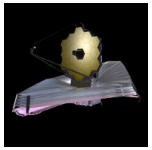

1222 - Cosmic reionization, metal enrichment and host galaxies from quasar spectroscopy

Cycle: 1, Proposal Category: GTO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NIRSpec FSS of J0020				
	1	FSS observation of J0020-3653	NIRSpec Fixed Slit Spectroscopy	(3) VDESJ0020-3653
NIRSpec FSS of J0411				
	2	FSS observation of J0411-0907	NIRSpec Fixed Slit Spectroscopy	(4) DELSJ0411-0907
NIRSpec MSA of J1120				
	5	Quasar in S200A1 and S200A2	NIRSpec MultiObject Spectroscopy	(5) TARGET-OBSERVATION-5
NIRSpec IFU of J0020, J0411 and J0439				
	3	IFU observation of J0020-3653	NIRSpec IFU Spectroscopy	(3) VDESJ0020-3653
	4	IFU observation of J0411-0907	NIRSpec IFU Spectroscopy	(4) DELSJ0411-0907

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	7	IFU observation of J0439+1634	NIRSpec IFU Spectroscopy	(6) UHSJ0439+1634
NIRSpec MSA of J0439				
	8	Quasar in S200A2	NIRSpec MultiObject Spectroscopy	(7) TARGET-OBSERVATION-8

ABSTRACT

Cosmic reionization and metal enrichment from quasar spectroscopy

Cosmic reionization is one of the key frontiers in astrophysics. The re-ionization process informs on the properties of the ionizing sources in the early epoch of galaxy formation. We will carry out ‘blue extended’ F070LP/G140H (0.7 to 1.8 microns) and F170LP/G235H (1.7 to 3.1 microns) R = 2700 NIRSpec fixed-slit spectroscopy of quasars at z > 6.5. These spectra will be free from the atmospheric absorption and sky emission that hampers ground-based observations.

NIRSpec Galaxy Assembly IFS Survey

NIRSpec 3 to 5 microns IFU spectroscopy of z > 6.5 quasar hosts: The primary goal is investigating the physics of AGN-driven outflows, as well as the effects onto their host galaxies. These observations will also enable us to investigate more broadly the properties of high-z AGN host galaxies.

OBSERVING DESCRIPTION

This program combines observations for two NIRSpec GTO team science programs that target some of the same high-redshift quasars.

Observations 1 and 2 - NIRSpec FSS observations of J0020-3653 and J0411-0907

These are Fixed Slit Spectroscopy observations of two quasars observing for 9 exposures in each of the S200A1 and S200A2 fixed slits. Full-frame NRSIRS2 readout is used. If enabled in time for Cycle 1 we would also like to be able to configure the MSA to carry out a pseudo-slitless survey for high-redshift Lyman alpha emitters.

We use the G140H/F070LP and G235H/F170LP grating and filter combinations to do spectroscopy at 0.7 to 3.1 microns. We realise there will be some spectral overlap with G140H at >1.4 microns but our prime targets have almost zero flux below 0.9 microns so this will not strongly affect the

spectra.

Observation 5 - NIRSpec MSA observation of ULAS J1120+0641

This is NIRSpec MSA follow-up of NIRCam pre-imaging in Simon Lilly's GTO Program 1243. This observation should not be scheduled until > 60 days after the pre-imaging is obtained. Since ULAS J1120+0641 is close to the ecliptic there are two well separated visibility windows per year. The pre-imaging should be in the first window and the MSA spectroscopy in the second.

The quasar will be placed in the fixed slits S200A1 and S200A2 whilst simultaneously configuring MSA shutters to target other galaxies identified in HST imaging. We use NIRSpec team software to design the MSA configurations and ensure they agree with positions in the APT MPT software.

We use the G140H/F070LP and G235H/F170LP grating and filter combinations to do spectroscopy at 0.7 to 3.1 microns. We realise there will be some spectral overlap at >1.4 microns but our prime targets have almost zero flux below 0.9 microns so this will not strongly affect the spectra.

Observation 8 - NIRSpec MSA observation of UHS J0439+1634

The quasar will be placed in the fixed slit S200A2 whilst simultaneously configuring MSA shutters to target other galaxies identified in HST imaging. We use NIRSpec team software to design the MSA configurations and ensure they agree with positions in the APT MPT software.

We use the G140H/F070LP and G235H/F170LP grating and filter combinations to do spectroscopy at 0.7 to 3.1 microns. We realise there will be some spectral overlap at >1.4 microns but our prime targets have almost zero flux below 0.9 microns so this will not strongly affect the spectra.

This quasar is gravitationally lensed and the flux is dominated by two images (A and B in Fan et al. 2019ApJ...870L..11) separated by 0.22 arcsec at a PA of +9 degrees. In order to maximize flux in the NIRSpec slit and separate the spectra of the two images we request an ORIENT closest possible to the axis defined by A & B. This is possible with V3PA in the range 70 to 72 degrees (NIRSpec Aperture PA 208.49 to 210.49) where the angular offset from ideal is only 20 degrees.

