

# 1264 - NIRSpec and MIRI IFS of SMGs

Cycle: 1, Proposal Category: GTO

# **INVESTIGATORS**

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## **OBSERVATIONS**

Folder	Observation	Label	Observing Template	Science Target
MIRI -		Zuoti	Cosciving Tempune	serence Turger
	1	GN20-MRS [WRIGHT _0302]	MIRI Medium Resolution Spectroscopy	(1) GN20-MRS
		GN20.2B.2A-MRS [W RIGHT_0307+0308]	MIRI Medium Resolution Spectroscopy	(3) GN20.2B.2A-MRS
	5	GN20-Imager [WRIGH T_0301+0305]	MIRI Imaging	(2) GN20-IMAGER

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Folder	Observation	Label	Observing Template	Science Target
MIRI -	HFLS3			
	6	HFLS3-MRS [WRIGH T_0401]	MIRI Medium Resolution Spectroscopy	(4) HFLS3-MRS
	8	HFLS3-Imager	MIRI Imaging	(5) HFLS3-IMAGER
NIRSpe	ec - SMGs			
	9	GN20 - NIRSpec	NIRSpec IFU Spectroscopy	(6) GN20-NIRSPEC
	10	HFLS3 - NIRSpec	NIRSpec IFU Spectroscopy	(7) HFLS3-NIRSPEC

### **ABSTRACT**

The observation IDs for the NIRSpec observations are: GN20 FERRUIT\_3049

HFLS3 FERRUIT\_3050

And for MIRI:

GN20 MRS and IMAGER WRIGHT\_0301 to 0308 HFLS3 MRS and IMAGER WRIGHT\_0401 to 0403

This APT is for MIRI and NIRSpec-IFU observations of 2 high-z sub-millimeter galaxies.

The combination of spectral coverage and subarcsec integral field medium resolution spectroscopy (MRS), makes MIRI a unique instrument to peer into the dustenshrouded phase of IRluminous starforming galaxies (DSFG) at high redshifts. MIRI provides the first direct subarcsec view ever at the (restframe) nearinfrared light distribution of the evolved stellar population, ionized and hot molecular gas phase in z~26 massive DSFGs, and therefore will investigate the physical processes of the obscured star formation and black hole growth in massive starforming galaxies (SFR above 100 Msun/yr) in the early universe. MRS spectroscopy of the main near-infrared emission lines (hydrogen Paschen, [FeII], H2, etc) will be obtained for the currently known highest redshift DSFG (HFLS3), and for a system of several DSFGs that could belong to a z~4 protocluster (GN20 and associated GN20.2a & GN20.2b). Mid-IR imaging of the host galaxies and surrounding fields will also be obtained with the MIRI imager.

The NIRSpec-IFU observations are part of the NIRSpec GTO Physics of Galaxy Assembly IFS survey. The goal of this program is to characterize the internal structure of distant galaxies and thereby investigate the primary physical processes driving galaxy evolution across cosmic time. The main specific objectives are to: trace the distribution of star formation, map the resolved properties of the stellar populations, trace the gas kinematics

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(i.e. velocity fields, velocity dispersion) and hence determine dynamical masses and also identify non-virial motions (outflow and inflows), map metallicity gradients and dust extinction. These quantities will be mapped for the brightest and most extended star-forming galaxies and AGN/QSO hosts up to z>8.

The NIRSpec-IFU observations are performed at R100 and R2700. The specific band for the high-resolution observations is aimed at including the most important emission lines (from ~ H-beta to H-alpha).

#### **OBSERVING DESCRIPTION**

MIRI IFS and MIRI Imager:

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The purpose of the program is to get a mid-IR spectra of the GN20 system (GN20 + GN20.2b + GN20.2a), and HFLS3, using 2 MRS configurations with simultaneous Imager observations (MEDIUM - F560W, LONG - F1000W). In addition, we request the imaging of the the GN20 system with F560W, F1000W, and F1000W for HFLS3. To save slew and maneuvering overheads, we propose all observations of each target to be "non-interruptible".

The PAs have been selected to avoid bright stars (which would saturate the detectors) in the MIRI fields, guarantee low background conditions, and existence of previos ancillary data.

The dithering strategies were selected to optimize the PSF and detector effects in all MRS channels and Imager filters. These strategies could be subject to change without modifying the total charged time.

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NIRSpec-IFU:

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These two sub-millimeter galaxies will be observed using the NIRSpec-IFU as part of the "Physics of Galaxy Assembly IFU survey" program.

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Observations will be performed with grating/filters PRISM (R100) and G395H/F290LP (R2700). By combining with the MIRI observations, we take advantage of the "smart accounting" option to save slew overheads.

For NIRSpec, the allowed PA range is defined such that contamination in the R100 spectra due to nearby sources leaking through the MSA is minimized. For the emission line high-resolution (R2700) spectra this is not so critical, but still we have checked for very bright sources in the MSA quadrants.

The PA restrictions of PA\_V3 = 300-310 degrees for GN20 is free of bright sources which could contaminate the NIRSpec-IFU observations, and is limited by constrains for the MIRI observations.

The strict PA\_V3 = 287 degrees for HFLS3 is free of bright sources which could contaminate the NIRSpec-IFU observations, and is limited by two very bright stars at both ends of the FoV for the MIRI observations.

We perform target acquisition with WATA, using the targets themselves, with settings to ensure a S/N above 20 (but far from saturation), as calculated using JWST ETC (v1.1.1).

A 4-point dither pattern will be used, were the first 4 points of the "medium" cycling pattern provide a good compromise between an amplitude (~0.5 ") large enough to "jump" the failed open microsutthers and to deal with other sources of background, while keeping a large FoV with complete exposure time (~2.5"x2.5"). This dither pattern also allows a good sub-pixel sampling.

No extra background exposures are included. For R100 it was considered that there will be a relatively large number of spaxels free from galaxy emission to derive the background. For the R2700, in addition, the goal is to study the emission lines and therefore the background should be less relevant.

Even though the contamination by bright targets leaking through the MSA is expected to be small for the PAs selected (see above), we take an extra leakage exposure for R100 in one pointing in order to be able to understand the effects of the surronding field.

The IRS2 reading mode was selected to maximise S/N.

The exposure times used were computed using JWST ETC (v1.1.1). A maximum duration of 3ksec was considered when arranging the number of

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The total charged time of NIRSpec alone would be 10.56h. Subtracting half of the 0.98h we save on large slew time from combining with MIRI, the corrected charged time of the NIRSpec observations is 10.07h.

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a	1	MEDIUM(B)	MRSSHORT		SLOW	33	2	1	Dither 1	4	8	6306.939	
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Dither 1

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Sequence Visits, Non-interruptible Aperture PA Range 300.0 to 310.0 Degrees (V3 300.0 to 310.0) Visits Same PA

Group Observations 1, 3, 5, Non-interruptible

Group Observations 1, 3, 5, Non-interruptible

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