16215 - UV to NIR Study of the the First Robust Pulsational or Pair Instability Supernova and its Low Metallicity Environment

Cycle: 28, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) SN2016IET	WFC3/IR	2	03-Jun-2020 13:01:02.0	yes
02	(1) SN2016IET	ACS/WFC	1	03-Jun-2020 13:01:02.0	yes

3 Total Orbits Used

ABSTRACT

SN2016iet is an unprecedented supernova in terms of its temporal evolution, spectra, and environment. The light curve exhibits two distinct peaks separated by 100 days, and slowly decline by only 5 mag in 2.5 years. The spectra are dominated by a blue continuum and low velocity calcium and oxygen lines with an unusually high Ca/O ratio, but lack hydrogen or helium. The SN is located at an unusually large offset (16 kpc, 5 effective radii) from a low metallicity dwarf galaxy (0.1 Zsun, 3e8 Msun). Modeling of the SN data indicates that it is powered by interaction of 20-85 Msun of ejecta with 35 Msun of H/He-free circumstellar material (CSM), ejected in the final decade before explosion. Thus, the progenitor's CO core shortly before explosion was 55-120 Msun, placing it in the regime of pulsational pair instability or pair instability explosions, further supported by the low metallicity. This is the first robust case for such an origin based directly on a large progenitor mass and low metallicity. We request observations of this unprecedented SN to achieve several goals that can only be done with HST: (i) track the SN emission at >1000 days post explosion, as it fades below ground-based capabilities, to track the large-scale CSM; (ii) use NIR data to search for the first time for evidence of dust formation in H/He-poor CSM interaction; (iii) measure the UV brightness of the host galaxy to precisely determine its star formation activity and escape fraction of ionizing radiation; and (iv) search for a potential underlying galaxy at the SN position, which from existing limits will be <1e-3 L*. This will be accomplished with 4 orbits in Cycle 27 and 3 orbits in Cycle 28.

OBSERVING DESCRIPTION

We request 4 orbits in Cycle 27 to observe SN2016iet at R.A.=12:32:33.23, decl.=+27:07:15.49 (J2000) to be observed during the early half of cycle 27, due to the fading nature of the source. The 4 orbits need not be done consequtively nor in a particular order, but they should be done within 30 days of each other. We split the 4 orbits into 2 distinct visits of 2 orbits each to aid the scheduler without increasing the overheads to much. One visit with WFC3/IR with one orbit dedicated to the F110W filter, and one orbit to the F160W filter. For the second visit one orbit should be done with ACS/WFC with the F625W filter, and a second orbit with WFC3/UVIS wit the F225W filter. For each orbit we request 4 individual exposures, dithered with a box pattern. Both visits should be scheduled within 30 days of each other, due to the fading nature of the supernova.

This multi-cycle proposal has three additional orbits scheduled during Cycle 28 to obtain templates after the supernova has faded. We request these during the late half of Cycle 28. One ACS/WFC orbit with filter F625W, one WFC3/IR orbit with filter F110W, and one orbit with the F160W filter.

Visit

Proposal 16215, Visit 01, implementation Wed Jun 03 17:01:03 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: GROUP 01,02 WITHIN 30D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-UVIS Purpose=DITHER Number Of Points=4 Point Spacing=23.02 Line Spacing=35.212	Coordinate Frame=POS-TARG Pattern Orientation=0.713 Angle Between Sides=89.287 Center Pattern=true		(1), (2)

Fixed Targets

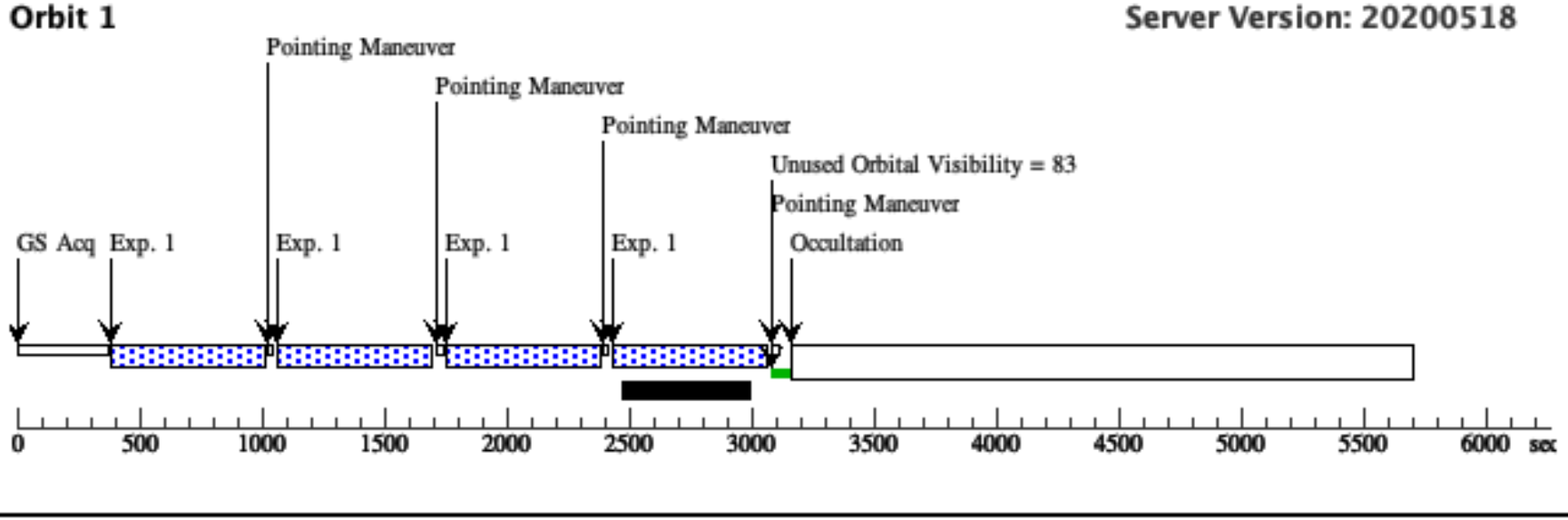
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2016IET	RA: 12 32 33.2300 (188.1384583d) Dec: +27 07 15.49 (27.12097d) Equinox: J2000		V=27.0+/-0.5	Reference Frame: ICRS

