15222 - What Type of Star Made the One-of-a-kind Supernova iPTF14hls?

Cycle: 25, 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) IPTF14HLS	WFC3/UVIS	1	17-Jul-2017 16:01:41.0	yes

1 Total Orbits Used

ABSTRACT

iPTF14hls is an onging nearby supernova with spectral features identical to those of the common Type IIP class but more slowly evolving, remaining luminous for over 600 days with at least five distinct peaks in its light curve and showing evidence for multiple pre-explosion eruptions. The observed properties of iPTF14hls are unique among all known supernovae, challenge all existing explosion models and likely indicate pre-explosion eruptions with time scales and energies never observed before. Such eruptions are theorized to occur in ~95-130 solar mass stars which experience

the pulsational pair instability. If iPTF14hls is indeed the first observed case of such a supernova, then determining its progenitor mass and metallicity will provide the first observational constraints of stellar evolutionary models in these mass ranges. Since no pre-explosion high-resolution imaging of the location of iPTF14hls exist, the only way to constrain the progenitor properties (independent of the supernova) is through HST studies of the site after the event fades. Such studies will require knowing the position of iPTF14hls to few-parsec precision. We propose a single-orbit HST observation to obtain high resolution localization of iPTF14hls before it fades. These images will serve as registration anchors for future post-event observations at the required precision (not possible with ground-based AO imaging). These observations will also allow us to measure the very late-time decline rate of iPTF14hls, constraining possible power sources, and to test an alternative explanation for iPTF14hls as a lensed normal supernova, by constraining any departure from point-source emission.

OBSERVING DESCRIPTION

This is a single orbit imaging observation of a supernova in two filters (F475W and F625W) with UVIS.
We implement a 3-point dither patern for each exposure to improve spatial resolution while still maintaining a minimum exposure time above 350s (to enable buffer readout during the next exposure).

We also wish to capture the overall morphology of the host galaxy, which is approximately 10 arcseconds across. In addition, we require a large number of sources around the supernova to be able to register the current images to any future HST images taken of the host galaxy after the supernova fades, in order to study the supernova's immediate environment. To make sure that the galaxy is far enough from any chip edge and that we have enough registration sources in all directions around the supernova, we choose the UVIS2 aperture.

Visit

Proposal 15222, iPTF14hls (01) Mon Jul 17 20:01:42 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.813 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(1), (2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	IPTF14HLS	RA: 09 20 34.3000 (140.1429167d) Dec: +50 41 46.80 (50.69633d) Equinox: J2000		V=20+/-0.1	Reference Frame: ICRS

Comments: The magnitude estimate depends on the epoch of observations as the supernova continues to fade.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F475W	(1) IPTF14HLS	WFC3/UVIS, ACCUM, UVIS2	F475W	FLASH=5		Pattern 3, Exps 1-1 in iPTF14hls (01) (3)	348 Secs (1185 Secs) *[==>395.0 Secs (Pattern 1)]* *[==>395.0 Secs (Pattern 2)]* *[==>395.0 Secs (Pattern 3)]*	***[1]***
2	F625W	(1) IPTF14HLS	WFC3/UVIS, ACCUM, UVIS2	F625W	FLASH=2		Pattern 3, Exps 2-2 in iPTF14hls (01) (3)	348 Secs (1185 Secs) *[==>395.0 Secs (Pattern 1)]* *[==>395.0 Secs (Pattern 2)]* *[==>395.0 Secs (Pattern 3)]*	***[1]***

Orbit Structure