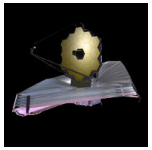

4744 - SN H0pe: Doubling the Time Delay Precision of a z=1.78 Multiply-imaged Type Ia Supernova

Cycle: 3, Proposal Category: GO

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OBSERVATIONS

Folder	***Observation***	***Label***	***Observing Template***	***Science Target***
PLCK G165.7+67.0				
	3	PLCK G165.7+67.0	NIRCam Imaging	(1) PLCK-G165

ABSTRACT

The most distant (z=1.78) lensed supernova (SN) Ia was discovered near peak brightness in JWST/NIRCam imaging in the PLCK G165.7+67.0 (G165) galaxy cluster, named "H0pe." SN H0pe is triply-imaged and provides the first opportunity to measure the Hubble constant (H0) using time delays from a multiply-imaged SN Ia. This H0 constraint is independent of the field SN Ia and CMB approaches, which are currently in ~5sigma tension. However, the lack of imaging without the supernova present makes disentangling the SN light from its bright host galaxy a challenge, particularly at wavelengths >2 micron where most of the leverage for time delays resides. The initial time delay measurements for SN H0pe are limited by photometric uncertainties in the F200W and F277W filters, and the absence of measurements in F356W & F444W, which cannot be extracted without template imaging.

1) Simulations demonstrate that obtaining a reference epoch after SN H0pe has faded introduces 18 new photometric points from the previously missing long wavelength filters, and improves the overall time delay uncertainties using all six filters by a factor of 2.

2) The reduced uncertainty in the time delay taken together with a conservative lens model uncertainty of 10% translates to ~20% reduction in the uncertainty on H0 by this method.

Therefore, we propose straightforward imaging of the G165 system with NIRCam in six broad bands, in order to to extract precision photometry of SN H0pe from extant data and provide the definitive time delay and H0 measurement. An investment of 3.5 hours with JWST can directly improve a critical independent cosmological measurement to confront the Hubble tension.

OBSERVING DESCRIPTION

We propose 1 epoch to obtain a template image of the highest-redshift lensed Type Ia supernova, ``SN H0pe." We will use 3 filter pairs of NIRCam imaging to acquire an image of the G165 cluster field. This will be the first image without the SN H0pe, and is required in order to do accurate difference imaging, photometry, and to obtain accurate time delays between the SN images. We will then measure H0 through the measurement of time delays.

Proposal 4744 - Targets - SN H0pe: Doubling the Time Delay Precision of a z=1.78 Multiply-imaged Type Ia Supernova

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	PLCK-G165	RA: 11 27 13.0000 (171.8041667d) Dec: +42 29 0.00 (42.48333d) Equinox: J2000		

Comments:
Category=Clusters of Galaxies
Description=[Galaxy groups]

Observation

Proposal 4744, Observation 3: PLCK G165.7+67.0

Thu Feb 29 21:02:06 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Comments: Primary targets are bright sub-mm lensed arcs located between brightest cluster galaxies.
Positioned near center of SW chip B3 to achieve full depth on those targets.
Also capturing two sub-mm sources positioned in SW chip A1.
Brightish star in module gap; area nearby less important in case affected by artifacts.

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)	PLCK-G165	RA: 11 27 13.0000 (171.8041667d) Dec: +42 29 0.00 (42.48333d) Equinox: J2000		

Comments:
Category=Clusters of Galaxies
Description=[Galaxy groups]

Template

Module	Subarray	Target Placement
ALL	FULL	Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEBOX	4	STANDARD		1

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	F444W	MEDIUM8	6	1	4	4	2490.931	
2	F150W	F356W	SHALLOW4	9	1	4	4	1889.672	
3	F200W	F277W	SHALLOW4	10	1	4	4	2104.407	

Special Requirements

Aperture PA Range 154.7 to 160.7 Degrees (V3 154.77457694 to 160.77457694)