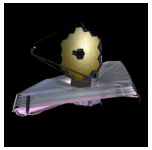

5629 - Extremely deep spectroscopy of quiescent galaxies at z~0.7: A direct measurement of the stellar initial mass function beyond the low-redshift universe

Cycle: 3, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Prof. Mariska Kriek (PI) (ESA Member)	
Aliza G. Beverage (CoI) (CoPI)	University of California - Berkeley
Chloe M. Cheng (CoI) (ESA Member) (CoPI)	Universiteit Leiden
Dr. Rachel Bezanson (CoI)	University of Pittsburgh
Dr. Gabriel Brammer (CoI) (ESA Member)	University of Copenhagen, Niels Bohr Institute
Prof. Charlie Conroy (CoI)	Harvard University
Prof. Pieter van Dokkum (CoI) (US Admin CoI)	Yale University
Prof. Robert Feldmann (CoI) (ESA Member)	Department of Astrophysics, Universitat Zurich
Prof. Marijn Franx (CoI) (ESA Member)	Universiteit Leiden
Prof. Meng Gu (CoI)	University of Hong Kong
Dr. Joel Leja (CoI)	The Pennsylvania State University
Brian Lorenz (CoI)	University of California - Berkeley
Pavel E. Mancera Pina (CoI) (ESA Member)	Universiteit Leiden
Dr. Andrew B. Newman (CoI)	Carnegie Institution of Washington
Dr. Sedona H. Price (CoI)	University of Pittsburgh
Prof. Alice E. Shapley (CoI)	University of California - Los Angeles
Prof. Arjen van der Wel (CoI) (ESA Member)	Universiteit Gent
Dr. Daniel R. Weisz (CoI)	University of California - Berkeley
Martje Slob (CoI) (ESA Member)	Universiteit Leiden
Dr. Piyush Sharda (CoI) (ESA Member)	Universiteit Leiden
Dr. Anna G de Graaff (CoI) (ESA Member)	Max Planck Institute for Astronomy

Name	*Institution*
Dr. Katherine Suess (CoI)	University of Colorado at Boulder

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	2	imf_dither3_13targs_open	NIRSpec MultiObject Spectroscopy	(6) IMF_apt_catalog_v4
	3	imf_dither3_13targs_open	NIRSpec MultiObject Spectroscopy	(6) IMF_apt_catalog_v4

ABSTRACT

The stellar initial mass function (IMF), which describes the distribution of the birth masses of stars, is of paramount importance to galaxy evolution. Exploiting the universality of the IMF shape, we infer fundamental parameters, such as stellar mass and star formation rate, and accordingly unravel how galaxies build up over time. However, in the centers of very massive elliptical galaxies, the IMF is distinctly different from what is observed in the Milky Way. With its excess of low-mass stars, this IMF would increase the inferred stellar masses by a factor of 2-3.

The cores of massive elliptical galaxies are thought to have formed at early times and thus we expect distant massive galaxies to also have a bottom-heavy IMF. However, this bottom-heavy IMF yields inferred stellar masses that exceed the dynamical masses. To solve this puzzle and derive more precise stellar masses and star formation rate of distant massive galaxies, we propose to directly measure the IMF in nine z~0.7 galaxies using ultra-deep spectroscopy with the NIRSpec-MSA. These observations will also yield stellar mass profiles, resolved stellar kinematics, and thus robust dynamical masses. Our program will (i) reveal whether the IMF was already bottom heavy in z~0.7 quiescent galaxies, (ii) yield the most robust baryonic-to-dark matter mass ratios in z~0.7 quiescent galaxies to date, (iii) provide new insights into the build up of the cores of massive elliptical galaxies, and (iv) assess other explanations for the "unphysical" stellar-to-dynamical mass ratios of distant quiescent galaxies. We will also observe 8 quiescent galaxies at 1<z<2 and 15 star-forming galaxies at similar and higher redshifts.

OBSERVING DESCRIPTION

We propose to obtain deep continuum, rest-frame optical, medium-resolution spectroscopy of quiescent galaxies at z~0.7, using NIRSpec-MSA and the G140M-F100LP dispersion-filter combination. Quiescent galaxies and star-forming galaxies at higher redshift are used as fillers. HST imaging (F814W) is available for all targets and thus no pre-imaging is needed. Furthermore, all primary targets will be covered by the COSMOS-Web program in Cycle 1.

We will use 3-shutter slits and a (custom) 2-position nodding pattern. We will extend the slits to 4 or 5 shutters, where possible. We will also apply a fixed dither of 1 shutter in the dispersion direction, to minimize impacts of detector defects. Our current mask design does not allow primary targets in areas affected by open shutters.

Our field can be observed for a limited PA range (64-85 degrees and 234-254 degrees). Our most optimal mask has a PA of 67.0 degrees, and targets 9 primary galaxies. Due to the high density, most PAs will observe a minimum of 8 primary targets.

