



# 5791 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

Cycle: 3, 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				
	2	NIRCam Pre-Imaging	NIRCam Imaging	(1) CL-TRUMPLER-14
	6	JWST_Tr14_RefVet	NIRSpec MultiObject Spectroscopy	(6) Tr14_RefVetted
	7	Prop5791_repeat11	NIRSpec MultiObject Spectroscopy	(7) Tr14_repeat

## **ABSTRACT**

The evolution of disks around young stellar objects governs the character of the planetary systems that form. In massive star-forming regions, UV irradiation drives mass loss from disks, which could affect the resulting planets. Although a significant fraction of planetary systems (including our Solar System) are thought to have arisen in extreme environments, the nearest (best studied) star-forming regions lack significant UV radiation fields, meaning that we must study more distant regions accessible for spectroscopic study only with a sensitive facility like JWST. We propose NIRSPEC/MSA observations of the Trumpler 14 cluster, a uniquely rich starburst cluster in the Solar neighborhood with a UV radiation field a thousand times higher than in the Orion Nebula. The MOS observations of the cluster will produce a sample of  $\sim 340$  cluster-member spectra (down to  $M=0.08 M_{\text{sun}}$ ). The near-infrared spectra will provide a statistical sample to determine 1) How does the disk fraction vary with local FUV strength and stellar mass? And 2) How do disk properties (e.g., CO temperatures, accretion rates, and mass-loss rates) vary with the environment? High signal-to-noise near-infrared spectroscopy allows the spectral classification of the stars and a characterization of accretion and disk irradiation via atomic and molecular emission. The spacing of cluster members in Tr14 makes efficient use of the MOS shutters. NIRCAM pre-imaging, together with existing VLT/HAWK-I and SPHERE images, will be used to better characterize the total stellar population of Tr 14. This unique dataset will be the first of its kind and will serve as a benchmark for disks in extreme conditions.

## **OBSERVING DESCRIPTION**

This proposal aims at obtaining imaging and NIRSPEC/MOS spectroscopy of the massive young star cluster Tr14 in the Carina nebula. This cluster is the nearest star-forming region where proto-planetary disks are exposed to extreme amounts of FUV radiation, ideal for studying the effect of photoevaporation on planet-forming disks.

We propose NIRCAM/LW F466N pre-imaging to obtain high-precision positions of low- and intermediate-mass members of Tr14. This data will be used with existing VLT near-infrared observations to identify the disk excess emission via color-color diagram selection. NIRCAM/SW F212N is requested to detect the evaporating disks via H<sub>2</sub> emission. Due to the bright O stars in the center of Tr 14, we have selected narrow-band filters to perform the imaging, minimizing the effect of saturation.

We propose NIRSPEC MOS spectroscopy in two wavelength settings: G140H/F100LP: to detect the stellar absorption lines of the intermediate and low-mass stars and derive their spectral types, effective temperature, and masses. G395H/F290LP: to detect and characterize the disk emission using emission lines of ionized hydrogen and molecular emission. Observations with 8 MSA configurations are requested to obtain spectra for a sample of  $>300$  cluster members with FUV irradiation ranging from  $10^3$ - $10^7 G_0$ .

The resulting spectroscopic database will be the largest spectroscopic dataset for irradiated and photoevaporating protoplanetary disks. Analysis of the spectra will include modeling disk continuum and spectral lines to infer disk structure, temperature, and mass-loss rate. Statistical analysis will be used to investigate correlations between disk properties and FUV irradiation, stellar mass, age, and environment. The derived disk properties will be compared to theoretical models of photoevaporating disks, and the disk-population statistics will be compared to results from numerical simulations.

The results from this study will demonstrate whether high FUV environments have a statistically significant effect on the properties of inner disks, where Earth-like planets may be expected to form.

