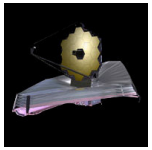

2905 - First look at high redshift Type Ia supernova cores: Nebular observations of lensed SN Zwicky

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Suhail Dhawan (PI) (ESA Member)	**University of Cambridge**
Dr. Joel Pearson Johansson (CoI) (ESA Member)	Stockholm University
Prof. Ariel Goobar (CoI) (ESA Member)	Stockholm University
Dr. Kate Maguire (CoI) (ESA Member)	University of Dublin, Trinity College
Dr. Nikki Arendse (CoI) (ESA Member)	Stockholm University
Dr. Steve Schulze (CoI) (ESA Member)	Stockholm University
Prof. Edvard Mortsell (CoI) (ESA Member)	Stockholm University
Ana Sagues Carracedo (CoI) (ESA Member)	Stockholm University
Dr. Saurabh W. Jha (CoI) (US Admin CoI)	Rutgers the State University of New Jersey
Dr. Jakob Nordin (CoI) (ESA Member)	Humboldt Universitat zu Berlin
Dr. Aayush Saxena (CoI) (ESA Member)	University of Oxford
Ms. Alice Townsend (CoI) (ESA Member)	Humboldt Universitat zu Berlin

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRSpec IFU Spectroscopy	(1) SN-ZWICKY
	2		NIRCam Imaging	(1) SN-ZWICKY

ABSTRACT

Type Ia supernovae (SNe Ia) are excellent distance indicators in cosmology, playing an influential role in understanding dark energy and origin of the Hubble tension. They are pivotal endpoints of stellar evolution and the nature of their progenitors is an important open question. SNe Ia cosmology, especially at high-redshift, is limited by systematic uncertainties, a key source is the evolution of SNe Ia properties with redshift. This proposal presents an unprecedented route to test for redshift evolution. We request the first nebular phase observation of a high-redshift SN Ia; SN Zwicky with a lookback time of 4 Gyr. SN Zwicky is the first strongly lensed SNIa in six years, presenting a rare opportunity for such observations. The mass ratios from the NIRSpec spectrum, will shed light on whether the SN originated from a Chandrasekhar mass or sub-Chandra progenitor. Comparing this with the sizable literature sample of nebular phase observations of local universe SNe Ia, we can determine whether there are evolution effects in the SN Ia properties with redshift, which will critically impact our ability for precision cosmology in the near future. With a small JWST time investment we can break new ground in understanding high-z SNe Ia.

OBSERVING DESCRIPTION

The proposal requests one spectrum and contemporaneous photometry of SN Zwicky in the near infrared at late phases. We request a prism spectrum with NIRSpec to get a high S/N for modelling the broad forbidden emissions that dominate the late time spectrum. Using state-of-the-art models from the literature that the team has developed, we will obtain the mass ratio of the iron group elements to understand the progenitor. This is uniquely possible by combining proposed observations with the exquisite early time data to break the degeneracy between the progenitor mass and metallicity. For spectroscopy, we request a total of 3500 seconds on source and 470s in each filter for imaging to get the required signal. The first two imaging observations should be spaced by approximately 30 days while the third should be taken when the SN is visible again in March 2024. These observations will be the first ever nebular phase observations of a high-redshift Type Ia supernova, a key test for high-z SN cosmology.

Proposal 2905 - Targets - First look at high redshift Type Ia supernova cores: Nebular observations of lensed SN Zwicky

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-ZWICKY	RA: 17 35 44.3178 (263.9346575d) Dec: +04 49 56.90 (4.83247d) Equinox: J2000		
Comments: *Category=Star* *Description=[Supernovae]*				
(2)	Gaia-DR3-4389518561485011712	RA: 17 35 44.8710 (263.9369625d) Dec: +04 49 54.31 (4.83175d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2016.0	
Comments: The parallax and proper motion for this star in the Gaia DR3 catalog is null (wrote these in the columns as 0). The star is 20.93 mag in the Gaia G-band. Ref epoch is 2016.0 *Catalog name is Gaia DR3, this is the link to the information: https://irsa.ipac.caltech.edu/workspace/TMP_XfFrDF_23659/Gator/irsa/24357/tbview.html.* *Category=Star* *Description=[G stars]* *Extended=NO*				

Observation

Proposal 2905, Observation 1

Mon Jul 31 18:03:39 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

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-ZWICKY	RA: 17 35 44.3178 (263.9346575d) Dec: +04 49 56.90 (4.83247d) Equinox: J2000		

Comments:
Category=Star
Description=[Supernovae]

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSIRS2	12	2	false	true	NONE	4	8	7119.378	135073

Special Requirements

Before Date 01-OCT-2023:00:00:00

Group Observations 1, 2, Non-interruptible

Observation

Proposal 2905, Observation 2

Mon Jul 31 18:03:39 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-ZWICKY	RA: 17 35 44.3178 (263.9346575d) Dec: +04 49 56.90 (4.83247d) Equinox: J2000		

Comments:
Category=Star
Description=[Supernovae]

Template

Module	Subarray	Target Placement
B	FULL	Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEBOX	3	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	F115W	F356W	BRIGHT2	7	1	3	3	450.944	135073
2	F150W	F444W	BRIGHT2	7	1	3	3	450.944	135073

Special Requirements

Before Date 01-OCT-2023:00:00:00
Offset 37.0 arcsec, 37.0 arcsec

Group Observations 1, 2, Non-interruptible