiple ages will also help constrain the CO depletion over time, extinction thourhg multiepoch studies, and also the disk evolution theories.

OBSERVING DESCRIPTION

We will observe a background source shining through the V4046 Sgr extended disk, separated by 2.78". We will employ the NIRSpec IFU isntrument with the G235H grating to target the H2 S(0) J=2-0 absorption line. Given the width of the targeted line, the G235H is required as it provides the highest resolution possible with NIRSpec, othewrise the absorption would be diluted and harder to detect. The targeted snr and sensitivity were estimated by a non-equilibrium line radiative transfer code and informed surface densitiy profiles from dynamical fits. The separaton with the bright V4046 Sgr binary system is large enough that we will not receive significant contamination and/or leakage. Nevertheless we will still apply multiple dithering in case PSF removals may be required. The proposal observations will also have a legacy values as other fainter background fall in the FIeld-of-View of teh IFU. As the disks moves out of the field, multiple epoch observations of these sources will lead to the measurement of the protoplanetary disk extinction, which subsequent benchmark of dust evolution studies.

A background observation was added offset from the circumstellar disk in an area emptry of bright sources near the targets based on Aladdin visualization.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	v4046_Sgr_bckg1	RA: 18 14 10.4829 (273.5436787d) Dec: -32 47 38.23 (-32.79395d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=Star* *Description=[K stars]* *Extended=NO*				
(3)	Background	RA: 18 14 10.6530 (273.5443875d) Dec: -32 48 0.09 (-32.80003d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=ISM* *Description=[Interstellar absorption]* *Extended=NO*				
(4)	v4046_Sgr_bckg2	RA: 18 14 10.2216 (273.5425900d) Dec: -32 47 39.42 (-32.79428d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=Star* *Description=[A stars]* *Extended=NO*				

Observation

Proposal 11087, Observation 1: NIRSPEC_IFU_V4046_sgr_bkg Fri Apr 24 17:00:59 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[Background_calib (Obs 2)]

Diagnostics

(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)	v4046_Sgr_bckg1	RA: 18 14 10.4829 (273.5436787d) Dec: -32 47 38.23 (-32.79395d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[K stars]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	4 v4046_Sgr_bckg2	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	276147

Template

HFF Readout Mode
false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	SMALL	1	4	

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	G235H/F170LP	NRSIRS2RAPID	25	2	false	true	NONE	4	8	3034.489	276147

Special Requirements	
	Aperture PA Range 46.97164917 to 56.97164917 Degrees (V3 268.0 to 278.0) Aperture PA Range 226.47164917 to 232.97164917 Degrees (V3 87.5 to 94.0) Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 11087, Observation 2: Background_calib

Fri Apr 24 17:00:59 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [NIRSPEC_IFU_V4046_sgr_bkg (Obs 1)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	Background	RA: 18 14 10.6530 (273.5443875d) Dec: -32 48 0.09 (-32.80003d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=ISM
Description=[Interstellar absorption]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	4 v4046_Sgr_bckg2	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	276147

Template

HFF Readout Mode
false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	NONE				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	G235H/F170LP	NRSIRS2RAPID	25	1	false	false	NONE	1	1	379.311	276147

Special Requirements	Sequence Observations 1, 2, Non-interruptible