Proposal 5791 - Targets - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CL-TRUMPLER-14	RA: 10 43 52.5360 (160.9689000d) Dec: -59 33 20.06 (-59.55557d) Equinox: J2000	Proper Motion RA: -4.01221088222211E-4 sec of time/yr Proper Motion Dec: 0.00328 arcsec/yr Epoch of Position: 2015.5	
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>				
<i>Category=Stellar Cluster</i>				
<i>Description=[Young star clusters]</i>				
(3)	tr14_jwst_targets_weighted_cl 1	RA: 10 43 54.1699 (160.9757079d) Dec: -59 33 25.64 (-59.55712d) Equinox: J2000		
<i>Comments:</i>				
<i>Description=[]</i>				
(4)	tr14_revised_27apr2025	RA: 10 43 54.1699 (160.9757079d) Dec: -59 33 25.59 (-59.55711d) Equinox: J2000		
<i>Comments:</i>				
<i>Description=[]</i>				
(5)	tr14_27apr2025_ta3	RA: 10 43 54.1699 (160.9757079d) Dec: -59 33 25.59 (-59.55711d) Equinox: J2000		
<i>Comments:</i>				
<i>Description=[]</i>				
(6)	Tr14_RefVetted	RA: 10 43 54.1699 (160.9757079d) Dec: -59 33 25.59 (-59.55711d) Equinox: J2000		
<i>Comments:</i>				
<i>Description=[]</i>				
(7)	Tr14_repeat	RA: 10 43 54.1699 (160.9757079d) Dec: -59 33 25.51 (-59.55709d) Equinox: J2000		
<i>Comments:</i>				
<i>Description=[]</i>				

Fixed Targets

Proposal 5791 - Observation 2 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

Wed Mar 18 23:00:39 GMT 2026

<b>Observation</b>	<p><b>Proposal 5791, Observation 2: NIRCam Pre-Imaging</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRCam Imaging</p>									
<b>Diagnostics</b>	<p>(NIRCam Pre-Imaging (Obs 2)) Warning (Form): By selecting Target Placement = Module Gap the target coordinates will not fall on any detector unless an appropriate Mosaic, set of Dithers or Offset Special Requirement is specified.</p> <p>(NIRCam Pre-Imaging (Obs 2)) Warning (Form): Some science pointings place the target outside of the aperture.</p> <p>(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> <p>(Visit 2:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>									
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>	
	(1)	CL-TRUMPLER-14	RA: 10 43 52.5360 (160.9689000d) Dec: -59 33 20.06 (-59.55557d) Equinox: J2000			Proper Motion RA: -4.01221088222211E-4 sec of time/yr Proper Motion Dec: 0.00328 arcsec/yr Epoch of Position: 2015.5				
	<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Stellar Cluster</i></p> <p><i>Description=[Young star clusters]</i></p>									
<b>Template</b>	<b>Module</b>		<b>Subarray</b>			<b>Target Placement</b>				
	ALL		FULL			Module gap (large extended source)				
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Type</b>		<b>Primary Dithers</b>		<b>Subpixel Dither Type</b>		<b>Dither Size</b>	<b>Subpixel Positions</b>	
	1	FULLBOX		8NIRSPEC		SMALL-GRID-DITHER			4	
<b>Spectral Elements</b>	<b>#</b>	<b>Short Filter</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Dithers</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	F212N	F466N+F444W	RAPID	2	2	64	32	1717.883	144473
<b>Special Requirements</b>	<p>Group Visits within 53.0 Days</p> <p>Visits Same PA</p>									

Proposal 5791 - Observation 6 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

