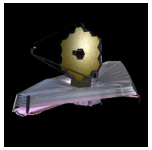

1671 - Emission line galaxies beyond the limits of the Hubble UDF: Physical conditions in ultra-faint star forming galaxies

Cycle: 1, Proposal Category: GO

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. Michael Maseda (PI)	**University of Wisconsin - Madison**	**maseda@astro.wisc.edu**
Dr. Themiya Nanayakkara (CoI)	Swinburne University of Technology	themiyananayakkara@gmail.com
Dr. Jorryt Matthee (CoI) (ESA Member)	Eidgenossiche Technische Hochschule (ETH)	matthee@strw.leidenuniv.nl
Dr. Roland Bacon (CoI) (ESA Member)	Centre de Recherche Astrophysique de Lyon	roland.bacon@univ-lyon1.fr
Dr. Kasper Borello Schmidt (CoI) (ESA Member)	Leibniz-Institut für Astrophysik Potsdam (AIP)	kbschmidt@aip.de
Dr. Anna Feltre (CoI) (ESA Member)	INAF-Osservatorio di Astrofisica e Scienza dello Spazio	anna.feltre@inaf.it
Dr. Tanya Urrutia (CoI) (ESA Member)	Leibniz-Institut für Astrophysik Potsdam (AIP)	tanya.urrutia@gmail.com
Dr. Johan Pierre Richard (CoI) (ESA Member)	Centre de Recherche Astrophysique de Lyon	johan.richard@univ-lyon1.fr
Dr. Haruka Kusakabe (CoI) (ESA Member)	University of Geneva, Department of Astronomy	haruka.kusakabe@unige.ch
Dr. Takuya Hashimoto (CoI)	University of Tsukuba	hashimoto.takuya.ga@u.tsukuba.ac.jp
Dr. Hanae Inami (CoI)	Hiroshima University	hanae@hiroshima-u.ac.jp
Dr. Roser Pello (CoI)	Laboratoire d'Astrophysique de Marseille (LAM)	roser.pello@orange.fr
Prof. Joop Schaye (CoI) (ESA Member)	Universiteit Leiden	schaye@strw.leidenuniv.nl
Prof. Marijn Franx (CoI) (ESA Member)	Universiteit Leiden	franx@strw.leidenuniv.nl
Leindert Boogaard (CoI) (ESA Member)	Max Planck Institute for Astronomy	boogaard@mpia.de
Ms. Charlotte Simmonds (CoI) (ESA Member)	University of Geneva, Department of Astronomy	charlotte.simmondswagemann@unige.ch
Dr. Floriane Leclercq (CoI)	University of Texas at Austin	floriane.leclercq@austin.utexas.edu
Dr. Rychard Bouwens (CoI) (ESA Member)	Universiteit Leiden	bouwens@strw.leidenuniv.nl
Dr. Thierry Contini (CoI) (ESA Member)	Institut de Recherche en Astrophysique et Planetolgie	thierry.contini@irap.omp.eu

Name	*Institution*	*E-Mail*
Dr. Jarle Brinchmann (CoI) (ESA Member)	Universidade do Porto	jarle@astro.up.pt
Mr. Anthony J. Taylor (CoI)	University of Wisconsin - Madison	ataylor@astro.wisc.edu
Prof. Ivo Labbe (CoI)	Swinburne University of Technology	ivolabbe@gmail.com
Dr. Amy J. Barger (CoI)	University of Wisconsin - Madison	barger@astro.wisc.edu
Dr. Christy A. Tremonti (CoI) (US Admin CoI)	University of Wisconsin - Madison	tremonti@astro.wisc.edu
Prof. Lutz Wisotzki (CoI) (ESA Member)	Leibniz-Institut für Astrophysik Potsdam (AIP)	lwisotzki@aip.de
Dr. Josephine Kerutt (CoI) (ESA Member)	University of Geneva, Department of Astronomy	josephine.kerutt@unige.ch
Prof. Anne Verhamme (CoI) (ESA Member)	University of Geneva, Department of Astronomy	anne.verhamme@unige.ch

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	MPT_custom	NIRSpec MultiObject Spectroscopy	(2) MUSE-DR2-MXDF-V2

ABSTRACT

In the last 15 years, the Hubble Space Telescope has spent more than four weeks worth of exposure time on a single 11 sq. arcminute region of the night sky: the Hubble Ultra Deep Field (UDF). However, deep VLT/MUSE optical integral field spectroscopy has recently revealed an abundant population of ultra-faint galaxies without counterparts in the HST imaging. These z=2.9-6.7 galaxies are detectable due to their strong Lyman-alpha emission, with equivalent widths that imply extremely young ages, small stellar masses, and a very low amount of metal enrichment. This unprecedented sample represents our best chance at studying galaxies in the earliest phases of formation, even with future JWST imaging surveys. We propose to use JWST/NIRSpec's MSA to follow-up a subset of 45-55 of these 171 galaxies at 1.7-5.1 microns in order to target strong optical emission lines: Halpha, [OIII], Hbeta, [NeIII], and [OII]. These observations will reveal exactly how metal-poor these galaxies are, will put direct constraints on stellar population models for young ages and low-metallicities, and, when combined with exquisite MUSE restframe-UV data, will reveal for the first time the physical conditions inside the lowest-mass star-forming galaxies at high redshift. The large wavelength coverage and sensitivity of NIRSpec are crucial for obtaining the information required to fully characterize these ultra-faint Lyman-alpha emitters.