**Observations 3 and 4 - NIRSpec IFU observations of J0020-3653 and J0411-0907

These are G395H/F290LP observations with the NIRSpec IFU. Each target is observed with 4 long exposures in a cycling dither pattern.
We are not using TA as Gaia GS are available for any orientation hence ensuring a pointing accuracy good enough for our purposes.
NRSIRS2RAPID has been selected for a better identification and removal of cosmic rays glitches.
Optimal ORIENT V3PA ranges to avoid bright star leakage through the MSA are 0-30 and 273-285 for J0020, and 65-84 and 283-299 for J0411.
For J0020 both these ranges can be set simultaneously in APT, whereas for J0411 only the 283-299 range has been applied.

Observation 7 - NIRSpec IFU observations of UHS J0439+1634

These are G395H/F290LP observations with the NIRSpec IFU. The target is observed with 8 exposures in a cycling dither pattern.
Because this quasar is bright, the exposures are shorter to avoid saturation.
J0439 is also observed using the R=100 prism with the IFU. There is a single dither position leakcal exposure to measure leakage through the MSA.
We are not using TA as Gaia GS are available for any orientation hence ensuring a pointing accuracy good enough for our purposes.
NRSIRS2RAPID has been selected for a better identification and removal of cosmic rays glitches.
The ORIENT for J0439 has been restricted to avoid a bright star to be located inside the MSA footprint. This ORIENT range is compatible with that required for Observation 8.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	VDESJ0020-3653	RA: 00 20 31.4720 (5.1311333d) Dec: -36 53 41.82 (-36.89495d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[High-redshift galaxies, Quasars]* *Extended=YES*				
(4)	DELSJ0411-0907	RA: 04 11 28.6300 (62.8692917d) Dec: -09 07 49.80 (-9.13050d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[High-redshift galaxies, Quasars]* *Extended=YES*				
(5)	TARGET-OBSERVATION-5	RA: 11 20 1.4611 (170.0060879d) Dec: +06 41 30.77 (6.69188d) Equinox: J2000		
Comments: This target was generated automatically for MSA Observation 5 *Category=Galaxy* *Description=[High-redshift galaxies, Primordial galaxies, Quasars]* *Extended=YES*				
(6)	UHSJ0439+1634	RA: 04 39 47.0800 (69.9461667d) Dec: +16 34 15.70 (16.57103d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[High-redshift galaxies, Quasars]* *Extended=YES*				
(7)	TARGET-OBSERVATION-8	RA: 04 39 51.3272 (69.9638633d) Dec: +16 33 50.19 (16.56394d) Equinox: J2000		
Comments: This target was generated automatically for MSA Observation 8 *Category=Galaxy* *Description=[High-redshift galaxies, Primordial galaxies, Quasars]* *Extended=YES*				

Observation

Proposal 1222, Observation 1: FSS observation of J0020-3653 Wed Jun 26 21:00:35 GMT 2019

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

Diagnostics

(Visit 1:1) Warning (Form): Data volume for this visit 31756.25 MB exceeds half the maximum allowed of 58000.0 MB.

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	VDESJ0020-3653	RA: 00 20 31.4720 (5.1311333d) Dec: -36 53 41.82 (-36.89495d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Quasars]
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	F110W	NRSRAPID	3	1	1	42.947	12649.2

Template

Slit	Subarray
S200A1 and S200A2	FULL

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	3	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140H/F070LP	S200A1	NRSIRS2RAPID	65	2	1	NONE	3	6	5777.2	
2	G140H/F070LP	S200A2	NRSIRS2RAPID	65	2	2	NONE	3	6	5777.2	
3	G235H/F170LP	S200A2	NRSIRS2RAPID	65	1	3	NONE	3	3	2888.6	
4	G235H/F170LP	S200A1	NRSIRS2RAPID	65	1	4	NONE	3	3	2888.6	

Observation

Proposal 1222, Observation 2: FSS observation of J0411-0907 Wed Jun 26 21:00:35 GMT 2019

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

Diagnostics

(Visit 2:1) Warning (Form): Data volume for this visit 31756.25 MB exceeds half the maximum allowed of 58000.0 MB.

