



7607 - Unveiling the Role of Stellar Density in the Formation of Free-Floating Planetary-Mass Objects in the Milky Way

Cycle: 4, Proposal Category: GO

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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		NIRCam Imaging	(1) RCW-38
	3		NIRCam Imaging	(1) RCW-38
	2		NIRCam Imaging	(2) Control_field
	4		NIRCam Imaging	(3) Control_field_2

ABSTRACT

Brown dwarfs (BDs) and free-floating planetary-mass objects (PMOs) represent a significant portion of the star-like population in the Galaxy. Yet their formation mechanism remains an open question. BDs are generally understood to form similarly to stars, exhibiting characteristics like disks and outflows. However, PMOs (masses < 12 MJup), may form either through cloud fragmentation (similar to stars) or through disk fragmentation

JWST Proposal 7607 (Created: Monday, March 9, 2026, 2:00:10PM Eastern Standard Time) - Overview

followed by ejection (similar to planets). Microlensing surveys suggest an increase in PMO numbers below 20 MJup, conflicting with observations from nearby star-forming regions (SFRs), where a declining trend is noted. One possible reason is that PMOs are predominantly formed in massive, dense star forming regions, which are underrepresented in the solar neighbourhood. Here we propose to determine the number of PMOs in a massive dense cluster, where dynamical interactions might favor the ejections of free-floating planets. Our target for this proposal is RCW 38, the densest stellar cluster within 4 kpc around us, 10 times denser than the Orion Nebula Cluster. We have designed a survey that allows us to study its planetary-mass population and derive its Initial Mass Function down to 2-3 MJup using JWST's NIRCам. By comparing RCW 38 to other clusters, this study will shed light on the discrepancies between young and field planetary populations, offering critical insights into the processes that govern the formation of the lowest-mass objects in the Galaxy.

OBSERVING DESCRIPTION

We will obtain deep observations of the young star cluster RCW 38 using NIRCам, in 10 wide and medium filters. The goal is to reach a SNR > 10 down to F150W = 26 mag.

We will use two Readout modes, Medium2 which offers a good compromise between frame loss and the achieving the required depth, and Rapid in order to obtain larger dynamic range in the cluster (i.e. to have access to a wide range in stellar masses).

Additionally, we will use an identical setup to observe a control field in the vicinity of the cluster, which will be used for statistical decontamination of the cluster member sequence in various CMDs available from different filter combinations. This will yield the numbers of expected members per magnitude and color bin, and consequently and estimate of the Initial Mass Function down to 2-3 MJup.

We will also use the photometry in various filters to construct objects' SEDs and help selecting candidates for future follow-ups.

Proposal 7607 - Targets - Unveiling the Role of Stellar Density in the Formation of Free-Floating Planetary-Mass Objects in the Milky ...

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous	
	(1)	RCW-38	RA: 08 59 4.6000 (134.7691667d) Dec: -47 30 38.00 (-47.51056d) Equinox: J2000	Epoch of Position: 2000		
	<i>Comments:</i> <i>Category=Stellar Cluster</i> <i>Description=[Young star clusters]</i>					
	(2)	Control_field	RA: 08 54 46.2773 (133.6928221d) Dec: -46 46 49.25 (-46.78035d) Equinox: J2000	Epoch of Position: 2000		
<i>Comments:</i> <i>Category=Unidentified</i> <i>Description=[Infrared sources, Parallel field]</i>						
(3)	Control_field_2	RA: 08 54 39.3000 (133.6637500d) Dec: -46 45 58.70 (-46.76631d) Equinox: J2000	Epoch of Position: 2000			
<i>Comments:</i> <i>Category=Unidentified</i> <i>Description=[Infrared sources, Parallel field]</i>						

Proposal 7607 - Observation 1 - Unveiling the Role of Stellar Density in the Formation of Free-Floating Planetary-Mass Objects in the ...

Mon Mar 09 19:00:10 GMT 2026

Observation	Proposal 7607, Observation 1 Diagnostic Status: Warning Observing Template: NIRCcam Imaging									
Diagnostics	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(1)	RCW-38	RA: 08 59 4.6000 (134.7691667d) Dec: -47 30 38.00 (-47.51056d) Equinox: J2000		Epoch of Position: 2000					
	<i>Comments:</i> Category=Stellar Cluster Description=[Young star clusters]									
Template	Module		Subarray			Target Placement				
	ALL		FULL			Module A center (small extended source)				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	SMALL-GRID-DITHER			2		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
	1	F150W	F277W	MEDIUM2	5	1	8	8	3607.555	
	2	F162M+F150W2	F335M	MEDIUM2	5	1	8	8	3607.555	
	3	F182M	F360M	MEDIUM2	5	1	8	8	3607.555	
	4	F200W	F444W	MEDIUM2	5	1	8	8	3607.555	
	5	F210M	F250M	MEDIUM2	5	1	8	8	3607.555	
Special Requirements	Aperture PA Range 62.86565232 to 65.86565232 Degrees (V3 63.0 to 66.0) Aperture PA Range 76.86565232 to 118.86565232 Degrees (V3 77.0 to 119.0) Aperture PA Range 124.86565232 to 142.86565232 Degrees (V3 125.0 to 143.0) Aperture PA Range 259.86565232 to 328.86565232 Degrees (V3 260.0 to 329.0) Aperture PA Range 331.86565232 to 358.86565232 Degrees (V3 332.0 to 359.0) Aperture PA Range 359.86565232 to 60.86565232 Degrees (V3 0.0 to 61.0) Fiducial Point Override NRCAS_FULLL									

Proposal 7607 - Observation 3 - Unveiling the Role of Stellar Density in the Formation of Free-Floating Planetary-Mass Objects in the ...