Wed Mar 18 23:00:39 GMT 2026

<b>Observation</b>	<b>Proposal 5791, Observation 6: JWST_Tr14_RefVet</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRSpec MultiObject Spectroscopy										
	(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 6:2) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 6:3) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 6:3) Warning (Form): The recommended value is 8 Reference Stars for this template. (Visit 6:4) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
<b>Diagnosics</b>											
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>		
	(6)	Tr14_RefVetted	RA: 10 43 54.1699 (160.9757079d) Dec: -59 33 25.59 (-59.55711d) Equinox: J2000								
<i>Comments:</i> Description=[]											
<b>Acquisition</b>	<b>#</b>	<b>Reference Star Bin</b>	<b>Target</b>	<b>Filter</b>	<b>MSA Configuration</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	Filter: F110W; Readout: NRSRAPID; 8 sources in 3 quads; [ Reduced Accuracy ]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	
	2	Filter: F110W; Readout: NRSRAPID; 8 sources in 4 quads; [ Reduced Accuracy ]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	
	3	Filter: F110W; Readout: NRSRAPID; 7 sources in 4 quads; [ Reduced Accuracy ]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	
	4	Filter: F110W; Readout: NRSRAPID; 8 sources in 3 quads; [ Reduced Accuracy ]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	
<b>Template</b>	<b>TA Method</b>	<b>HFF Readout Mode</b>	<b>Obtain Confirmation Images</b>	<b>Science Aperture</b>	<b>Primary Candidate List</b>	<b>Filler Candidate List</b>	<b>Spectral Overlap Map</b>	<b>Spectral Overlap Threshold</b>			
	MSATA	false	No	MSA Center	Tr14_RefVetted (4852 sources)		jwst-nirspec-hr-no-g235h	1.5			

Proposal 5791 - Observation 6 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

Reference Stars	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
	1	119	160.970009	-59.601350	20.29234018146972 6	1	1366	161.009442	-59.573341	19.59933938801269 4
	1	546	160.970950	-59.587511	20.43834008991699	1	1561	160.955303	-59.569770	19.57433976948242
	1	548	161.007607	-59.587407	19.65033998310546 8	1	1847	161.015880	-59.565150	19.61733903706054 6
	1	1211	160.993914	-59.575288	20.67533960163574	1	2031	160.903937	-59.562351	19.89133920490722 6
	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
	2	893	160.970684	-59.579828	19.7233399373291	2	4108	160.966414	-59.536734	19.51233949482421 8
	2	1561	160.955303	-59.569770	19.57433976948242	2	4318	160.959358	-59.531831	19.76633920490722 6
	2	2031	160.903937	-59.562351	19.89133920490722 6	2	4408	160.967565	-59.529029	19.97234048664550 7
	2	2423	161.013604	-59.557149	20.20234002888183 5	2	4632	160.960242	-59.521052	20.19333925068359 3
Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
3	119	160.970009	-59.601350	20.29234018146972 6	3	1561	160.955303	-59.569770	19.57433976948242	
3	270	160.996151	-59.595510	19.96733941853027 3	3	1847	161.015880	-59.565150	19.61733903706054 6	
3	396	160.968164	-59.591469	19.79834070026855 4	3	4140	160.997812	-59.535967	19.93034066975097 6	
3	1366	161.009442	-59.573341	19.59933938801269 4						
Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
4	3633	161.053625	-59.544548	20.14433946430664	4	4310	160.936022	-59.531901	19.73634042561035	
4	3679	161.043394	-59.543883	19.93533983051757 7	4	4318	160.959358	-59.531831	19.76633920490722 6	
4	4108	160.966414	-59.536734	19.51233949482421 8	4	4659	161.003891	-59.519234	20.24533929645996	
4	4251	160.961693	-59.533297	19.94134034931640 5	4	4720	160.992236	-59.516149	19.70033922016601 5	

Proposal 5791 - Observation 6 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

