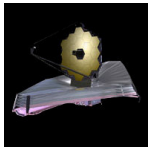

4087 - Refining the Mira Distance Ladder with NIRCam Observations of M101

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
M101				
	1		NIRCam Imaging	(1) SN-2011FE-FIELD

ABSTRACT

The recent tension between direct, model-independent measurements of the Hubble constant and the model-dependent values inferred from observations of the CMB has posed the strongest challenge to LambdaCDM in nearly 30 years. However, the burden of proof for a potentially groundbreaking discovery of new physics is high. Thus, alternative routes to the present measurements of the Hubble constant – which rely primarily on Cepheids and Tip of Red Giant Branch as intermediate distance indicators – must be explored in order to verify the current results and to fully understand the role of systematic uncertainties. Oxygen-rich Mira variables are luminous, ubiquitous, NIR and IR standard candles and present a particularly compelling path forward to studying the tension in the era of JWST. Here, we propose to use the high angular resolution and infrared coverage of NIRCam to simultaneously refine the Mira-based distance ladder and re-examine Cepheid crowding in the Type Ia Supernova host galaxy M101. This will allow us to verify the Cepheid results by using an independent ladder subject to different systematics, and by directly reanalyzing the Cepheids in M101. In this joint proposal consisting of one epoch of JWST NIRCam and three epochs of coordinated HST WFC3/IR

and ACS observations, we will (1) de-blend the backgrounds of known Cepheids and Miras in M101, (2) improve Mira spectral type classification, and (3) study the effect of dust and mass loss on the Mira PLR. The three HST epochs will allow us to phase the single-epoch JWST observations to mean magnitude and produce Mira PLR in JWST bands for the first time.

OBSERVING DESCRIPTION

We propose to observe Cepheids and Mira candidates in the nearby SN Ia host galaxy, M101, with NIRCam in 6 filters (F115W, F150W, F182M, F277W, F356W, and F444W). The observations will be taken in a single epoch. We also request 3 coordinated orbits (split into 3 epochs) of HST observations, one prior to, and one after the JWST obsservations. For HST, we propose WFC3/IR observations (in F160W and F110W filters) and parallel ACS F555W observations to determine the phases of the Miras and Cepheids respectively at the time of the JWST observations.

These observations will allow us to produce Mira PLRs in the NIRCam filters, uncrowd the backgrounds of Cepheids and Miras previously observed in M101, improve our spectral classification of Miras, and reduce the uncertainty in the Hubble constant measurements of both methods.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-2011FE-FIELD	RA: 14 03 5.7110 (210.7737958d) Dec: +54 16 25.22 (54.27367d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Spiral galaxies]

Observation

Proposal 4087, Observation 1

Thu May 11 15:03:47 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam 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)	SN-2011FE-FIELD	RA: 14 03 5.7110 (210.7737958d) Dec: +54 16 25.22 (54.27367d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Spiral galaxies]

Template

Module	Subarray	Target Placement
ALL	FULL	Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F150W	F277W	SHALLOW4	8	1	4	4	1674.936	
2	F182M	F444W	SHALLOW4	8	1	4	4	1674.936	
3	F115W	F356W	SHALLOW4	8	1	4	4	1674.936	

Special Requirements

Aperture PA Range 241.9286469 to 254.9286469 Degrees (V3 242.0 to 255.0)
Offset 109.0168610861384 arcsec, 8.314496674448183 arcsec