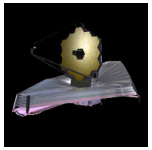

5883 - The most distant Cosmos-Web strong gravitational lens: mass content in the foreground lens and dissecting the background source

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	Main	NIRSpec IFU Spectroscopy	(1) CWeb-EinsteinRing

ABSTRACT

We propose to spectroscopically confirm the redshift of a possibly record breaking gravitational lens at z~2, discovered recently in the COSMOS-Web survey. If confirmed, this source will represent an exceptional laboratory to study the rise of the massive elliptical galaxies. Our proposed NIRSpec IFU observations are designed to achieve a kinematic study of the deflector, to be joined with the lensing analysis. By lifting degeneracy between the baryons and the Dark Matter (DM) to establish the mass profile, we could reveal the assembly channels (wet/dry merger) of this massive elliptical galaxy. Combined with stellar population synthesis models, we will test the need for a bottom-heavy IMF for massive elliptical galaxies. Furthermore, we will easily confirm the spectroscopic redshift of the lensed source, possibly between z=3 and 5.5. As a result, the uncertainty on the total halo mass of the deflector will improve from 100% to 5%. This accuracy is sufficient to clarify if radical changes in our understanding of massive high-z source is needed. As a side product, we will take advantage of this gravitational telescope to resolve spatially the lensed galaxy over a scale of 400 pc or better, unveiling the complex nature of the source at z>5. While such lensing system is unique, some of its extreme properties (if confirmed) could revolutionize our understanding of massive galaxies. Furthermore, it represents a precursor of what could be done applying JWST on the high-z lenses potentially discovered with Euclid.

OBSERVING DESCRIPTION

We propose to target the highest redshift strong gravitational lens with the NIRSPEC IFU. Both the foreground lens, the nearly complete Einstein ring and still abundant blank sky nicely fill the field of view.

The goal is to get a spatially resolved spectrum of both the lens (at z=2) and the ring (at z=3 or ~5.2). The G235H/F170P grating covers 1.66 to 3.17 \mu (the gap near 2.45 mu has no impact for us) captures all the relevant spectral features:

- CaII triplet in absorption for the lens
- [OII], Hb, [OIII] (and possibly Ha) in emission for the source.

The absorption lines in the compact lens (AB magnitude F277W=21.17) will be used to derive a velocity dispersion profile for the lens (spectral resolution will set a lower limit of 40 km/s for the accuracy). Though compact, we aim at getting a radial profile of the velocity dispersion to undertake a joint lensing and dynamical modeling of the lens mass distribution. Altogether, we will derive a precise radial profile of the dark matter, and visible stellar components. Furthermore, we will constrain the normalisation of the Initial Mass Function of stars in the lensing galaxy at redshift 2, which is crucial to put constraints on the universality of the IMF.

The emission lines of the ring (integrated AB magnitude F277W=22.01) will be mapped at the IFU spaxel resolution all along the ring and will provide us with a detailed velocity field of the reconstructed (de-lensed) source, along with line ratio maps at similar resolution. Thanks to the magnifying power of lensing, we will reach a typical resolution of 400-500 pc (or better) in the source plane at z=5 or 3.

The total exposure time (as infered from the 175237 ETC workbook) is set by the SNR we need in the continuum spectrum of the lens. With 4-point dithers, 50 groups of 2 integrations, we need about 8 hours total. The lens is bright enough for the target acquisition to be done on the galaxy itself.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CWeb-EinsteinRing	RA: 10 00 24.1131 (150.1004712d) Dec: +01 53 34.84 (1.89301d) Equinox: J2000		

Comments: No particular need for additional background. The target is extended but does not fill the IFU
Category=Galaxy
Description=[Einstein rings, Elliptical galaxies, High-redshift galaxies]
Extended=YES

Observation

Proposal 5883, Observation 1: Main

Tue Feb 25 16:00:29 GMT 2025

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)	CWeb-EinsteinRing	RA: 10 00 24.1131 (150.1004712d) Dec: +01 53 34.84 (1.89301d) Equinox: J2000		

Comments: No particular need for additional background. The target is extended but does not fill the IFU
Category=Galaxy
Description=[Einstein rings, Elliptical galaxies, 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	NRSRAPID	3	1	1	42.947	175237

Template

HFF Readout Mode
false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

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	G235H/F170LP	NRSIRS2	16	6	false	true	NONE	4	24	28360.802	240248
2	G235H/F170LP	NRSIRS2	16	1	true	false	NONE	1	1	1181.7	