



16768 - Supernova 2020wnt: a pair-instability explosion in our backyard?

Cycle: 29, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) SN2020WNT	WFC3/IR WFC3/UVIS	1	10-Jan-2022 16:00:49.0	yes
02	(1) SN2020WNT	WFC3/IR	1	10-Jan-2022 16:00:50.0	yes

2 Total Orbits Used

ABSTRACT

We propose for one orbit of WFC3 UVIS/IR imaging, and one non-disruptive ToO orbit of WFC3 IR grism spectroscopy of a nearby superluminous supernova (SLSN) 2020wnt to discern whether it is a pair-instability (PI) SN. PISNe are the theoretical death of a 140-260 solar mass stars, and they may be a dominant contributor to nucleosynthesis in the early universe. A direct observation of a bona fide PISN does not yet exist in the literature. SN 2020wnt is the best candidate for a PISN yet discovered. It has a long rise from a large ejecta mass (~60 Msun) to a peak luminosity of -20.5 mags; both consistent with some PISN models. The light curve declines post-maximum with a rate of 0.01 mag/day, consistent with the radioactive decay of Co-56. Lastly, latest near-IR spectrum shows features associated with Fe-group elements. These features point to an explosion that

Proposal 16768 (STScI Edit Number: 5, Created: Monday, January 10, 2022 at 4:00:51 PM Eastern Standard Time) - Overview produces a copious amount of nickel, like a PISN. Our imaging observations will (i) determine whether the SN is still bright enough for the grism observations and (ii) probe the host properties local to the SN site. If the SN is brighter than 22 mags in the F140W filter, we will trigger a non-disruptive ToO to obtain grism spectroscopy. The particular lines we aim to observe are the [S I], [Si I] and [Fe II] line complexes around 1.1, 1.25, and 1.6 micron. The nebular spectrum will measure the nucleosynthetic yield of the SN, and unambiguously determine whether SN 2020wnt is a PISN or other more common deaths of a massive star.

OBSERVING DESCRIPTION

We plan to observe SN 2020wnt in two epochs. The first epoch contains one orbit and focuses on imaging the SN and the host using WFC3 UVIS and IR with the F275W, F475W, F110W, F140W, and F160W. For the second epoch, we observe SN 2020wnt with the WFC3 IR Grisms. We will obtain direct imaging in the F105W and F140W filters. Then we will observe the source with both the G102 and G141 grisms.

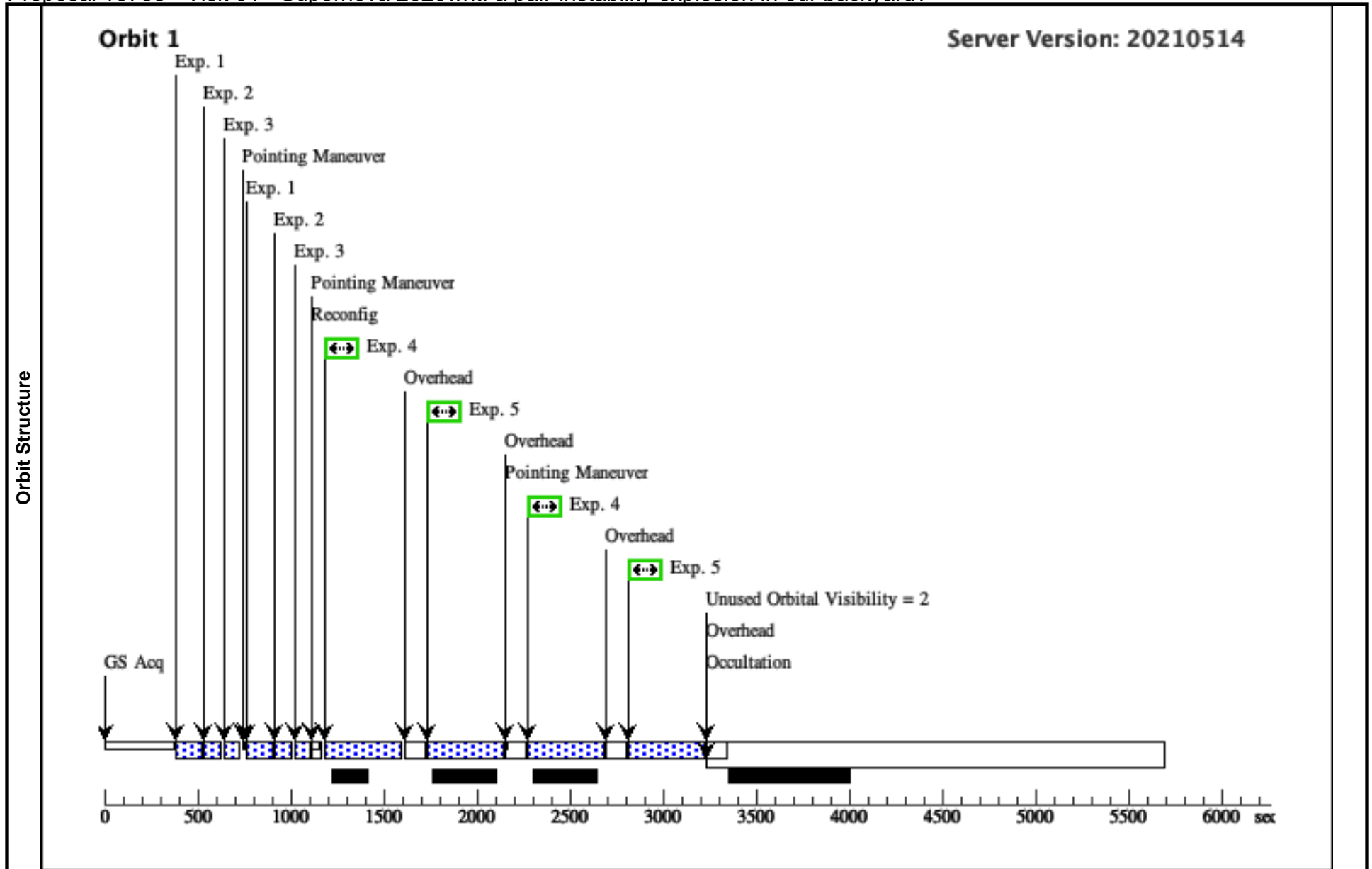
Proposal 16768 - Visit 01 - Supernova 2020wnt: a pair-instability explosion in our backyard?