We plan to observe this pointing/configuration for 30 hrs, divided over three visits. Each visit consists of 24 or 25 integrations of 1473.478 seconds each, with 20 groups per integration. We need exactly the same PA for each visit, so we can use the same mask design. We have two nod and two dither positions. We will use the NRSIRS2 read-out mode. Total integration time is 40 hours.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(6)	IMF_apt_catalog_v4	RA: 09 59 41.1785 (149.9215771d) Dec: +02 29 46.35 (2.49621d) Equinox: J2000		

Comments:
Description=[]

Observation

Proposal 5629, Observation 2: imf_dither3_13targs_open Tue Feb 04 23:00:33 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRSpec MultiObject Spectroscopy

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 2:1) Warning (Form): The recommended value is 8 Reference Stars for this template.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(6)	IMF_apt_catalog_v4	RA: 09 59 41.1785 (149.9215771d) Dec: +02 29 46.35 (2.49621d) Equinox: J2000		

Comments:
Description=[]

Acquisition

#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	Filter: CLEAR; Readout: NRSRAPIDD6; 6 sources in 3 quads; [Optimal TA Accuracy]	SAME	CLEAR	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	

Template

TA Method	HFF Readout Mode	Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map	Spectral Overlap Threshold
MSATA	false	After Target ACQ	MSA Center	imf (34 sources)		jwst-nirspec-g140m	1.5

Reference Stars

Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
1	1120630	149.911686	2.481845	24.66966	1	1139098	149.887456	2.498813	23.47154
1	1124626	149.886709	2.485241	25.03716	1	1160666	149.881425	2.521526	25.45116
1	1132708	149.933391	2.492774	24.65103	1	1161025	149.890360	2.517663	23.35612

Confirmation

#	Confirmation Type	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time
1	After Target Acq	NRSIRS2	8	1	1	598.144

Spectral Elements

#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
1	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
2	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
3	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
4	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
5	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
6	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
7	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
8	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
9	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
10	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
11	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80682432915 452		-1.0	1	2	2946.956
12	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80681292997		1.0	1	2	2946.956
13	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80681292997		1.0	1	2	2946.956
14	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80682432915 452		-1.0	1	2	2946.956

#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
15	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80682432915452		-1.0	1	2	2946.956
16	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80681292997		1.0	1	2	2946.956
17	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80681292997		1.0	1	2	2946.956
18	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80682432915452		-1.0	1	2	2946.956
19	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80682432915452		-1.0	1	2	2946.956
20	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80681292997		1.0	1	2	2946.956

Special Requirements

MSA Scheduled Aperture PA 246.8073 to 246.8073 Degrees (V3 108.23277 to 108.23277)

Same Aperture PA 2, 3

Observation

Proposal 5629, Observation 3: imf_dither3_13targs_open Tue Feb 04 23:00:33 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRSpec MultiObject Spectroscopy

Diagnostics

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 3:1) Warning (Form): The recommended value is 8 Reference Stars for this template.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(6)	IMF_apt_catalog_v4	RA: 09 59 41.1785 (149.9215771d) Dec: +02 29 46.35 (2.49621d) Equinox: J2000		

Comments:
Description=[]

Acquisition

#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	Filter: CLEAR; Readout: NRSRAPIDD6; 6 sources in 3 quads; [Optimal TA Accuracy]	SAME	CLEAR	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	

Template

TA Method	HFF Readout Mode	Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map	Spectral Overlap Threshold
MSATA	false	After Target ACQ	MSA Center	imf (34 sources)		jwst-nirspec-g140m	1.5

Reference Stars

Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
1	1120630	149.911686	2.481845	24.66966	1	1139098	149.887456	2.498813	23.47154
1	1124626	149.886709	2.485241	25.03716	1	1160666	149.881425	2.521526	25.45116
1	1132708	149.933391	2.492774	24.65103	1	1161025	149.890360	2.517663	23.35612

Confirmation

#	Confirmation Type	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time
1	After Target Acq	NRSIRS2	8	1	1	598.144

Spectral Elements

#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
1	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
2	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
3	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
4	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
5	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
6	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
7	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80682015678 87		-1.0	1	2	2946.956
8	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
9	1 (G140M/F100LP)	c1		149.91053583333 33 Degrees 2.5020333333333 333 Degrees	246.80680875663 617		1.0	1	2	2946.956
10	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80682432915 452		-1.0	1	2	2946.956
11	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80682432915 452		-1.0	1	2	2946.956
12	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80681292997		1.0	1	2	2946.956
13	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80681292997		1.0	1	2	2946.956
14	1 (G140M/F100LP)	c2		149.91062358333 332 Degrees 2.5018283333333 335 Degrees	246.80682432915 452		-1.0	1	2	2946.956

#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
15	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80682432915452		-1.0	1	2	2946.956
16	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80681292997		1.0	1	2	2946.956
17	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80681292997		1.0	1	2	2946.956
18	1 (G140M/F100LP)	c2		149.91062358333332 Degrees 2.5018283333333335 Degrees	246.80682432915452		-1.0	1	2	2946.956

Special Requirements

MSA Scheduled Aperture PA 246.8073 to 246.8073 Degrees (V3 108.23277 to 108.23277)

Same Aperture PA 2, 3