OBSERVING DESCRIPTION

We will use NIRSpec's MSA to target faint, high-equivalent width Lyman-alpha emitters in the UDF (03 32 38, -27 47 0). These targets have been selected from MUSE integral field spectroscopy to be promising candidates for extremely young and metal-poor stellar populations at $2.9 < z < 6.7$. With G235M/F170LP and G395M/F290LP data, we will measure optical emission lines like Halpha, Hbeta, [OIII], and [OII] for all sources. These

emission lines will be used to determine the systemic redshifts of the galaxies as well as their gas-phase metallicities.

In order to maximize multiplexing, we are allowing for some spectral overlap (minimal separation of 130 shutters between targets) as we are in a detector noise-limited regime. Further, we are not planning to dither as (1) this would minimize the number of targets receiving the full integration time, which is crucial for our science and (2) we already have some redshift information for each target so we can ensure no emission lines fall in the detector gap. 3 nods are performed for each grating setup. Each grating setup has 3 integrations of 100 groups in NRSIRS2RAPID (1473s exposures). R1000 Band II (III) has 3 (2) sequences at each position to build up signal-to-noise.

A target catalog is included in this APT file. This includes all of our scientific targets (from MUSE) as well as all sources from the GOODS-S catalog of Skelton et al. (2014) which will be used for target acquisition.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	DR2-MXDF-WIDE-GOODSS	RA: 03 32 38.9520 (53.1623000d) Dec: -27 47 6.89 (-27.78525d) Equinox: J2000		
Comments: Catalog includes all sources from the Skelton et al. (2014) GOODS-S catalog, which can be used for TA (including compact galaxies). *Description=[]*				
(2)	MUSE-DR2-MXDF-V2	RA: 03 32 36.7742 (53.1532258d) Dec: -27 47 13.54 (-27.78709d) Equinox: J2000		
Comments: Updates to astrometry - all sources now on GAIA reference frame (Whitaker et al. 2019). Sources all now have NIRSpec imaging magnitudes estimated from SED fitting. *Description=[]*				

Observation

Proposal 1671, Observation 1: MPT_custom Wed Sep 07 23:01:05 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRSpec MultiObject 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
(2)	MUSE-DR2-MXDF-V2	RA: 03 32 36.7742 (53.1532258d) Dec: -27 47 13.54 (-27.78709d) Equinox: J2000		

Comments: Updates to astrometry - all sources now on GAIA reference frame (Whitaker et al. 2019). Sources all now have NIRSpec imaging magnitudes estimated from SED fitting.
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: NRSRAPID; 8 sources in 3 quads; [Optimal TA Accuracy]	SAME	CLEAR	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	

Template

TA Method	Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map	Spectral Overlap Threshold
MSATA	After Target ACQ	MSA Center	P1 (150 sources)	P25 (25650 sources)	jwst-nirspec-mr	1.5

Reference Stars

Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
1	24315	53.163022	-27.797726	22.86868262238852	1	31586	53.138354	-27.766409	22.424868532800147
1	30490	53.185761	-27.772298	23.296773335548526	1	32799	53.130119	-27.759156	21.654360455120027
1	31080	53.178171	-27.769213	22.669282731985078	1	33042	53.133134	-27.758789	21.399055380768257
1	31452	53.130806	-27.767934	22.745390571749475	1	34067	53.191727	-27.753587	22.523639271478174

Confirmation

#	Confirmation Type	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time
1	After Target Acq	NRSIRS2RAPID	40	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 (G235M/F170LP)	c1	3 Shutter Slitlet	53.161801249999996 Degrees -27.764488888888877 Degrees	55.07005636553129			3	9	13261.301
2	1 (G235M/F170LP)	c1	3 Shutter Slitlet	53.161801249999996 Degrees -27.764488888888877 Degrees	55.07005636553129			3	9	13261.301
3	1 (G235M/F170LP)	c1	3 Shutter Slitlet	53.161801249999996 Degrees -27.764488888888877 Degrees	55.07005636553129			3	9	13261.301
4	2 (G395M/F290LP)	c1	3 Shutter Slitlet	53.161801249999996 Degrees -27.764488888888877 Degrees	55.07005636553129			3	9	13261.301
5	2 (G395M/F290LP)	c1	3 Shutter Slitlet	53.161801249999996 Degrees -27.764488888888877 Degrees	55.07005636553129			3	9	13261.301

Special Requirements

MSA Scheduled Aperture PA 55.07400521 to 55.07400521 Degrees (V3 276.50766 to 276.50766)