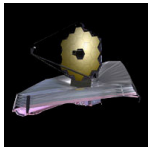

8213 - Warm or gone? Searching for molecular gas in a massive quiescent galaxy at z = 3

Cycle: 4, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Jan Scholtz (PI) (ESA Member)	**University of Cambridge, Kavli Institute for Cosmology**
Dr. Francesco D'Eugenio (CoI) (ESA Member)	University of Cambridge, Kavli Institute for Cosmology
Prof. Pablo G. Perez-Gonzalez (CoI) (ESA Member)	Centro de Astrobiologia - CAB
Darshan Kakkad (CoI) (ESA Member)	University of Hertfordshire
Prof. Roberto Maiolino (CoI) (ESA Member)	University of Cambridge
Eleonora Parlanti (CoI) (ESA Member)	Scuola Normale Superiore, Pisa
Dr. Mirko Curti (CoI) (ESA Member)	European Southern Observatory - Germany
Dr. Stephane Charlot (CoI) (ESA Member)	CNRS, Institut d'Astrophysique de Paris
Dr. Isabella Lamperti (CoI) (ESA Member)	Universita di Firenze
Dr. Martin Albert Bourne (CoI) (ESA Member)	University of Hertfordshire
Dr. Jake Samuel Bennett (CoI) (US Admin CoI)	Harvard University
Dr. Elena Bertola (CoI) (ESA Member)	INAF - Osservatorio Astrofisico di Arcetri
Dr. Gareth C Jones (CoI) (ESA Member)	University of Cambridge
Dr. Sophie Koudmani (CoI) (ESA Member)	University of Hertfordshire
Dr. Debora Sijacki (CoI) (ESA Member)	University of Cambridge
Mr. Ignas Juodzbalis (CoI) (ESA Member)	University of Cambridge

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
MRS obs				
	1	MIRI	MIRI Medium Resolution Spectroscopy	(1) Pablo_galaxy

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	2	MIRI_background	MIRI Medium Resolution Spectroscopy	(2) Pablo_galaxy-bkg

ABSTRACT

The discovery of massive quiescent galaxies at z>3 with JWST has shown that the galaxy evolution is much faster than previously thought. Galaxies need to grow to 1e11 Msol and quench within the first billion years of cosmic time. Such short timescales may require significantly stronger and faster feedback from supermassive black holes than at Cosmic Noon, but the exact quenching mechanism still eludes us. In the search for clues, an overlooked direction has been the warm ISM/CGM, which theoretical models suggest should hold the key to understanding feedback. We propose deep MIRI-MRS observations of warm molecular gas in GS-15078 - a massive quiescent galaxy at z~3.06, hosting an AGN with strong neutral gas outflows yet no evidence for cold molecular gas or dust from ultra-deep ALMA observations. These pioneering observations will illuminate the last corner where molecular gas can still be found, answering the question of whether this gas phase is indeed gone, or if it is still present, but heated to higher temperatures. Regardless of the detection, this observation will determine the quenching mechanism of this quiescent galaxy: 1) starvation of the galaxy or 2) preventative feedback by heating the gas

OBSERVING DESCRIPTION

We target a single galaxy with MIRI-MRS using the A-arm to target H2 (1–0) S(1) emission line.

We require an emission line sensitivity at 8.586 microns down to 1e-17 erg/s/cm2. We set the detector with SLOW! readout pattern with 20 groups per integration. In total, we need 32 integrations to reach the desired sensitivity - 4.47 h in total. We chose a 4-point dither pattern optimized for an extended source. We require dedicated background observations of a blank part of the sky. The background observations are set up in the same manner as a single integration for our on-target integrations. We do not require any target acquisition as the pointing accuracy of the telescope is sufficient to centre the target in the FoV of the telescope.

Proposal 8213 - Targets - Warm or gone? Searching for molecular gas in a massive quiescent galaxy at z = 3

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	Pablo_galaxy	RA: 03 32 39.6744 (53.1653100d) Dec: -27 48 50.90 (-27.81414d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[Active galactic nuclei, Elliptical galaxies, X-ray quasars]*				
(2)	Pablo_galaxy-bkg	RA: 03 32 39.6744 (53.1653100d) Dec: -27 48 42.90 (-27.81192d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=Unidentified* *Description=[Blank field]*				

Observation

Proposal 8213, Observation 1: MIRI Mon Nov 03 19:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[MIRI_background (Obs 2)]

Diagnostics

(MIRI (Obs 1)) Warning (Form): Imager Filter overlap.

(Visit 1:1) Warning (Form): Data Excess over middle threshold

(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)	Pablo_galaxy	RA: 03 32 39.6744 (53.1653100d) Dec: -27 48 50.90 (-27.81414d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[Active galactic nuclei, Elliptical galaxies, X-ray quasars]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	All MRS	YES	FULL	Allow Auto Reorder

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1		IMAGER	F1280W	FASTR1	152	9	1	Dither 1	4	36	15273.82	226797
1	SHORT(A)	MRSLONG		FASTR1	152	9	1	Dither 1	4	36	15273.82	226797
1	SHORT(A)	MRSSHORT		FASTR1	152	9	1	Dither 1	4	36	15273.82	226797

Special Requirements	Group Observations 1, 2, Non-interruptible

Observation

Proposal 8213, Observation 2: MIRI_background Mon Nov 03 19:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [MIRI (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
(2)	Pablo_galaxy-bkg	RA: 03 32 39.6744 (53.1653100d) Dec: -27 48 42.90 (-27.81192d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Unidentified
Description=[Blank field]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	Imager	YES	FULL	Allow Auto Reorder

Dithers

#	Dither Type	Optimized For	Direction
1	2-Point	BACKGROUND	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1		IMAGER	F1280W	FASTR1	152	1	1	Dither 1	2	2	843.612	
1	SHORT(A)	MRSLONG		FASTR1	152	1	1	Dither 1	2	2	843.612	
1	SHORT(A)	MRSSHORT		FASTR1	152	1	1	Dither 1	2	2	843.612	

Special Requirements	Group Observations 1, 2, Non-interruptible