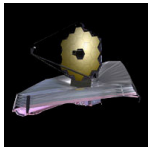

4196 - How to Form a Compact Massive Galaxy: Spatially Resolved Maps of Pa-beta at z=2.3

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	SPARKY-IFU	NIRSpec IFU Spectroscopy	(1) SPARKY

ABSTRACT

The central density of stars in a galaxy appears to be one of, if not *the* primary determinant of its evolutionary path. At the extreme end, the densest cores at the hearts of today's red-and-dead elliptical galaxies, appear to have formed via an extraordinary -and likely rapid- event that shut off star

formation and truncated their in-situ growth, unlike less dense star-forming counterparts. However, the formation of these extremely dense cores (~10$^$11 Msun within a kpc) is poorly understood as distinguishing amongst formation channels requires mapping star formation and kinematic signatures at sub-kpc resolution. Observations are further complicated by dust obscuration and AGN contamination. We propose NIRSpec IFU observations of Paschen-beta and Pa-gamma in a rare, but prototypical massive galaxy core lacking any AGN contamination. Using G395M, we will map Pa-Beta to distinguish between rotation-, dispersion-, or wind-dominated kinematics. The same observations will map the Pa-Beta and Pa-Gamma line strengths, yielding a dust-corrected map of star formation. If the kinematics are dispersion dominated and the star formation is more compact than the stellar continuum, this would suggest a merger- or instability-induced central starburst. Wind-dominated would point to impending rapid (<100 Myr) shut-down of star formation. Rotation-dominated kinematics and more extended dust-corrected star formation would imply gradual, accretion-throttled formation. In this case, it is likely to be the highest rotation velocity ever observed in a normal star-forming galaxy. With an investment of just 2.7 hours, we will place new constraints on the formation of massive galaxies.

OBSERVING DESCRIPTION

We propose NIRSpec IFU observations of a massive, compact star-forming galaxy without AGN signatures at z=2.3.

We request a total of 2.7 hours with G395M/F290LP, which will provide the wavelength coverage, and spatial and spectral resolution for our key science goals. Specifically, we will have the coverage and spatial resolution to map both the Paschen-beta and Paschen-gamma lines with a total SNR >= 25, which we will use to determine the extinction-corrected star formation distribution of our target. Additionally, the R1000 spectral resolution of G395M will be sufficient to resolve the galaxy kinematics using Paschen-beta.

Our observing strategy uses the 4-point "CYCLING" dither pattern with 'medium' offsets. The 4-point subpixel sampling ensures high spatial resolution, which is crucial given the compact size of our target. The selection of the "medium" dither amplitude provides large enough offsets to mitigate the impact of failed-open shutters and detector artefacts, while leaving a large area with the full integration time. We also specify the NRSIRS2RAPID readout pattern in both cases, to reduce the detector readout noise in our observations.

PA constraints have been requested to minimize MSA leakage from nearby bright sources.

No separate background exposures are requested. The compact size of our target will allow us to estimate the background from regions of the exposures away from our target. Furthermore, as our science goals focus on emission lines the background should be less important.

No MSA leakage calibration exposures are requested, as we have included the other two mitigation strategies of (1) PA constraints to avoid bright objects within the MSA footprints, and (2) dithering. As our science goals focus on emission lines that should be less affected by any leakage, we have determined the other two mitigation strategies should be sufficient for our program.

No target acquisition is requested, as nearly all available guide stars have GAIA astrometry.

Proposal 4196 - Targets - How to Form a Compact Massive Galaxy: Spatially Resolved Maps of Pa-beta at z=2.3

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SPARKY	RA: 12 36 27.7300 (189.1155417d) Dec: +62 07 12.80 (62.12022d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Compact galaxies, Elliptical galaxies, Galaxy bulges, Galaxy disks]
Extended=YES

Observation

Proposal 4196, Observation 1: SPARKY-IFU

Tue Jan 02 23:00:36 GMT 2024

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)	SPARKY	RA: 12 36 27.7300 (189.1155417d) Dec: +62 07 12.80 (62.12022d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Compact galaxies, Elliptical galaxies, Galaxy bulges, Galaxy disks]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	8	

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	G395M/F290LP	NRSIRS2RAPID	41	1	false	true	NONE	8	8	4901.867	

Special Requirements

Aperture PA Range 256.892975 to 30.892975 Degrees (V3 117.92132583 to 251.92132583)