



2593 - CECILIA: A direct-method metallicity calibration for Cosmic Noon through the Epoch of Reionization

Cycle: 1, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	PA=19.3: red-A, new C at	NIRSpec MultiObject Spectroscopy	(15) Q2343-22J7-TAJ10-WBS-CONJ28-M25

ABSTRACT

Tracing the build-up of metals over cosmic time is a key science goal of JWST, but the primary diagnostics of chemical abundances are indirect and currently without suitable calibrations at high redshifts. Various "strong line" metallicity indicators that work well in the local universe produce conflicting predictions at $z \sim 2-3$ because they rely on intrinsic correlations among the physical conditions in galaxies' star-forming regions and their massive stars, both of which are significantly different in the early universe. This program uses NIRSpec to provide a new calibration sample of galaxy spectra to characterize these intrinsic correlations in situ at $z=2$. The proposed observations will enable "direct" electron-temperature-based

measurements of gas-phase metallicities as well as independent estimates of the hardness of the stellar ionizing fields. In turn, these data will enable the re-calibration of strong-line metallicity estimators and improve the interpretation of photoionization models at high redshift. In contrast to other methods of calibrating these relationships, the $[SIII]6312+[OII]7320,30$ method proposed here is efficient over a broad parameter space of galaxy properties, including at high metallicities where current methods disagree, and it is uniquely achievable using JWST. The proposed sample includes galaxies selected using multiple methods over a wide range in stellar mass to maximize the applicability of the resulting relations to diverse galaxies across cosmic time. The outcome of this proposal will be tools that can be used to determine chemical abundances for thousands of future objects observed by JWST from $z=2$ to the Epoch of Reionization at $z>6$.

OBSERVING DESCRIPTION

CECILIA uses JWST/NIRSpec to measure multiple faint auroral and strong nebular emission lines in the rest-optical spectra of a sample of ~ 25 galaxies at $z\sim 2-3$. These measurements will be used to re-calibrate metallicity diagnostics for all $z>2$ galaxies. A single MSA configuration is used to obtain deep spectra using G235M and G395M. To maximize the number of high-priority targets that meet the centering criteria in the final configuration, CECILIA requires a restricted list of viable position angles. Here we provide a list in terms of priority. The three highest priority PAs, in descending order are 15, 205, 203. The next rank of priority for PAs are 5, 202, 27, 28, 29. The lowest priority PAs that still meet the scientific goals of the program are 221, 208, 206, 21, 25, 20, 211, 215, and 210.

Targets are selected from the Keck Baryonic Structure Survey (KBSS) to have spectroscopic redshifts that place all of the required emission lines on the detector in both bands. Galaxies are prioritized on the basis of small sizes, large star-formation rates, and/or high nebular $[OIII]5007$ line fluxes measured from existing ground-based spectra, all of which increase the ease of detection of faint emission lines. Limiting line fluxes are determined by considering (1) line flux predictions from photoionization models designed to reconcile the rest-UV-optical spectra of $z\sim 2-3$ galaxies and (2) typical physical sizes (median semi-major axis = $0.26''$ and an axis ratio of $b/a = 0.6$) and orientation relative to the MSA slitlets assuming the “midpoint” centering constraint. The proposed observations assume 3 shutter slitlets and 3 nod positions within the slit. To achieve the science goals of the program requires a total ~ 29.5 hours in G235M, with 20 groups/integration, 6 integrations/exposure, and 4 exposures at each of the 3 nod positions. A total of 1.1 hours is needed in G395M, with 9 groups/integration, 2 integrations/exposure, and 1 exposure at each of the 3 nod positions.

