



# 6151 - The determination of the upper initial mass function in the nearest massive star-forming region, W51A

Cycle: 3, Proposal Category: GO

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>
<b>Taehwa Yoo (PI)</b>	<b>University of Florida</b>
Dr. Adam G Ginsburg (CoI) (CoPI) (US Admin CoI)	University of Florida
Aden Dawson (CoI)	University of Florida

## OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	W51A-NIRCam imagin g	NIRCam Imaging	(3) W51A-NIRCAM
	2	W51A MIRI IMAGIN G	MIRI Imaging	(1) W51A
	3	W51A MIRI IMAGIN G_background	MIRI Imaging	(2) W51background

## ABSTRACT

The universality of the initial mass function (IMF) is still an open question. The compilation of observation has been reported that the slope of the IMF has non-negligible scatter and moderate deviation from the canonical IMF models, possibly due to the observational uncertainties and/or environmental effects. The acquisition of the IMF in very young ( $t < 1\text{Myr}$ ) star-forming region is expected to eliminate the great uncertainty in estimating the initial mass from tracing back the evolution of evolved stars. Therefore, we propose to observe (proto)stars in W51A, the nearest young and massive star-forming region with NIRcam and MIRI. In particular, we are focusing on the upper IMF as W51A is the best target to observe the birth of massive stars given its age ( $t < 1\text{Myr}$ ) and mass ( $M > 10^4 M_{\text{sun}}$ ). The another advantage of observing this region is that we can

exploit the catalog of dust core and YSOs provided by ALMA observation. Especially, the comparison of the core mass function and the IMF will provide a unique opportunity of directly observing an evolution process from core to star in the same region. As a byproduct of NIRCam and MIRI observation, a rich information of YSOs will be provided. With this data, the evolution of YSOs can be explored by classifying YSOs with spectral slope. Finally, we expect to verify the star formation model by measuring the mean protostellar luminosity and by examining the possible primordial mass segregation.

## **OBSERVING DESCRIPTION**

In order to determine the IMF in the massive star-forming region, W51A, we request the following NIRCam and MIRI imaging observations.

The target is placed at the center of the W51A where W51 main substructure is placed. We used the same position of apertures for both NIRCam and MIRI imaging.

For NIRCam imaging of W51A, we made observations with 5 pairs of filters, (SW, LW) = (F162M, F335M), (F182M, F360M), (F210M, F410M), (F140M, F480M), (F187N, F405N). FULLBOX-3 dithering pattern is chosen to cover a large area. After considering the data rate, each observation has readout pattern = SHALLOW2, Groups/Int=5, Integration/Exp=1, Subpixel dither type=SMALL-GRID-DITHER, small grid dither=2. This leads to the total dithers=8 and the total exposure time for each observation=1890 sec.

In MIRI imaging, we selected F560W, F770W, F1000W, F1280W, F2100W. We choose 4-Point-Sets dither because our targets are mostly point sources. To prevent saturation, we made observation plan with readout pattern=FASTR1, Groups/Int=5, Integration/Exp=1, Exposures/Dither=1 with total dither=4. This gives total exposure time per each observation=55.501 sec. We request the special requirement for aperture V3PA range from 105 to 125 degrees in order to cover the ALMA-IMF footprint.

This setup ensures to observe a low-mass (0.09 Msun) star and a faint YSO (80 percentile of various YSO models) with S/N>10 and no saturation of a bright YSO (20 percentile of various YSO models).

Proposal 6151 - Targets - The determination of the upper initial mass function in the nearest massive star-forming region, W51A

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	W51A	RA: 19 23 42.1312 (290.9255467d) Dec: +14 30 47.00 (14.51306d) Equinox: J2000		
<i>Comments:</i> <i>Category=Stellar Cluster</i> <i>Description=[Protoclusters]</i>				
(2)	W51background	RA: 19 23 54.9926 (290.9791358d) Dec: +14 29 30.11 (14.49170d) Equinox: J2000		
<i>Comments:</i> <i>Category=Calibration</i> <i>Description=[Telescope/sky background]</i>				
(3)	W51A-NIRCAM	RA: 19 23 42.1312 (290.9255467d) Dec: +14 30 47.00 (14.51306d) Equinox: J2000		
<i>Comments:</i> <i>Category=Stellar Cluster</i> <i>Description=[Protoclusters]</i>				

Proposal 6151 - Observation 1 - The determination of the upper initial mass function in the nearest massive star-forming region, W51A

Wed Apr 02 21:00:16 GMT 2025

<b>Observation</b>	<b>Proposal 6151, Observation 1: W51A-NIRCam imaging</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRCam Imaging									
	(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>		
	(3)	W51A-NIRCAM	RA: 19 23 42.1312 (290.9255467d) Dec: +14 30 47.00 (14.51306d) Equinox: J2000							
<i>Comments:                      Category=Stellar Cluster                      Description=[Protoclusters]</i>										
<b>Template</b>	<b>Module</b>		<b>Subarray</b>			<b>Target Placement</b>				
	ALL		FULL			Module Gap				
<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		4	SMALL-GRID-DITHER			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	F187N	F405N+F444W	SHALLOW2	5	1	8	8	1889.672	
	2	F162M+F150W2	F335M	SHALLOW2	5	1	8	8	1889.672	
	3	F182M	F360M	SHALLOW2	5	1	8	8	1889.672	
	4	F210M	F410M	SHALLOW2	5	1	8	8	1889.672	
	5	F140M	F480M	SHALLOW2	5	1	8	8	1889.672	

Proposal 6151 - Observation 2 - The determination of the upper initial mass function in the nearest massive star-forming region, W51A

Wed Apr 02 21:00:16 GMT 2025

<b>Observation</b>	<b>Proposal 6151, Observation 2: W51A MIRI IMAGING</b> <b>Diagnostic Status: Error</b> Observing Template: MIRI Imaging Background Observations:[W51A MIRI IMAGING_background (Obs 3)]																																																																												
	(W51A MIRI IMAGING (Obs 2)) Error (Form): Linked observation of background target has non-similar exposure (W51A MIRI IMAGING (Obs 2)) Warning (Form): Target requiring background exposure selected for template that doesn't require background exposure (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.																																																																												
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<b>Special Requirements</b>	Group Visits within 53.0 Days Aperture PA Range 109.83544897 to 129.83544897 Degrees (V3 105.0 to 125.0) Visits Same PA  Group Observations 2, 3, Non-interruptible																																																																												

Proposal 6151 - Observation 3 - The determination of the upper initial mass function in the nearest massive star-forming region, W51A

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<b>Observation</b>	<p><b>Proposal 6151, Observation 3: W51A MIRI IMAGING_background</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: MIRI Imaging</p> <p>Background Observation For: [W51A MIRI IMAGING (Obs 2)]</p>										
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	1	CYCLING	1	4		5	1			DEFAULT	
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	1	F2100W	FASTR1	5	1	1	Dither 1	4	4	55.501	
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