



# 2317 - Initial mass function in the lowest metallicity protocluster in the Galaxy

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>
Sh2-284				
	1	NIRCAM 1 field	NIRCam Imaging	(1) SH2-284

## ABSTRACT

The formation of stars at low metallicities, and in particular the determination of their characteristic mass scales, is a central problem in galaxy formation and evolution, i.e., to understand the properties of the high redshift universe. However, measurements of the initial mass function (IMF) in low metallicity environments have been limited because of the distance to the regions and the corresponding difficulty in characterizing low-mass sources. Studies have been performed in the Magellanic Clouds, but here the stellar populations could not be probed to the lowest masses, i.e., below the mass where the Galactic field star IMF is found to peak ( $\sim 0.25 M_{\text{sun}}$  for a log-normal fit). Here we propose to study the IMF in Sh2-284, at a distance of 4.5 kpc, the lowest metallicity star-forming region in the Galaxy. With the unique sensitivity of NIRCAM on JWST together with the access to the water band filters that trace the effective temperature of low-mass objects, we will be able to accurately characterize individual stars and

brown dwarfs and to discriminate between background objects and cluster members down to a mass limit of 15 Jupiter masses. This is sufficient to reach past the expected IMF peak, precisely determine its shape at the low-mass end, and measure the star to brown dwarf ratio, all achieved for the first time in a metal poor environment.

### **OBSERVING DESCRIPTION**

This is a NIRCcam program to image a massive star forming region that has the lowest metallicity known in the Galaxy. The observations are designed to characterise the stellar and brown dwarf content. We require a single pointing with Fullbox6 dither pattern to cover a 6'x2.5' field of view. Three filters will be used in each of the SW and LW arms for a total of 6 filters observed. The SW filter F162M, F182M and F200W will be used to enable a mass estimation for substellar objects or brown dwarfs, by measuring the water absorption feature at 1.82um that is sensitive to Teff. F356W will be used to trace the infrared excess of circumstellar discs in the region. The narrow band F470N and F405N will be obtained to study the accretion/outflow activities. Overall the data will be used to derive effective temperatures of the cluster content, determine the fraction of objects with circumstellar disks and to determine the spatial distribution of sources. There are no special observing requirements.

Modified at September, 2021.

Slightly shifted position; a special requirement for PA is added.

The combination of these two is to make sure the cluster is located at the center of one module in a fullbox pattern.

A subpixel dither is added to improve the PSF sampling (accordingly we use Fullbox tightgap3 instead of Fullbox6 )

Proposal 2317 - Targets - Initial mass function in the lowest metallicity protocluster in the Galaxy

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	SH2-284	RA: 06 46 16.2876 (101.5678650d) Dec: +00 05 5.46 (.08485d) Equinox: J2000		
<i>Comments:</i> Category=Stellar Cluster Description=[Protoclusters, Young star clusters] Extended=NO					

Proposal 2317 - Observation 1 - Initial mass function in the lowest metallicity protocluster in the Galaxy

Thu May 26 21:01:52 GMT 2022

<b>Observation</b>	<p><b>Proposal 2317, Observation 1: NIRCAM 1 field</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRCAM Imaging</p>									
<b>Diagnostics</b>	(Visit 1:1) 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>		
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	<p><i>Comments:</i>  <i>Category=Stellar Cluster</i>  <i>Description=[Protoclusters, Young star clusters]</i>  <i>Extended=NO</i></p>									
<b>Template</b>	<b>Module</b>					<b>Subarray</b>				
	ALL					FULL				
<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		3TIGHTGAPS	STANDARD			2		
<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>ETC Wkbk.Calc ID</b>
	1	F162M+F150W2	F405N+F444W	SHALLOW2	6	1	6	6	1739.357	
	2	F182M	F470N+F444W	SHALLOW2	6	1	6	6	1739.357	
	3	F200W	F356W	BRIGHT2	5	1	6	6	644.206	
<b>Special Requirements</b>	<p>Aperture PA Range 60 to 110 Degrees (V3 60.09936043 to 110.09936043)</p> <p>Aperture PA Range 240 to 300 Degrees (V3 240.09936043 to 300.09936043)</p>									