Proposal 2593 - Targets - CECILIA: A direct-method metallicity calibration for Cosmic Noon through the Epoch of Reionization

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(15)	Q2343-22J7-TAJ10-WBS- CONJ28-M25	RA: 23 46 26.3920 (356.6099667d) Dec: +12 48 8.03 (12.80223d) Equinox: J2000		
	<i>Comments:</i> Description=[]				

Proposal 2593 - Observation 1 - CECILIA: A direct-method metallicity calibration for Cosmic Noon through the Epoch of Reionization

Wed Jun 29 23:00:28 GMT 2022

Observation	<p>Proposal 2593, Observation 1: PA=19.3: red-A, new Cat</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec MultiObject Spectroscopy</p>										
	<p>(PA=19.3: red-A, new Cat (Obs 1)) Warning (Form): Config c1 (#1) has 3 primary slit traces affected by failed open shutters. (PA=19.3: red-A, new Cat (Obs 1)) Warning (Form): Config c1 (#2) has 3 primary slit traces affected by failed open shutters. (PA=19.3: red-A, new Cat (Obs 1)) Warning (Form): Config c1 (#3) has 3 primary slit traces affected by failed open shutters. (PA=19.3: red-A, new Cat (Obs 1)) Warning (Form): Config c1 (#4) has 3 primary slit traces affected by failed open shutters. (PA=19.3: red-A, new Cat (Obs 1)) Warning (Form): Config c1 (#5) has 3 primary slit traces affected by failed open shutters. (Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>										
Diagnostics											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous		
	(15)	Q2343-2217-TAJ10-WBS-CONJ28-M25	RA: 23 46 26.3920 (356.6099667d) Dec: +12 48 8.03 (12.80223d) Equinox: J2000								
<i>Comments: Description=[]</i>											
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: F140X; Readout: NRSRAPIDD6; 8 sources in 4 quads; [Optimal TA Accuracy]	SAME	F140X	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	
	2	Filter: F140X; Readout: NRSRAPIDD6; 8 sources in 4 quads; [Optimal TA Accuracy]	SAME	F140X	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	
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	galaxies (444 sources)	BlankSky (7868 sources)	jwst-nirspec-mr		1.5		
Reference Stars	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
	1	1031	356.589604	12.784096	23.2200	1	1097	356.639346	12.805536	24.0100	
	1	1035	356.627081	12.771782	23.2400	1	1133	356.646141	12.820149	24.3000	
	1	1053	356.606924	12.829160	23.5900	1	1158	356.585090	12.784542	24.5300	
	1	1083	356.598173	12.825961	23.8400	1	1164	356.618834	12.788871	24.6200	
	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
	2	1031	356.589604	12.784096	23.2200	2	1097	356.639346	12.805536	24.0100	
	2	1035	356.627081	12.771782	23.2400	2	1133	356.646141	12.820149	24.3000	
	2	1053	356.606924	12.829160	23.5900	2	1158	356.585090	12.784542	24.5300	
	2	1083	356.598173	12.825961	23.8400	2	1164	356.618834	12.788871	24.6200	

Proposal 2593 - Observation 1 - CECILIA: A direct-method metallicity calibration for Cosmic Noon through the Epoch of Reionization

Confirmation	Confirmation						
	#	Confirmation Type	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time
	1	After Target Acq	NRSIRS2RAPID	38	1	1	568.967
	2	After Target Acq	NRSIRS2RAPID	38	1	1	568.967

Spectral Elements	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 (G395M/F290LP)	c1	3 Shutter Slitlet	356.61146541666 665 Degrees 12.802277777777 778 Degrees	19.300330681903 244			3	6	4464.2
	2	2 (G235M/F170LP)	c1	3 Shutter Slitlet	356.61146541666 665 Degrees 12.802277777777 778 Degrees	19.300330681903 244			3	18	26522.602
	3	2 (G235M/F170LP)	c1	3 Shutter Slitlet	356.61146541666 665 Degrees 12.802277777777 778 Degrees	19.300330681903 244			3	18	26522.602
	4	2 (G235M/F170LP)	c1	3 Shutter Slitlet	356.61146541666 665 Degrees 12.802277777777 778 Degrees	19.300330681903 244			3	18	26522.602
	5	2 (G235M/F170LP)	c1	3 Shutter Slitlet	356.61146541666 665 Degrees 12.802277777777 778 Degrees	19.300330681903 244			3	18	26522.602

Special Requirements	Special Requirements