



3503 - Mapping the rapidly evolving interstellar medium of emerging young star clusters

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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Dr. Elena Sabbi (CoI)	NOIRLab - Gemini North (HI)
Prof. Kelsey E. Johnson (CoI)	The University of Virginia

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	2	WGyes_20step_3conf_ fin5	NIRSpec MultiObject Spectroscopy	(3) table_eyesc_MSA_master
	3	WGyes_20step_3conf_ fin6	NIRSpec MultiObject Spectroscopy	(3) table_eyesc_MSA_master

ABSTRACT

Thanks to JWST’s game-changing capabilities the critical but poorly understood process of star cluster emergence from their natal clouds can be observed in a range of extragalactic environments beyond the Local Group. NIRCcam imaging studies sampling stellar continua, Paa(1.87 micron), Bra(4.05 micron) and 3.35 micron PAH emission of the spiral NGC628 have revealed ~1800 candidate emerging clusters (eYSCs). Within this large sample, variations in the SEDs and MIR colors of the eYSCs suggest a rapid evolutionary sequence of the HII and photo-dissociation regions (PDRs) as the clusters clear their surroundings. The details of this fundamental process will be established through spectroscopy. We propose a pilot NIRSpec/MSA 1-5 micron study of a representative sample of ~100 eYSCs in NGC 628 to measure rapid evolutionary changes occurring on the ~10 pc scales of star clusters. This dataset will: 1) Diagnose stellar feedback (e.g., photoionisation and shocks) using H and He recombination lines and the de-excited [FeII] transition. 2) Explore the properties of warm molecular gas from H2 emission and its relationships to the rapidly evolution of the PDRs. 3) Extend our understanding of PAH properties by resolving the strengths of the 3.35 μ PAH emission in its fundamental (aromatic and aliphatic) components as a way to chart the evolution of dust properties as clusters emerge. These unprecedented results can only be achieved with JWST spectroscopy and will be fundamental to inform our understanding of the separation of star clusters from their molecular fuel supplies while also informing radiative models used to study the larger scale IR emission of local and distant galaxies.

OBSERVING DESCRIPTION

We will get NIRSpec MOS observations of ~100 embedded young star clusters newly detected in JWST/NIRCcam imaging in NGC628. Key line emissions necessary to achieve our science goals are over the 1--to--5 micron range.

The selected spectral configuration consists of disperser G140M and filter F100LP, G235M/F170LP, and G395M/F290LP. We opt for 3-shutter nodding pattern and no large dither to recover the spectral gaps. We use as readout NRSIRS2RAPID. A integration of 30 groups times 3 exposures (i.e., noddings) is sufficient to reach the necessary S/N to conduct our science in all the 3 settings.

JWST Proposal 3503 (Created: Monday, July 29, 2024 at 11:00:34 AM Eastern Standard Time) - Overview

Our target position, obtained from NIRCcam data, is known with a precision of 10 mas. We have used the MSA planning tool to simulate the efficiency of the setup and maximise the number of targets for which we obtain spectra. The best results (and highest efficiency) are achieved by using a 3-nodding strategy, with a 3 shutter slitlet, entire open area of the shutter as centring, and 3 configurations over a search grid centred of the galaxy and as large as the NIRCcam FoV. We do not allow for targets spectra to overlap. In total between 90 and 100 targets can be planned (depending if we use monte carlo shuffling or weights).

Proposal 3503 - Targets - Mapping the rapidly evolving interstellar medium of emerging young star clusters

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(3)	table_eysc_MSA_master	RA: 01 36 41.5271 (24.1730296d)		
			Dec: +15 47 11.70 (15.78658d)		
			Equinox: J2000		
		<i>Comments:</i>			
		<i>Description=[]</i>			

Proposal 3503 - Observation 2 - Mapping the rapidly evolving interstellar medium of emerging young star clusters

