14733 - Single-Degenerate or Double-Degenerate? The Case for a Third Epoch Observation of the Confirmed Ia Supernova Remnant 0509-67.5

Cycle: 24, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Luke Hovey (PI) (Contact)	**Los Alamos National Laboratory**	**lhovey@lanl.gov**
Dr. John P. Hughes (CoI)	Rutgers the State University of New Jersey	jackph@physics.rutgers.edu
Dr. Kristoffer A. Eriksen (CoI)	Los Alamos National Laboratory	keriksen@lanl.gov

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) SNR0509-67.5	ACS/WFC	2	29-Jul-2016 15:05:50.0	yes

2 Total Orbits Used

ABSTRACT

Observations of Ia supernovae have been invaluable in measuring distances on cosmological scales and led to the discovery of the accelerating universe. Even though it is accepted that these supernovae are the result of thermonuclear explosions of accreting white dwarf stars, little is known on the progenitor systems. One important tool in constraining these systems is the observations of supernova remnants. The remnant 0509-67.5 is of particular interest in this endeavor due to its remarkably circular structure and being situated in the Large Magellanic Cloud (LMC). Being located in the LMC, we know the distance to this remnant to greater accuracy than any of the galactic remnants. This enables us to translate the proper motion measurements of the forward shock into physical units of velocity, which we have done in Hovey et al. (2015). Using these measurements we are able to assess a dynamical offset of the explosion site from the geometric center of the remnant in the east-west plane. Unfortunately we are unable to make this measurement in the north-south plane due to our second epoch observation being imaged with the WFPC2 camera after the ACS

camera failed. We are requesting a third observation of 0509-67.5 with the ACS camera so we can fully constrain the search radius for a possible surviving companion star. With a third epoch observation, we will be able to measure the proper motions around the entire rim to with much higher precision than those in Hovey et al. (2015) and place the best constraint on possible progenitor companion. This measurement is not technically challenging, but will deepen our knowledge of the progenitor systems of Ia supernovae.

OBSERVING DESCRIPTION

We have been awarded two orbits of HST time to obtain a third epoch observation of the LMC supernova remnant 0509-67.5 in order to measure the proper motions of the forward shock where the S/N was too low in our second epoch WFPC2 observation. Hence, we ask for a standard 4-point box dither pattern with the ACS WFC camera using a F658N narrow-band filter. This data will be used to constrain the search area for surviving companion stars under the single-degenerate model of Ia supernovae.

Visit

Proposal 14733, Visit 01, implementation Fri Jul 29 19:05:51 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 321.2D TO 342.2 D

Comments: We ask that this be on WFC-2 and the roll angle be as close to -28.7994 degrees (or 331.2006) as possible (determined from taking the PA_APER keyword of -31.2714 from the 2006 ACS WFC observation of 0509-67.5, then subtracting β_y of 177.528 for the WFC and then adding 180 degrees, as per the instructions found here: http://www.stsci.edu/hst/acs/documents/handbooks/cycle19/c07_obstechniques09.html in section 7.8.1) so that the PSFs of the image is nearly identical of the ACS observation taken in 2006 ID#11015 so that proper motions can be measured in low S/N portions of the remnant's rim.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187	Coordinate Frame=POS-TARG Pattern Orientation=20.67 Angle Between Sides=69.05 Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SNR0509-67.5	RA: 05 09 31.2000 (77.3800000d) Dec: -67 31 16.70 (-67.52131d) Equinox: J2000		V=18+/-.5	Reference Frame: ICRS

Comments: Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SNR0509-67.5	ACS/WFC, ACCUM, WFC2	F658N	CR-SPLIT=2		Pattern 1, Exps 1-1 in Visit 01 (1)	1333 Secs (5331 Secs)	
								[==>642.0 Secs (Pattern 1, Split 1)]	***[1]***
								[==>642.0 Secs (Pattern 1, Split 2)]	
								[==>642.0 Secs (Pattern 2, Split 1)]	
								[==>643.0 Secs (Pattern 2, Split 2)]	
								[==>690.0 Secs (Pattern 3, Split 1)]	***[2]***
								[==>690.0 Secs (Pattern 3, Split 2)]	
								[==>691.0 Secs (Pattern 4, Split 1)]	
								[==>691.0 Secs (Pattern 4, Split 2)]	

Orbit Structure