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	DELSJ0411-0907	RA: 04 11 28.6300 (62.8692917d) Dec: -09 07 49.80 (-9.13050d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Quasars]
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	F110W	NRSRAPID	3	1	1	42.947	12649.2

Template

Slit	Subarray
S200A1 and S200A2	FULL

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	3	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140H/F070LP	S200A1	NRSIRS2RAPID	65	2	1	NONE	3	6	5777.2	
2	G140H/F070LP	S200A2	NRSIRS2RAPID	65	2	2	NONE	3	6	5777.2	
3	G235H/F170LP	S200A2	NRSIRS2RAPID	65	1	3	NONE	3	3	2888.6	
4	G235H/F170LP	S200A1	NRSIRS2RAPID	65	1	4	NONE	3	3	2888.6	

Observation

Proposal 1222, Observation 5: Quasar in S200A1 and S200A2

Wed Jun 26 21:00:35 GMT 2019

Diagnostic Status: Warning

Observing Template: NIRSpec MultiObject Spectroscopy

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	TARGET-OBSERVATION-5	RA: 11 20 1.4611 (170.0060879d) Dec: +06 41 30.77 (6.69188d) Equinox: J2000		

Comments: This target was generated automatically for MSA Observation 5
Category=Galaxy
Description=[High-redshift galaxies, Primordial galaxies, Quasars]
Extended=YES

Acquisition

#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		SAME	F140X	Auto Acq MSA Config	NRS	3	1	4	558.312	

Template

TA Method	Obtain Confirmation Images	Science Aperture
MSATA	No	MSA Center

Reference Stars

Spectral Elements

#	Grating/Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140H/F070LP	Configuration: p1c0	NRSIRS2RAPID	65	2	NONE	3	6	5777.2	
2	G235H/F170LP	Configuration: p1c0	NRSIRS2RAPID	65	1	NONE	3	3	2888.6	
3	G235H/F170LP	Configuration: p2c0	NRSIRS2RAPID	65	1	NONE	3	3	2888.6	
4	G140H/F070LP	Configuration: p2c0	NRSIRS2RAPID	65	2	NONE	3	6	5777.2	

Special Requirements	
	On Hold This is NIRSpec MSA follow-up of NIRCam pre-imaging in Simon Lilly's GTO Program 1243. So this observation should not be scheduled until > 60 days after the pre-imaging is obtained. MSA Planned Aperture PA 69.492 to 69.492 Degrees (V3 290.99966 to 290.99966)

Observation

Proposal 1222, Observation 3: IFU observation of J0020-3653 Wed Jun 26 21:00:35 GMT 2019

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	VDESJ0020-3653	RA: 00 20 31.4720 (5.1311333d) Dec: -36 53 41.82 (-36.89495d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Quasars]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	4	

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	G395H/F290LP	NRSIRS2RAPID	185	1	false	true	NONE	4	4	10854.134	

Special Requirements

Aperture PA Range 51.892975 to 168.892975 Degrees (V3 273.0 to 30.0)

Observation

Proposal 1222, Observation 4: IFU observation of J0411-0907 Wed Jun 26 21:00:35 GMT 2019

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	DELSJ0411-0907	RA: 04 11 28.6300 (62.8692917d) Dec: -09 07 49.80 (-9.13050d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Quasars]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	4	

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	G395H/F290LP	NRSIRS2RAPID	185	1	false	true	NONE	4	4	10854.134	

Special Requirements

Aperture PA Range 61.892975 to 77.892975 Degrees (V3 283.0 to 299.0)

Observation

Proposal 1222, Observation 7: IFU observation of J0439+1634 Wed Jun 26 21:00:35 GMT 2019

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(6)	UHSJ0439+1634	RA: 04 39 47.0800 (69.9461667d) Dec: +16 34 15.70 (16.57103d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Quasars]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	8	

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	G395H/F290LP	NRSIRS2RAPID	92	1	false	true	NONE	8	8	10854.134	
2	PRISM/CLEAR	NRSIRS2RAPID	31	1	false	true	NONE	8	8	3734.756	
3	PRISM/CLEAR	NRSIRS2RAPID	31	1	true	false	NONE	1	1	466.844	

Special Requirements

Aperture PA Range 208.892975 to 210.892975 Degrees (V3 70.0 to 72.0)

Observation

Proposal 1222, Observation 8: Quasar in S200A2

Wed Jun 26 21:00:35 GMT 2019

Diagnostic Status: Warning

Observing Template: NIRSpec MultiObject Spectroscopy

Diagnostics

(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(7)	TARGET-OBSERVATION-8	RA: 04 39 51.3272 (69.9638633d) Dec: +16 33 50.19 (16.56394d) Equinox: J2000		

Comments: This target was generated automatically for MSA Observation 8
Category=Galaxy
Description=[High-redshift galaxies, Primordial galaxies, Quasars]
Extended=YES

Acquisition

#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		SAME	F140X	Auto Acq MSA Config	NRS	3	1	4	558.312	

Template

TA Method	Obtain Confirmation Images	Science Aperture
MSATA	No	MSA Center

Reference Stars

Spectral Elements

#	Grating/Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140H/F070LP	Configuration: c0	NRSIRS2RAPID	65	1	NONE	3	3	2888.6	
2	G235H/F170LP	Configuration: c0	NRSIRS2RAPID	65	1	NONE	3	3	2888.6	

Special Requirements	
	Aperture PA Range 208.49234 to 210.49234 Degrees (V3 70.0 to 72.0) MSA Planned Aperture PA 209.492 to 209.492 Degrees (V3 70.99966 to 70.99966)