Mon Mar 09 19:00:11 GMT 2026

Observation	<p>Proposal 7607, Observation 3</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCcam Imaging</p>									
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		
	(1)	RCW-38	RA: 08 59 4.6000 (134.7691667d) Dec: -47 30 38.00 (-47.51056d) Equinox: J2000		Epoch of Position: 2000					
	<p><i>Comments:</i> <i>Category=Stellar Cluster</i> <i>Description=Young star clusters</i></p>									
Template	Module		Subarray			Target Placement				
	ALL		FULL			Module A center (small extended source)				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		3	SMALL-GRID-DITHER			2		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
	1	F150W	F277W	RAPID	2	2	12	6	322.103	
	2	F162M+F150W2	F335M	RAPID	2	2	12	6	322.103	
	3	F182M	F360M	RAPID	2	2	12	6	322.103	
	4	F200W	F444W	RAPID	2	2	12	6	322.103	
	5	F210M	F250M	RAPID	2	2	12	6	322.103	
Special Requirements	<p>Aperture PA Range 62.86565232 to 65.86565232 Degrees (V3 63.0 to 66.0) Aperture PA Range 76.86565232 to 118.86565232 Degrees (V3 77.0 to 119.0) Aperture PA Range 124.86565232 to 142.86565232 Degrees (V3 125.0 to 143.0) Aperture PA Range 259.86565232 to 328.86565232 Degrees (V3 260.0 to 329.0) Aperture PA Range 331.86565232 to 358.86565232 Degrees (V3 332.0 to 359.0) Aperture PA Range 359.86565232 to 60.86565232 Degrees (V3 0.0 to 61.0) Fiducial Point Override NRCAS_FULLL</p>									

Proposal 7607 - Observation 2 - Unveiling the Role of Stellar Density in the Formation of Free-Floating Planetary-Mass Objects in the ...

Mon Mar 09 19:00:11 GMT 2026

Observation	<p>Proposal 7607, Observation 2</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCcam Imaging</p>									
Diagnostics	<p>(Observation 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>(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(2)	Control_field	RA: 08 54 46.2773 (133.6928221d) Dec: -46 46 49.25 (-46.78035d) Equinox: J2000		Epoch of Position: 2000					
	<p><i>Comments:</i> Category=Unidentified Description=[Infrared sources, Parallel field]</p>									
Template	Module		Subarray			Target Placement				
	ALL		FULL			Module gap (large extended source)				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	SMALL-GRID-DITHER			2		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
	1	F150W	F277W	MEDIUM2	5	1	8	8	3607.555	
	2	F162M+F150W2	F335M	MEDIUM2	5	1	8	8	3607.555	
	3	F182M	F360M	MEDIUM2	5	1	8	8	3607.555	
	4	F200W	F444W	MEDIUM2	5	1	8	8	3607.555	
	5	F210M	F250M	MEDIUM2	5	1	8	8	3607.555	
Special Requirements	<p>Aperture PA Range 46.92542306 to 71.92542306 Degrees (V3 47.0 to 72.0)</p> <p>Aperture PA Range 76.92542306 to 235.92542306 Degrees (V3 77.0 to 236.0)</p> <p>Aperture PA Range 239.92542306 to 294.92542306 Degrees (V3 240.0 to 295.0)</p> <p>Aperture PA Range 300.92542306 to 308.92542306 Degrees (V3 301.0 to 309.0)</p> <p>Aperture PA Range 318.92542306 to 358.92542306 Degrees (V3 319.0 to 359.0)</p> <p>Aperture PA Range 359.92542306 to 37.92542306 Degrees (V3 0.0 to 38.0)</p>									

Proposal 7607 - Observation 4 - Unveiling the Role of Stellar Density in the Formation of Free-Floating Planetary-Mass Objects in the ...

Mon Mar 09 19:00:11 GMT 2026

Observation	<p>Proposal 7607, Observation 4</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCcam Imaging</p>									
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		
	(3)	Control_field_2	RA: 08 54 39.3000 (133.6637500d) Dec: -46 45 58.70 (-46.76631d) Equinox: J2000		Epoch of Position: 2000					
	<p><i>Comments:</i> <i>Category=Unidentified</i> <i>Description=[Infrared sources, Parallel field]</i></p>									
Template	Module		Subarray			Target Placement				
	ALL		FULL			Module B center (small extended source)				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		3	SMALL-GRID-DITHER			2		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
	1	F150W	F277W	RAPID	2	2	12	6	322.103	
	2	F162M+F150W2	F335M	RAPID	2	2	12	6	322.103	
	3	F182M	F360M	RAPID	2	2	12	6	322.103	
	4	F200W	F444W	RAPID	2	2	12	6	322.103	
	5	F210M	F250M	RAPID	2	2	12	6	322.103	
Special Requirements	<p>Aperture PA Range 0.05262691 to 38.05262691 Degrees (V3 0.0 to 38.0)</p> <p>Aperture PA Range 47.05262691 to 72.05262691 Degrees (V3 47.0 to 72.0)</p> <p>Aperture PA Range 77.05262691 to 236.05262691 Degrees (V3 77.0 to 236.0)</p> <p>Aperture PA Range 240.05262691 to 295.05262691 Degrees (V3 240.0 to 295.0)</p> <p>Aperture PA Range 301.05262691 to 309.05262691 Degrees (V3 301.0 to 309.0)</p> <p>Aperture PA Range 319.05262691 to 359.05262691 Degrees (V3 319.0 to 359.0)</p> <p>Fiducial Point Override NRCBS_FULLL</p>									