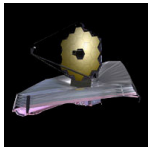

# 2484 - JWST probes star formation efficiency in giant molecular clouds at z=1

Cycle: 1, Proposal Category: GO

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**OBSERVATIONS**

| *Folder* | *Observation* | *Label* | *Observing Template* | *Science Target* |
|---|---|---|---|---|
| Observation Folder | | | | |
| | 5 | | NIRSpec IFU Spectroscopy | (12) Group MACSJ1206GROUP |

**ABSTRACT**

Deep HST images of strongly lensed clumpy galaxies at redshift z~1-3 shows UV-bright clumps, on average, 100x more massive than local star cluster complexes. Their physical properties supports an in-situ clump formation under fragmentation of turbulent, marginally stable high-redshift

gas disks. Among these galaxies, the Cosmic Snake, a strongly lensed clumpy galaxy at z=1.036, resolved down to physical scale of 30-70 pc in HST images (0.13"), sets a record of hosting 21 stellar clumps (HST rest-frame UV/optical) and 17 giant molecular clouds (GMCs) in ALMA CO observations at matched HST resolution. These GMCs have gas masses high enough to allow for the formation of the massive stellar clumps. The comparison of GMCs and stellar clump masses suggests a GMC star formation efficiency (~30%) much higher than observed in contemporary galaxies (<6%). If confirmed, it would suggest an evolution in the efficiency of forming stars with redshift. We propose to use an independent approach to derive the star formation efficiency of Cosmic Snake GMCs based on a statistical framework recently applied to nearby galaxies, which translates cloud-scale variations of the flux ratio between tracers of molecular gas and star formation to the molecular cloud evolutionary timeline, necessary to reliably determine the cloud-scale star formation efficiency. This framework relies on a tracer of very recent star formation, therefore we request for NIRSpec IFU Ha mapping of the Cosmic Snake galaxy to spatially (~0.1") cross-match young HII regions, traced by Ha, and molecular clouds.

**OBSERVING DESCRIPTION**

We request NIRSpec IFU spectroscopy imaging of a strongly lensed galaxy at z=1, dubbed the 'Cosmic Snake' and extremely magnified by the cluster MACS J1206.2–0847. The goal is to measure spatially resolved Halpha emission at 0.1" resolution across the detected star-forming regions. The NIRSpec observations are taken in G140H with 2 integrations per exposure and 75 groups. The selected detector setup is NRSIRSRAPID2 and a 5-point medium cycling dithering pattern is used. Background subtraction is performed using a blank off scene selected in HST/F160W. The corresponding exposure time allows us to detect Halpha emission at >5sigma (peak wavelength, 0.2arcsec diameter aperture for a point source in the faintest clumps), while also recovering [NII] emission for the brightest clumps. We require a specific range of PA to optimise the orientation of the IFU with the elongation of the Cosmic Snake arc.

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (10) | MACSJ1206-COSMICSNAKE | RA: 12 06 10.8171 (181.5450713d)<br>Dec: -08 48 9.40 (-8.80261d)<br>Equinox: J2000 | | |
| *Comments:*<br>*Category=Galaxy*<br>*Description=[High-redshift galaxies]* | | | | |
| (11) | MACSJ1206-BLANK | RA: 12 06 10.5680 (181.5440333d)<br>Dec: -08 48 12.75 (-8.80354d)<br>Equinox: J2000 | | |
| *Comments:*<br>*Category=Galaxy*<br>*Description=[High-redshift galaxies]* | | | | |
| (12) | Group MACSJ1206GROUP | | | |
| *Comments:*<br>*Target Selection=[10 MACSJ1206-COSMICSNAKE, 11 MACSJ1206-BLANK]* | | | | |

## Observation

**Proposal 2484, Observation 5** Thu Sep 16 04:00:17 GMT 2021

**Diagnostic Status: Warning**

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[]

## Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (12) | Group MACSJ1206GROUP | | | |

*Comments:*
*Target Selection=[10 MACSJ1206-COSMICSNAKE, 11 MACSJ1206-BLANK]*

## Template

| TA Method |
|---|
| VERIFY_ONLY |

## Dithers

| # | Dither Type | Size | Starting Point | Number of Points | Points |
|---|---|---|---|---|---|
| 1 | CYCLING | MEDIUM | 1 | 5 | |

## Pointing Verification

| # | PV MSA Configuration | Filter | PV Readout Pattern | PV Groups/Int | PV Integrations/Exp | PV Total Dithers | PV Total Integrations | PV Total Exposure Time |
|---|---|---|---|---|---|---|---|---|
| 1 | ALLOPEN | F140X | NRS | 3 | 1 | 1 | 1 | 139.578 |

## 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 | G140H/F100LP | NRSIRS2 | 15 | 2 | false | true | NONE | 5 | 10 | 11087.556 | |

| Special Requirements | Aperture PA Range 133.392975 to 122.692975 Degrees (V3 354.50000015 to 343.80000015) |
|---|---|