Mon Jan 10 21:00:51 GMT 2022

Visit	Proposal 16768, Visit 01, completed Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)					
	(Exposure 4 (Pattern 2, Exps 4-5 in Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (Exposure 5 (Pattern 2, Exps 4-5 in Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser					
Diagnosics						
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures	
		(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1-3)	
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(4-5)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	SN2020WNT	RA: 03 46 37.9500 (56.6581250d) Dec: +43 13 45.30 (43.22925d) Equinox: J2000		V=(?) z = 22 AB mag	Reference Frame: ICRS
Comments: Category=EXT-STAR Description=[SUPERNOVA] Extended=NO						

Proposal 16768 - Visit 01 - Supernova 2020wnt: a pair-instability explosion in our backyard?

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(WFC3IR.i m.1529996)	(1) SN2020WNT	WFC3/IR, MULTIACCUM, IRSUB512	F160W	NSAMP=6; SAMP-SEQ=SPAR S25		Pattern 1, Exps 1-3 i n Visit 01 (1)	115.459282 Secs (230.919 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	2	(WFC3IR.i m.1529995)	(1) SN2020WNT	WFC3/IR, MULTIACCUM, IRSUB512	F140W	NSAMP=4; SAMP-SEQ=SPAR S25		Pattern 1, Exps 1-3 i n Visit 01 (1)	69.61678 Secs (139.234 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	3	(WFC3IR.i m.1529993)	(1) SN2020WNT	WFC3/IR, MULTIACCUM, IRSUB512	F105W	NSAMP=4; SAMP-SEQ=SPAR S25		Pattern 1, Exps 1-3 i n Visit 01 (1)	69.61678 Secs (139.234 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	4	(WFC3UVI S.im.152967 1)	(1) SN2020WNT	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F475W	FLASH=4		Pattern 2, Exps 4-5 i n Visit 01 (2)	400 Secs (770 Secs) [==>385.0 Secs (Pattern 1)] [==>385.0 Secs (Pattern 2)]	[1]
	5	(WFC3UVI S.im.152967 9)	(1) SN2020WNT	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F275W	FLASH=11		Pattern 2, Exps 4-5 i n Visit 01 (2)	400 Secs (770 Secs) [==>385.0 Secs (Pattern 1)] [==>385.0 Secs (Pattern 2)]	[1]



Proposal 16768 - Visit 02 - Supernova 2020wnt: a pair-instability explosion in our backyard?

Mon Jan 10 21:00:51 GMT 2022

Visit	Proposal 16768, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 298D TO 310 D; ORIENT 112D TO 130 D; ORIENT 185D TO 205 D; ORIENT 5D TO 25 D; AFTER_01 BY 20 D TO 100 D										
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures		
		(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false							(1-4)
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	SN2020WNT	RA: 03 46 37.9500 (56.6581250d) Dec: +43 13 45.30 (43.22925d) Equinox: J2000				V=(?) z = 22 AB mag		Reference Frame: ICRS		
	<i>Comments:</i> Category=EXT-STAR Description=[SUPERNOVA] Extended=NO										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(WFC3IR.im.1530016)	(1) SN2020WNT	WFC3/IR, MULTIACCUM, GRISM1024	F140W	SAMP-SEQ=SPARS 10; NSAMP=5		Pattern 1, Exps 1-4 in Visit 02 (1)	42.936143 Secs (85.872 Secs) [=>(Pattern 1)] [=>(Pattern 2)]		[1]
	2	(WFC3IR.sp.1530000)	(1) SN2020WNT	WFC3/IR, MULTIACCUM, GRISM1024	G141	SAMP-SEQ=SPARS 50; NSAMP=13		Pattern 1, Exps 1-4 in Visit 02 (1)	602.937703 Secs (1205.875 Secs) [=>(Pattern 1)] [=>(Pattern 2)]		[1]
	3	(WFC3IR.im.1530015)	(1) SN2020WNT	WFC3/IR, MULTIACCUM, GRISM1024	F105W	SAMP-SEQ=SPARS 10; NSAMP=4		Pattern 1, Exps 1-4 in Visit 02 (1)	32.93518 Secs (65.87 Secs) [=>(Pattern 1)] [=>(Pattern 2)]		[1]
	4	(WFC3IR.sp.1530001)	(1) SN2020WNT	WFC3/IR, MULTIACCUM, GRISM1024	G102	SAMP-SEQ=SPARS 50; NSAMP=13		Pattern 1, Exps 1-4 in Visit 02 (1)	602.937703 Secs (1205.875 Secs) [=>(Pattern 1)] [=>(Pattern 2)]		[1]

