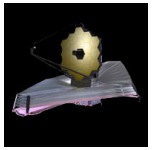

# 2285 - A massive quiescent galaxy at redshift 4.657

Cycle: 1, Proposal Category: GO

**INVESTIGATORS**

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**OBSERVATIONS**

| *Folder* | *Observation* | *Label* | *Observing Template* | *Science Target* |
|---|---|---|---|---|
| GOODSS-9209 | | | | |
| | 1 | | NIRSpec Fixed Slit Spectroscopy | (1) GOODSS-9209 |
| | 2 | | NIRSpec Fixed Slit Spectroscopy | (1) GOODSS-9209 |

**ABSTRACT**

We propose ultra-deep rest-frame UV-optical spectroscopy of the earliest robustly identified massive quiescent galaxy. Our target, GOODSS-9209, has a stellar mass of 10^11 Solar masses, a star formation rate (SFR) suppressed by at least 1 dex below the star-forming main sequence, and a spectroscopic redshift of 4.657, placing it just 1.25 Gyr after the Big Bang. This object provides a unique perspective on galaxy evolution during the first billion years, holding the key to understanding when and how baryonic feedback processes first began to arrest the extremely intense star

formation observed in the earliest galaxies.

By observing H alpha at 3.7 microns we will precisely measure the SFR of GOODSS-9209. If no star formation is detected, as suggested by photometric studies, this would be the first clear evidence that a passively evolving galaxy population exists as early as z~5. Alternatively, as this is the most firmly identified quiescent galaxy at z~5, a detection of residual star formation would strongly imply no galaxies have completely quenched by this epoch, and could indicate we have caught one of the first quenching events in progress.

GOODSS-9209 is known to have been quiescent for 300 Myr, however its prior evolution is unknown. Through spectral fitting we will measure the full star-formation history (SFH), stellar metallicity and alpha enhancement. A bursty SFH, combined with high metallicity and alpha enhancement would confirm this object formed rapidly as a submillimetre galaxy, showing such events can result in sustained quiescence. This inexpensive yet extremely high impact science case provides an ideal demonstration of the unique capabilities of JWST.

**OBSERVING DESCRIPTION**

This proposal targets a single, faint, high value galaxy at z=4.657 with medium-resolution spectroscopy using the NIRSpec fixed slits mode. Two filter+grating combinations are used: F170LP/G235M (3 hours) and F290LP/G395M (2 hours). The aim is to achieve an average continuum SNR=20 per pixel over the rest-frame wavelength interval from 3000-9300 Angstroms. These data will allow us to measure the current star-formation rate, star formation history and stellar metallicity of our target. The NRSIRS2 readout mode will be used, in order to keep the data volume within the required limits. Target acquisition will be through MSATA.

# Proposal 2285 - Targets - A massive quiescent galaxy at redshift 4.657

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | GOODSS-9209 | RA: 03 32 25.9625 (53.1081771d)<br>Dec: -27 49 30.44 (-27.82512d)<br>Equinox: J2000 | Proper Motion RA: 0 arcsec/yr<br>Proper Motion Dec: 0 arcsec/yr<br>Parallax: 0"<br>Epoch of Position: 2000 | |

*Comments:*
*Category=Galaxy*
*Description=[High-redshift galaxies]*
*Extended=YES*

## Observation

**Proposal 2285, Observation 1** Fri Sep 16 21:01:25 GMT 2022

**Diagnostic Status: Warning**

Observing Template: NIRSpec Fixed Slit 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) | GOODSS-9209 | RA: 03 32 25.9625 (53.1081771d)<br>Dec: -27 49 30.44 (-27.82512d)<br>Equinox: J2000 | Proper Motion RA: 0 arcsec/yr<br>Proper Motion Dec: 0 arcsec/yr<br>Parallax: 0"<br>Epoch of Position: 2000 | |

*Comments:*
*Category=Galaxy*
*Description=[High-redshift galaxies]*
*Extended=YES*

## Acquisition

| # | Target | TA Method | Subarray | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SAME | WATA | FULL | F140X | NRSRAPIDD6 | 3 | 1 | 1 | 171.788 | 87552.4 |

## Template

| Slit | Subarray |
|---|---|
| S200A1 | FULL |

## Dithers

| # | Primary Dither Positions | Sub-Pixel Pattern |
|---|---|---|
| 1 | 5 | NONE |

## Spectral Elements

| # | Grating/Filter | Slit | Readout Pattern | Groups/Int | Integrations/Exp | # | Autocal | Total Dithers | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | G395M/F290LP | S200A1 | NRSIRS2 | 20 | 1 | 1 | NONE | 5 | 5 | 7367.389 | 87552.1 |
| 2 | G235M/F170LP | S200A1 | NRSIRS2 | 30 | 1 | 2 | NONE | 5 | 5 | 11014.612 | 87552.2 |

## Observation

**Proposal 2285, Observation 2** Fri Sep 16 21:01:25 GMT 2022

**Diagnostic Status: Warning**

Observing Template: NIRSpec Fixed Slit 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 |
|---|---|---|---|---|
| (1) | GOODSS-9209 | RA: 03 32 25.9625 (53.1081771d)<br>Dec: -27 49 30.44 (-27.82512d)<br>Equinox: J2000 | Proper Motion RA: 0 arcsec/yr<br>Proper Motion Dec: 0 arcsec/yr<br>Parallax: 0"<br>Epoch of Position: 2000 | |

*Comments:*
*Category=Galaxy*
*Description=[High-redshift galaxies]*
*Extended=YES*

## Acquisition

| # | Target | TA Method | Subarray | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SAME | WATA | FULL | F140X | NRSRAPIDD6 | 3 | 1 | 1 | 171.788 | 87552.4 |

## Template

| Slit | Subarray |
|---|---|
| S200A1 | FULL |

## Dithers

| # | Primary Dither Positions | Sub-Pixel Pattern |
|---|---|---|
| 1 | 5 | NONE |

## Spectral Elements

| # | Grating/Filter | Slit | Readout Pattern | Groups/Int | Integrations/Exp | # | Autocal | Total Dithers | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | G395M/F290LP | S200A1 | NRSIRS2 | 20 | 1 | 1 | NONE | 5 | 5 | 7367.389 | 87552.1 |
| 2 | G235M/F170LP | S200A1 | NRSIRS2 | 30 | 1 | 2 | NONE | 5 | 5 | 11014.612 | 87552.2 |