#	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 (G140H/F100LP)	c1	3 Shutter Slitlet	160.97481466666 667 Degrees - 59.573343333333 355 Degrees	237.17537365103 064			3	3	1094.167
2	2 (G395H/F290LP)	c1	3 Shutter Slitlet	160.97481466666 667 Degrees - 59.573343333333 355 Degrees	237.17537365103 064			3	3	1094.167
3	1 (G140H/F100LP)	c2	3 Shutter Slitlet	160.96846208333 335 Degrees - 59.568344722222 21 Degrees	237.18084098663 718			3	3	1094.167
4	2 (G395H/F290LP)	c2	3 Shutter Slitlet	160.96846208333 335 Degrees - 59.568344722222 21 Degrees	237.18084098663 718			3	3	1094.167
5	1 (G140H/F100LP)	c3	3 Shutter Slitlet	160.95566083333 335 Degrees - 59.553163611111 13 Degrees	237.19184793881 83			3	3	1094.167
6	2 (G395H/F290LP)	c3	3 Shutter Slitlet	160.95566083333 335 Degrees - 59.553163611111 13 Degrees	237.19184793881 83			3	3	1094.167
7	1 (G140H/F100LP)	c4	3 Shutter Slitlet	160.94931491666 665 Degrees - 59.548164166666 65 Degrees	237.19730966248 61			3	3	1094.167
8	2 (G395H/F290LP)	c4	3 Shutter Slitlet	160.94931491666 665 Degrees - 59.548164166666 65 Degrees	237.19730966248 61			3	3	1094.167
9	1 (G140H/F100LP)	c5	3 Shutter Slitlet	160.96026875 Degrees - 59.551657777777 79 Degrees	237.18787154707 928			3	3	1094.167
10	2 (G395H/F290LP)	c5	3 Shutter Slitlet	160.96026875 Degrees - 59.551657777777 79 Degrees	237.18787154707 928			3	3	1094.167
11	1 (G140H/F100LP)	c6	3 Shutter Slitlet	160.95392241666 667 Degrees - 59.546658611111 13 Degrees	237.19333367161 934			3	3	1094.167
12	2 (G395H/F290LP)	c6	3 Shutter Slitlet	160.95392241666 667 Degrees - 59.546658611111 13 Degrees	237.19333367161 934			3	3	1094.167
13	1 (G140H/F100LP)	c7	3 Shutter Slitlet	160.98403395833 333 Degrees - 59.570331666666 675 Degrees	237.16741758412 616			3	3	1094.167
14	2 (G395H/F290LP)	c7	3 Shutter Slitlet	160.98403395833 333 Degrees - 59.570331666666 675 Degrees	237.16741758412 616			3	3	1094.167

Proposal 5791 - Observation 6 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
15	1 (G140H/F100LP)	c8	3 Shutter Slitlet	160.97768058333 335 Degrees - 59.565333611111 1 Degrees	237.17288568550 515			3	3	1094.167
16	2 (G395H/F290LP)	c8	3 Shutter Slitlet	160.97768058333 335 Degrees - 59.565333611111 1 Degrees	237.17288568550 515			3	3	1094.167
17	1 (G140H/F100LP)	c9	3 Shutter Slitlet	160.99488708333 33 Degrees - 59.563480277777 785 Degrees	237.15804467952 76			3	3	1094.167
18	2 (G395H/F290LP)	c9	3 Shutter Slitlet	160.99488708333 33 Degrees - 59.563480277777 785 Degrees	237.15804467952 76			3	3	1094.167
19	1 (G140H/F100LP)	c10	3 Shutter Slitlet	160.98853341666 666 Degrees - 59.558482777777 78 Degrees	237.16351316843 665			3	3	1094.167
20	2 (G395H/F290LP)	c10	3 Shutter Slitlet	160.98853341666 666 Degrees - 59.558482777777 78 Degrees	237.16351316843 665			3	3	1094.167
21	1 (G140H/F100LP)	c11	3 Shutter Slitlet	160.98269883333 333 Degrees - 59.564157500000 02 Degrees	237.16855602938 813			3	3	1094.167
22	2 (G395H/F290LP)	c11	3 Shutter Slitlet	160.98269883333 333 Degrees - 59.564157500000 02 Degrees	237.16855602938 813			3	3	1094.167
23	1 (G140H/F100LP)	c12	3 Shutter Slitlet	160.97634679166 669 Degrees - 59.559159444444 45 Degrees	237.17402304622 314			3	3	1094.167
24	2 (G395H/F290LP)	c12	3 Shutter Slitlet	160.97634679166 669 Degrees - 59.559159444444 45 Degrees	237.17402304622 314			3	3	1094.167
25	1 (G140H/F100LP)	c13	3 Shutter Slitlet	161.00305920833 33 Degrees - 59.544280000000 015 Degrees	237.15095861953 805			3	3	1094.167
26	2 (G395H/F290LP)	c13	3 Shutter Slitlet	161.00305920833 33 Degrees - 59.544280000000 015 Degrees	237.15095861953 805			3	3	1094.167
27	1 (G140H/F100LP)	c14	3 Shutter Slitlet	160.99670791666 665 Degrees - 59.539283055555 53 Degrees	237.15642532680 087			3	3	1094.167
28	2 (G395H/F290LP)	c14	3 Shutter Slitlet	160.99670791666 665 Degrees - 59.539283055555 53 Degrees	237.15642532680 087			3	3	1094.167

