17437 - When does the initial mass function become heavy? A unique view of two massive galaxies at z=1

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) AGEL0014	WFC3/IR WFC3/UVIS	2	14-Nov-2023 11:00:28.0	yes

2 Total Orbits Used

ABSTRACT

The stellar initial mass function (IMF) is a critical assumption underlying nearly every galaxy observable, yet it remains poorly constrained at high (z>0) redshift. The low-mass end in particular (M<0.4 Msun) significantly affects the mass-to-light ratio, and therefore measurements of key galaxy properties including the stellar mass and dark matter content are highly sensitive to its assumed shape. Thanks to upcoming cycle 2 JWST/NIRSpec IFU observations of 2 massive lensed quiescent galaxies at z~1, a precise measurement of the IMF at z~1 using spectral lines sensitive to low-mass stars will be possible for the first time.

However, this forthcoming JWST IFU data has far more potential than solely measuring the IMF spectroscopically. This proposal will significantly expand the science available from this dataset by using only 2 orbits of HST/WFC3 to build a precise lens model of the one target without pre-existing WCF3 images and reconstruct the source galaxy's morphology. The high spatial resolution imaging from HST will open the door for spatially resolved studies of the target, allowing us to use the JWST data to its full capacity.

With the combined HST imaging and JWST spectra we can then make an independent measurement of the IMF normalisation from dynamical modeling, a method which is in tension with results from stellar spectral features. Additionally, the dynamical models will provide a measure of the total mass density slope at an epoch where simulations and observations differ significantly in their predictions. This analysis will be the first of its kind and will provide a key test for galaxy formation and evolution theories.

OBSERVING DESCRIPTION

For the IR/F140W we find that with 4 dithers of total exposure time ~900s, for an extended 3" source with 1x1 pixel binning, assuming a flat continuum in F\lambda and standard background levels we obtain a S/N ~ 10 per pixel. For the UVIS/F814W we find that in 4 frames of total exposure time ~3000s, for an extended 3" source with 2x2 pixel binning, assuming a flat continuum in F\lambda and standard background levels we obtain a S/N~ 5 per pixel. Based on the instrument overheads listed in the WFC3 user documentation, the total time required comes to 2 orbits. Increasing from 3 to 4 dithers for each filter has a negligable change on the S/N as estimated by the ETC, but will improve the spatial sampling in the

dithered images.

Visit

Proposal 17437, DESJ0014+0041 new sequence (01), implementation Tue Nov 14 16:00:29 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: (none)

Comments: Sequence as decided by ETC:
- For the IR/F140W 4 dithers of total exposure time 900s
- For the UVIS/F814W 4 frames of total exposure time 3000s

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(2)
(4)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=false		(3)
(5)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AGEL0014 Alt Name1: DESJ0014+0041	RA: 00 14 24.2782 (3.6011592d) Dec: +00 41 45.46 (.69596d) Equinox: J2000		V=22.62	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[GRAVITATIONAL LENS]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	NIR-orbit 1	(1) AGEL0014	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=13; SAMP-SEQ=STEP50		Pattern 2, Exps 1-1 in DESJ0014+0041 new sequence (01) (2)	399.233383 Secs (798.467 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	Optical-orbit 1	(1) AGEL0014	WFC3/UVIS, ACCUM, UVIS2	F814W			Pattern 3, Exps 2-2 in DESJ0014+0041 new sequence (01) (3)	803 Secs (1606 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
3	NIR-orbit 2	(1) AGEL0014	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=13; SAMP-SEQ=STEP50	POS TARG 1.4,1.4	Pattern 4, Exps 3-3 in DESJ0014+0041 new sequence (01) (4)	399.233383 Secs (798.467 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***
4	Optical-orbit 2	(1) AGEL0014	WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 0.3,0.3	Pattern 5, Exps 4-4 in DESJ0014+0041 new sequence (01) (5)	803 Secs (1606 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***

Orbit Structure