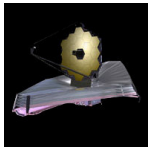

3962 - A NIRSpec pilot program on planet-forming disks around very-low mass stars

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Benoit Tabone (PI) (ESA Member)	**Institut d'Astrophysique Spatiale**
Prof. Thomas K. Henning (CoI) (ESA Member)	Max Planck Institute for Astronomy
Prof. Inga Kamp (CoI) (ESA Member)	Kapteyn Astronomical Institute
Dr. Ewine F. Van Dishoeck (CoI) (ESA Member)	Universiteit Leiden
Sierra Grant (CoI) (ESA Member)	Max Planck Institute for Extraterrestrial Physics
Dr. Gregory J. Herczeg (CoI)	Peking University
Lukasz Tychoniec (CoI) (ESA Member)	European Southern Observatory - Germany
Goran Olofsson (CoI) (ESA Member)	Stockholm University
Aditya Mahadeva Arabhavi (CoI) (ESA Member)	University of Groningen
Ms. Jayatee Kanwar (CoI) (ESA Member)	Kapteyn Astronomical Institute
Dr. Giulia Perotti (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Alessio Caratti o Garatti (CoI) (ESA Member)	INAF - Osservatorio Astronomico di Capodimonte (OAC)
Prof. Manuel Guedel (CoI) (ESA Member)	University of Vienna
Prof. Rens Waters (CoI) (ESA Member)	Radboud Universiteit Nijmegen
Prof. Thomas P. Ray (CoI) (ESA Member)	Dublin Institute For Advanced Studies

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRSpec IFU Spectroscopy	(1) PGZ2001-J160532.1-193315
	2		NIRSpec IFU Spectroscopy	(7) ISO-CHAI-147

ABSTRACT

We propose deep NIRSpec IFU observations from 1.66 to 5.27 micron of two disks orbiting very-low mass stars (VLMS). VLMS host a rich population of potentially habitable planets (e.g. Proxima Centauri b). Because their disks are faint, little is known about the formation of this planet population. The first MIRI-MRS observations of the two targets have already revealed an extremely rich hydrocarbon chemistry, potentially related to the destruction of refractory carbon. This suggests that planets formed around VLMS could have very distinct elemental compositions compared with more massive stars. However, NIRSpec spectroscopic observations of VLMS disks are critically lacking to establish a global view of the inner disk composition. The proposed NIRSpec observations will allow to (1) measure for the first time the C/O elemental ratio in the gas, (2) infer the radial distribution of elements across the disk, and (3) search for new gas-phase species and refractory carbon. This program will provide legacy value to the community by demonstrating the potential of NIRSpec observations of VLMS disks in combination of MIRI-MRS, and by providing necessary constraints to link the composition of exoplanets to their formation history.

OBSERVING DESCRIPTION

We request NIRSpec IFU spectroscopy with the high spectral resolution gratings G235H and G395H (R~2700). We choose 4-point-dither over nodding in case the sources show extended emission in specific lines (H2, [Fe II]). The emission at other wavelengths is expected to be compact across the wavelength range (<1 au which corresponds to <5 mas at the distance of our targets). No dedicated background observation is required since empty sky in the field of view will be sufficient to correct for any background contribution. No additional leakcal exposure is required due to the absence of strong sources in the surrounding.

Our goal is to detect weak molecular emission lines down to 0.12 mJy at 4.6micron (CO fundamental band) and ~0.24 mJy at 2.5micron (SNR of 6). The line broadening is of the order of 20-40 km/s, thus all the lines are spectrally unresolved. We estimated the exposure time with the NIRSpec ETC using synthetic spectra of our two sources that fit the available photometric measurements at 2.2 and 5 micron. The combination of groups and integrations is chosen to reach the requested noise level avoiding detector saturation.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	PGZ2001-J160532.1-193315	RA: 16 05 32.1406 (241.3839192d) Dec: -19 33 16.36 (-19.55454d) Equinox: J2000	Proper Motion RA: -7.363361079911354E-4 sec of time/yr Proper Motion Dec: -0.02210300008300692 arcsec/yr Epoch of Position: 2015.5	
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=[Protoplanetary disks]* *Extended=NO*				
(7)	ISO-CHAI-147	RA: 11 08 26.3657 (167.1098571d) Dec: -77 15 55.08 (-77.26530d) Equinox: J2000	Proper Motion RA: -0.006709703311371911 sec of time/yr Proper Motion Dec: -4.5900005716248415E-4 arcsec/yr Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Protoplanetary disks]*				

Observation

Proposal 3962, Observation 1

Thu May 11 13:03:45 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

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)	PGZ2001-J160532.1-193315	RA: 16 05 32.1406 (241.3839192d) Dec: -19 33 16.36 (-19.55454d) Equinox: J2000	Proper Motion RA: -7.363361079911354E-4 sec of time/yr Proper Motion Dec: -0.02210300008300692 arcsec/yr Epoch of Position: 2015.5	

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=[Protoplanetary disks]
Extended=NO

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G235H/F170LP	NRSIRS2RAPID	10	2	false	true	NONE	4	8	1283.822	142205
2	G395H/F290LP	NRSIRS2RAPID	10	6	false	true	NONE	4	24	3851.467	142205

Observation

Proposal 3962, Observation 2

Thu May 11 13:03:45 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

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
(7)	ISO-CHAI-147	RA: 11 08 26.3657 (167.1098571d) Dec: -77 15 55.08 (-77.26530d) Equinox: J2000	Proper Motion RA: -0.006709703311371911 sec of time/yr Proper Motion Dec: -4.5900005716248415E-4 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Protoplanetary disks]

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G235H/F170LP	NRSIRS2RAPID	10	2	false	true	NONE	4	8	1283.822	142205
2	G395H/F290LP	NRSIRS2RAPID	10	6	false	true	NONE	4	24	3851.467	142205