Mon Jul 29 16:00:34 GMT 2024

Observation	Proposal 3503, Observation 2: WGyes_20step_3conf_fin5 Diagnostic Status: Warning Observing Template: NIRSpec MultiObject Spectroscopy																																										
	(WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c1-3 (#1) has 2 primary slit traces affected by failed open shutters. (WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c1-3 (#2) has 2 primary slit traces affected by failed open shutters. (WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c1-3 (#3) has 2 primary slit traces affected by failed open shutters. (WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c2-3 (#4) has 1 primary slit traces affected by failed open shutters. (WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c2-3 (#5) has 1 primary slit traces affected by failed open shutters. (WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c2-3 (#6) has 1 primary slit traces affected by failed open shutters. (WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c3-3 (#7) has 2 primary slit traces affected by failed open shutters. (WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c3-3 (#8) has 2 primary slit traces affected by failed open shutters. (WGyes_20step_3conf_fin5 (Obs 2)) Warning (Form): Config c3-3 (#9) has 2 primary slit traces affected by failed open shutters. (Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.																																										
Diagnostics																																											
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(3)</td> <td>table_eyesc_MSA_master</td> <td>RA: 01 36 41.5271 (24.1730296d) Dec: +15 47 11.70 (15.78658d) Equinox: J2000</td> <td></td> <td></td> </tr> </tbody> </table>										#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous	(3)	table_eyesc_MSA_master	RA: 01 36 41.5271 (24.1730296d) Dec: +15 47 11.70 (15.78658d) Equinox: J2000																									
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Acquisition	<table border="1"> <thead> <tr> <th>#</th> <th>Reference Star Bin</th> <th>Target</th> <th>Filter</th> <th>MSA Configuration</th> <th>Readout Pattern</th> <th>Groups/Int</th> <th>Integrations/Exp</th> <th>Total Integrations</th> <th>Total Exposure Time</th> <th>ETC Wkbk.Calc ID</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Filter: F110W; Readout: NRSRAPID; 8 sources in 3 quads; [Optimal TA Accuracy]</td> <td>SAME</td> <td>F110W</td> <td>Auto Acq MSA Config</td> <td>NRSRAPID</td> <td>3</td> <td>1</td> <td>4</td> <td>171.788</td> <td></td> </tr> <tr> <td>2</td> <td>Filter: F110W; Readout: NRSRAPID; 8 sources in 2 quads; [Optimal TA Accuracy]</td> <td>SAME</td> <td>F110W</td> <td>Auto Acq MSA Config</td> <td>NRSRAPID</td> <td>3</td> <td>1</td> <td>4</td> <td>171.788</td> <td></td> </tr> </tbody> </table>										#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	1	Filter: F110W; Readout: NRSRAPID; 8 sources in 3 quads; [Optimal TA Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788		2	Filter: F110W; Readout: NRSRAPID; 8 sources in 2 quads; [Optimal TA Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	
	#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID																																
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2	Filter: F110W; Readout: NRSRAPID; 8 sources in 2 quads; [Optimal TA Accuracy]	SAME	F110W	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		No	MSA Center	primary (1322 sources)	filler (882 sources)	jwst-nirspec-mr	1.5																																			

Proposal 3503 - Observation 2 - Mapping the rapidly evolving interstellar medium of emerging young star clusters

Reference Stars	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
	1	8	24.190126	15.765626	20.73032770172151 4	1	36	24.175479	15.804571	20.37518145530098 2
	1	10	24.184992	15.768443	20.36334794290777 2	1	37	24.179057	15.805217	20.41990442919587 4
	1	17	24.170662	15.778940	20.62233090232406 1	1	40	24.171821	15.810695	20.53571932537813 2
	1	33	24.171148	15.800555	20.18244799070334 5	1	46	24.168202	15.817965	20.64290135004373 6
	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
	2	33	24.171148	15.800555	20.18244799070334 5	2	45	24.161875	15.815333	20.52285880903967
	2	36	24.175479	15.804571	20.37518145530098 2	2	48	24.161777	15.819648	20.19872533306399 7
	2	37	24.179057	15.805217	20.41990442919587 4	2	49	24.160904	15.820071	20.85266459558165
	2	41	24.148886	15.811299	20.27719052477636 6	2	50	24.161719	15.820608	20.51985138568873

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)	c1-3	3 Shutter Slitlet	24.17909375 Degrees 15.781539722222 224 Degrees	209.00526373110 998			3	3	1400.533
	2	2 (G235M/F170LP)	c1-3	3 Shutter Slitlet	24.17909375 Degrees 15.781539722222 224 Degrees	209.00526373110 998			3	3	1400.533
	3	3 (G395M/F290LP)	c1-3	3 Shutter Slitlet	24.17909375 Degrees 15.781539722222 224 Degrees	209.00526373110 998			3	3	1400.533
	4	1 (G140M/F100LP)	c2-3	3 Shutter Slitlet	24.171245416666 668 Degrees 15.779374444444 445 Degrees	209.00312745951 81			3	3	1400.533
	5	2 (G235M/F170LP)	c2-3	3 Shutter Slitlet	24.171245416666 668 Degrees 15.779374444444 445 Degrees	209.00312745951 81			3	3	1400.533
	6	3 (G395M/F290LP)	c2-3	3 Shutter Slitlet	24.171245416666 668 Degrees 15.779374444444 445 Degrees	209.00312745951 81			3	3	1400.533
	7	1 (G140M/F100LP)	c3-3	3 Shutter Slitlet	24.158896333333 335 Degrees 15.792314444444 445 Degrees	208.99973461641 264			3	3	1400.533
	8	2 (G235M/F170LP)	c3-3	3 Shutter Slitlet	24.158896333333 335 Degrees 15.792314444444 445 Degrees	208.99973461641 264			3	3	1400.533
	9	3 (G395M/F290LP)	c3-3	3 Shutter Slitlet	24.158896333333 335 Degrees 15.792314444444 445 Degrees	208.99973461641 264			3	3	1400.533