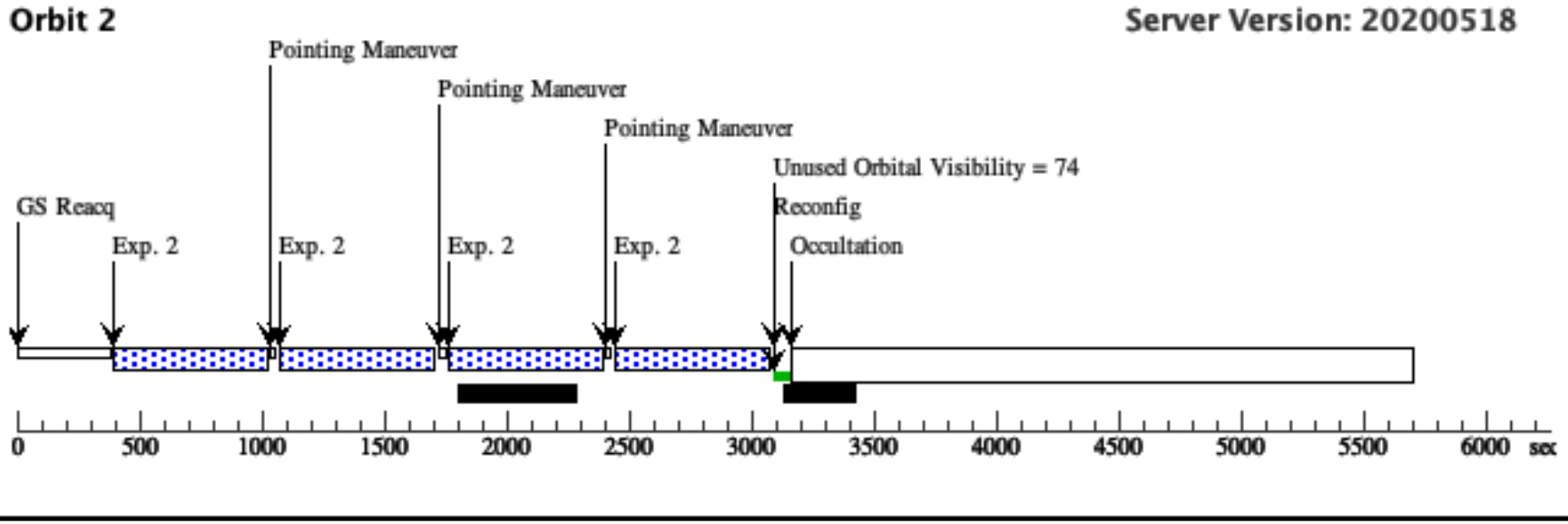
Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	WFC3/IR_110	(1) SN2016IET	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=7; SAMP-SEQ=SPARS100	GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 01 (1)	602.934229 Secs (2411.737 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	WFC3/IR_160	(1) SN2016IET	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=7; SAMP-SEQ=SPARS100		Pattern 1, Exps 2-2 in Visit 01 (1)	602.934229 Secs (2411.737 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure





Visit

Proposal 16215, Visit 02, implementation Wed Jun 03 17:01:03 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2016IET	RA: 12 32 33.2300 (188.1384583d) Dec: +27 07 15.49 (27.12097d) Equinox: J2000		V=27.0+/-0.5	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACS	(1) SN2016IET	ACS/WFC, ACCUM, WFC2	F625W			Pattern 3, Exps 1-1 in Visit 02 (3)	522 Secs (2088 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure