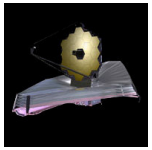

1617 - The Boundary of Galaxy Formation: Constraints from the Ancient Star Formation of the Isolated, Extremely Low-Mass Galaxy Leo P

Cycle: 1, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Leo P				
	1	LeoP	NIRCam Imaging	(1) LEO-P

ABSTRACT

In the early universe, at the lowest masses where gravity is in a tug-of-war with the energy injected by internal events (stellar feedback) and outside events (reionization, environmental effects), the dominant factors that govern the growth of the smallest structures are still speculative. Archeological studies of low-mass galaxies in the Local Group (LG) have striven to answer this question through detailed analyses of the oldest stars. Yet, the LG is, by definition, a complicated system and the history of its satellite galaxies are intertwined with their evolution in the shadow of their massive host. The only laboratory to truly measure how galaxies at the limit of structure formation grow is a very low-mass system that is isolated.

Leo P is an isolated, extremely low-mass (M*~10^5 Msun), metal poor (<3% Solar), gas-rich galaxy just outside the LG at 1.6 Mpc. It is the quintessential system to test theories of how the smallest structures in our universe survive and grow. We will image the resolved stars in Leo P to below the old main sequence turn-off, a depth unreachable with HST but achievable with JWST, to derive the ancient star formation history of the galaxy. The star formation history will test if (i) early star formation in Leo P was ``quelled", as predicted nearly uniformly by reionization models, and then re-ignited, (ii) Leo P has a delayed onset in star formation suggesting the accretion history of baryons may be dependent on environment at low masses, or (iii) Leo P has constant star formation across all epochs which is not predicted by cosmological models in this mass range and which would also be in tension with reionization models.

OBSERVING DESCRIPTION

We will image Leo P with NIRCam with the short-wavelength filters F090W and F150W, with simultaneous imaging in the long-wavelength filter F277W. The target galaxy has an angular size that fits within one NIRCam module; we elect to use only module B for the observations to reduce data transfer rates and total data volume. Our science goals require the obsevations to reach below the old main sequence turn-off with a SNR=5 for a metal-poor, 13 Gyr old star (m_F090W=29.55 mag based on the MIST stellar evolution models). We will use a DEEP8 readout with 5 groups, 6 integrations for the F150W filter and 10 integrations for the F090W filter. We use a 7-point subpixel dither pattern to mitigate cosmic rays and bad pixels, improve PSF sampling, and reduce flat-field errors thereby maximizing the SNR. The JWST ETC v1.5.2 suggests a total science time of 29.4 hrs to achieve our photometric depth requirement. Total requested time with overhead from the APT is 35.7 hours.The background variability is >5%. Given the faint stars we are imaging and the requirement of precision photometry, we request the background limited constraint of <10% above minimum. We place the bright foreground in a chip away from the main stellar disk to avoid persistence image effects and Dragon's Breath with orient constraints to ensure the majority of the stellar disk falls on the Module B chips. With the scheduling constraints, Leo P is observable for 19 days per year.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	LEO-P	RA: 10 21 42.5094 (155.4271225d) Dec: +18 05 16.09 (18.08780d) Equinox: J2000		

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Dwarf irregular galaxies, Field galaxies]

Observation

Proposal 1617, Observation 1: LeoP

Fri May 27 05:02:13 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 1:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	LEO-P	RA: 10 21 42.5094 (155.4271225d) Dec: +18 05 16.09 (18.08780d) Equinox: J2000		

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Dwarf irregular galaxies, Field galaxies]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		7

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W	F277W	DEEP8	5	10	70	7	66814.92	
2	F150W	F277W	DEEP8	5	6	42	7	40058.889	

Special Requirements

Group Visits within 53.0 Days
Aperture PA Range 119.3 to 120 Degrees (V3 119.27547802 to 119.97547802)
Visits Same PA
Background Limited. Background no more than 10th percentile above minimum