Proposal 5791 - Observation 6 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

Special Requirements

Group Visits within 53.0 Days  
Visits Same PA  
MSA Scheduled Aperture PA 237.1746 to 237.1746 Degrees (V3 98.6 to 98.6)

Proposal 5791 - Observation 7 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

Wed Mar 18 23:00:39 GMT 2026

<b>Observation</b>	<b>Proposal 5791, Observation 7: Prop5791_repeat11</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRSpec MultiObject Spectroscopy										
	(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>		
	(7)	Tr14_repeat	RA: 10 43 54.1699 (160.9757079d) Dec: -59 33 25.51 (-59.55709d) Equinox: J2000								
<i>Comments: Description=[]</i>											
<b>Acquisition</b>	<b>#</b>	<b>Reference Star Bin</b>	<b>Target</b>	<b>Filter</b>	<b>MSA Configuration</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	Filter: F110W; Readout: NRSRAPID; 8 sources in 4 quads; [ Reduced Accuracy ]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	
<b>Template</b>	<b>TA Method</b>	<b>HFF Readout Mode</b>	<b>Obtain Confirmation Images</b>	<b>Science Aperture</b>	<b>Primary Candidate List</b>	<b>Filler Candidate List</b>	<b>Spectral Overlap Map</b>	<b>Spectral Overlap Threshold</b>			
	MSATA	false	No	MSA Center	Tr14_repeat (4856 sources)		jwst-nirspec-hr-no-g235h	1.5			
<b>Reference Stars</b>	<b>Visit</b>	<b>ID</b>	<b>RA</b>	<b>Dec</b>	<b>Magnitude</b>	<b>Visit</b>	<b>ID</b>	<b>RA</b>	<b>Dec</b>	<b>Magnitude</b>	
	1	270	160.996151	-59.595510	19.96733941853027	1	1763	161.052618	-59.566830	19.67833986103515	
	1	763	160.990398	-59.582024	20.37534036457519	1	1925	161.014015	-59.564111	20.46934022724609	
	1	1561	160.955303	-59.569770	19.57433976948242	1	2543	161.020863	-59.555940	20.56634034931640	
	1	1616	161.047424	-59.568985	19.63833894550781	1	4140	160.997812	-59.535967	19.93034066975097	

Proposal 5791 - Observation 7 - The Crucible of Planet Formation - Protoplanetary Disks in the Extreme Environment of Trumpler 14

	#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
<b>Spectral Elements</b>	1	1 (G140H/F100LP)	c1	3 Shutter Slitlet	160.994864875 Degrees - 59.567909166666 65 Degrees	212.44296085257 452			3	3	875.333
	2	2 (G395H/F290LP)	c1	3 Shutter Slitlet	160.994864875 Degrees - 59.567909166666 65 Degrees	212.44296085257 452			3	3	875.333
	3	1 (G140H/F100LP)	c2	3 Shutter Slitlet	160.99824120833 333 Degrees - 59.564651388888 876 Degrees	212.44004473541 975			3	3	875.333
	4	2 (G395H/F290LP)	c2	3 Shutter Slitlet	160.99824120833 333 Degrees - 59.564651388888 876 Degrees	212.44004473541 975			3	3	875.333
	5	1 (G140H/F100LP)	c3	3 Shutter Slitlet	160.99814929166 666 Degrees - 59.566432500000 02 Degrees	212.44012740720 456			3	3	875.333
	6	2 (G395H/F290LP)	c3	3 Shutter Slitlet	160.99814929166 666 Degrees - 59.566432500000 02 Degrees	212.44012740720 456			3	3	875.333
<b>Special Requirements</b>	MSA Scheduled Aperture PA 212.4594 to 212.4594 Degrees (V3 73.88488 to 73.88488)										