Overview of JWST GTO Programmes High-z Galaxy Evolution

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Preparing the JWST Era EWASS - 28 June 2017



Established by the European Commissior

Four instruments to study the high-z Universe



MIRI



NIRISS





includes some coordinated plans to make the most of GTO

Deep Field Surveys

Imaging and MO

DS

NIRCam + NIRSpec GT Teams (PI M. Rieke; F

exploits NIRCam/NIRSpec and NIRCam/MIRI parallels

Two-tier survey (medium + deep)

Scientific objective:

study formation and evolu

Each tier includes imaging w/ 9(+) NIRCam spectroscopy at 0.7-5.2 microns





Imaging and MOS in CANDELS/GOODS

NIRCam + NIRSpec GT Teams

<u>Medium survey:</u> 190 sq. arcmin in each field 28.8 (10σ; AB)

MIRI parallels over ~ 14 sq. arcmin w/ 26.7 (AB) in F770W over 8 sq. arcmin

NIRSpec parallels for ~ 5000 targets x 13-43 ks integration each (R=100 & 1000)

GOODS-N Medium: 60 h GOODS-S Medium: 121 h GOODS-S (UDF) Deep: 244 h

TOTAL: 425 h

<u>Deep survey:</u> 46 sq. arcmin in each field 29.8 (10σ; AB)

NIRSpec parallels for 2 pointings x 200 ks integration each (R=100 & 1000)

focus on z>6 targets

NIRCam fundamental to probe sources of reionisation

NIRCam and NIRSpec GTO programme in GOODS-S



Courtesy of NIRCam GT Team

Wide-area MOS in CANDELS

NIRSpec GT Team (PI P. Ferruit)

NIRSpec MOS over 270 sq. arcmin. (35 pointings) R=100 and R=2700 Total time ~ 106 h

includes ~ 50 sources with continuum mag(3 μ m)<24 (AB) and ~ 250 Ha emitters w/ f > 10–17 erg s⁻¹cm⁻² per pointing

Scientific objectives:

determine SFR, metallicities, etc., mainly for z>4 galaxies

explores new regime for spectroscopy currently unaccessible with any telescope

MIRI shallow multi-band survey in GOODS-S

MIRI US GT Team (PI G. Rieke)

30 sq. arcmin centred on HUDF uses all MIRI imaging bands

Scientific objectives:

Detailed SED modelling to unveil AGN Calibrate SFR indicators at z~2

will get complementary NIRSpec data for a galaxy subset Power-law excess in IR SED



Caputi (2013)

see also Alonso-Herrero et al. (2006)

MIRI Ultra-deep imaging in XDF

MIRI EU GT Team (PI G. Wright)



Will have deep NIRCam and NIRISS parallels



Courtesy of F. Walter

MIRI crucial to probe $\lambda > 4000$ Angstrom at $z \sim 10+$

Galaxy Clusters

Canadian NIRISS Unbiased Cluster Survey (CANUCS)

NIRISS GT Team (PI R. Doyon)

targets 5 lensing galaxy clusters at 0.35<z<0.55

Scientific objectives:

obtain emission line and line ratio maps for cluster members (spatial distribution of SFR, dust and metals)

Characterise lensed sources of reionisation

Fine-tune lensing models

Mainly NIRISS + minor NIRCam & NIRSpec components

Total time 199 h

Cluster	RA	DEC	Redshift	Survey
Abell 370	02:39:52.8	-01:34:36	0.375	HFF
M0416.1-2403	04:16:09.4	-24:04:04	0.395	HFF
M0417.5-1154	04:17:34.7	-11:54:32	0.443	RELICS
M1149.6 + 2223	11:49:35.9	$+22{:}23{:}55$	0.543	HFF
M1423.8 + 2404	14:23:47.8	+24:04:40	0.545	CLASH



Galaxy Cluster MACS J1149+2223

High-Redshift Galaxy MACS1149-JI

A Distant Gravitationally-Lensed Galaxy at Redshift = 9.6 NASA / ESA / STScl/ J. Hora (Harvard-Smitsonian CIA)

Hubble Space Telescope • ACS • WFC3 ssc2012-12/

Massive Galaxy Clusters

Pls R. Windhorst; M. Stiavelli

NIRCam imaging of 7 lensing galaxy clusters

Scientific objectives:

discover the most distant background galaxies

Study time-variable objects

Mainly NIRCam + minor NIRISS component

MACS0416, MACS1149, Abell-2744, El Gordo, PLCK-G165.7+67, CLG-J1212+2733, and GAMA-100033





Spectroscopy of Individual Targets



Multiple programmes to target high-z quasars

NIRSpec Galaxy Assembly IFS survey includes 15 AGN at z=1.5-4.7 and luminous QSOs	NIRSpec Team
+ NIRSpec fixed slit w/R=2700 for four QSOs at z>6.7	
NIRCam + NIRSpec IFU of z>5 quasar hosts	MIRI US GT Team
MIRI MRS programme for high-z (z>6.7) includes a few luminous QSOs	MIRI EU GT Team
NIRCam slitless spectroscopy and imaging of six luminous quasars at z>6	PI S. Lilly
NIRCam + NIRSpec IFU of multiply lensed quasars SDSSJ1206-4332, WFI 2033-4723, HE 0435-1223, PG 1115+080	PI M. Stiavelli
NIRSpec IFU of six luminous quasars at z~6 and AGN at z=7.51	PI R. Windhorst

Normal Galaxies at High z

MIRI MRS programme for a few bright Lya emitters at z=7-9 (goal: detect Ha)

MIRI MRS programme for a few luminous sub-mm galaxies at z=4-6

NIRSpec IFS programme 28 bright and extended LBGs at z=2-6, and z>6 LAE including five at z=6.6-8.68

NIRSpec IFS programme for a few luminous sub-mm galaxies at z=4-6 **MIRI EU GT Team**

NIRSpec Team

Summary

Deep blank fields make a significant part of JWST GTO high-z programmes

- ✓ study of galaxy evolution down to satellites galaxies
- ✓ unveil sources of reionisation
- ✓ serendipitous discoveries

Cluster Fields

✓ galaxy evolution and dynamics in unique environment
✓ take advantage of lensing to reach faintest limits

Pre-selected targets

✓ understand the nature of the most puzzling sources known to date