Proposal 3503 - Observation 2 - Mapping the rapidly evolving interstellar medium of emerging young star clusters

Special Requirements

Group Visits within 53.0 Days
Visits Same PA
MSA Scheduled Aperture PA 209.0036 to 209.0036 Degrees (V3 70.42904 to 70.42904)

Proposal 3503 - Observation 3 - Mapping the rapidly evolving interstellar medium of emerging young star clusters

Mon Jul 29 16:00:34 GMT 2024

Observation	Proposal 3503, Observation 3: WGyes_20step_3conf_fin6 Diagnostic Status: Warning Observing Template: NIRSpec MultiObject Spectroscopy										
	(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)	table_eyesc_MSA_master	RA: 01 36 41.5271 (24.1730296d) Dec: +15 47 11.70 (15.78658d) 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: F110W; Readout: NRSRAPID; 8 sources in 2 quads; [Optimal TA Accuracy]	SAME	F110W	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 and New MSA Config	MSA Center	primary (1322 sources)		filler (882 sources)	jwst-nirspec-mr		1.5	
Reference Stars	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
	1	2	24.189783	15.753929	20.33705611220050	1	33	24.171148	15.800555	20.18244799070334	
	1	3	24.179720	15.754527	20.23689827125763	1	35	24.175948	15.803009	20.08793201836048	
	1	10	24.184992	15.768443	20.36334794290777	1	37	24.179057	15.805217	20.41990442919587	
	1	32	24.164366	15.795896	20.24398491530960	1	38	24.170411	15.807389	20.08276646700653	
Confirmation	#	Confirmation Type		Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp		Conf. Total Integrations	Conf. Total Exposure Time		
	1	c1-4		NRSIRS2RAPID	2	1		1	43.767		
	2	c2-2		NRSIRS2RAPID	2	1		1	43.767		
	3	c3-2		NRSIRS2RAPID	2	1		1	43.767		

Proposal 3503 - Observation 3 - Mapping the rapidly evolving interstellar medium of emerging young star clusters

	#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
Spectral Elements	1	1 (G140M/F100LP)	c1-4	3 Shutter Slitlet	24.174044583333 334 Degrees 15.784233333333 333 Degrees	25.138370877316 866			3	3	1400.533
	2	2 (G235M/F170LP)	c1-4	3 Shutter Slitlet	24.174044583333 334 Degrees 15.784233333333 333 Degrees	25.138370877316 866			3	3	1444.3
	3	3 (G395M/F290LP)	c1-4	3 Shutter Slitlet	24.174044583333 334 Degrees 15.784233333333 333 Degrees	25.138370877316 866			3	3	1531.833
	4	1 (G140M/F100LP)	c2-2	3 Shutter Slitlet	24.179270958333 337 Degrees 15.781873333333 333 Degrees	25.139784073685 14			3	3	1400.533
	5	2 (G235M/F170LP)	c2-2	3 Shutter Slitlet	24.179270958333 337 Degrees 15.781873333333 333 Degrees	25.139784073685 14			3	3	1444.3
	6	3 (G395M/F290LP)	c2-2	3 Shutter Slitlet	24.179270958333 337 Degrees 15.781873333333 333 Degrees	25.139784073685 14			3	3	1531.833
	7	1 (G140M/F100LP)	c3-2	3 Shutter Slitlet	24.181723625000 004 Degrees 15.786902777777 778 Degrees	25.140459232347 983			3	3	1400.533
	8	2 (G235M/F170LP)	c3-2	3 Shutter Slitlet	24.181723625000 004 Degrees 15.786902777777 778 Degrees	25.140459232347 983			3	3	1444.3
	9	3 (G395M/F290LP)	c3-2	3 Shutter Slitlet	24.181723625000 004 Degrees 15.786902777777 778 Degrees	25.140459232347 983			3	3	1531.833
Special Requirements	MSA Scheduled Aperture PA 25.1381 to 25.1381 Degrees (V3 246.56355 to 246.56355)										