17917 - ACS WFC [O III] Imaging of the Iconic Young SNR 1E0102.2-7219 in the SMC

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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Dr. Nathan Smith (CoI)	University of Arizona

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) SNR-B0102-72.3	ACS/WFC	1	14-May-2025 16:00:25.0	yes
02	(1) SNR-B0102-72.3	ACS/WFC	1	14-May-2025 16:00:25.0	yes

2 Total Orbits Used

ABSTRACT

We propose to obtain a final Advanced Camera for Surveys (ACS) Wide-Field Channel (WFC) image in the light of [O III]4959,5007 emission of the young, oxygen-rich supernova remnant 1E0102.2-7219 (E0102) in the Small Magellanic Cloud (SMC). When combined with prior ACS/WFC images from 2003 and 2013, this will establish a 20+ year baseline of multi-epoch ACS imaging for measuring proper motions of the pristine supernova ejecta and detecting temporal changes in flux and velocity. E0102 has low line-of-sight extinction, represents the core-collapse explosion of a massive star in a low-metallicity environment akin to the high redshift universe, and has copious supporting data from extensive observations across the entire electromagnetic spectrum. This investigation of E0102 requires <0.1 arcsec spatial resolution in order to measure precise proper motions of the ejecta and resolve important physical scales at the distance of the SMC. Even with the multi-decade time baseline, the ejecta motions

to be measured are still only one to several 50 mas ACS pixels in magnitude. We thus emphasize the importance for very precise image registration of obtaining a final ACS image epoch so that images obtained through the same optical system -- with the same image scale and geometric distortions -- can be compared.

OBSERVING DESCRIPTION

As demonstrated for Cas A using WFPC2, broadband filter imaging is an effective way to reveal structure of enriched ejecta in specific elemental species in young SNRs like E0102.2-7219 (E0102) when the emission-line spectrum is dominated by a few strong features, especially the [O III]4959,5007 doublet. The ACS/WFC F475W filter covering ~400-540 nm captures the total velocity range of the [O III]-emitting ejecta in E0102 without significant contamination by stars. The ACS imaging strategy will follow standard image acquisition and dithering techniques that have been successful on prior programs. There are no special requirements for roll constraints since we expect numerous stars to be available in all image sets for alignment purposes. We use only a single normal orbit in the APT tool for estimating scheduling feasibility, with many observing windows during the remainder of Cycle 32 and beyond. We will obtain three 750 sec WFC images in a single orbit through the F475W filter using a 3-point line dither pattern to fill the interchip gap. Standard pipeline processing for removing cosmic rays and instrumental artifacts suffice for preparing the new image for comparison with the two prior F475W epochs (2003, 2013), as well as the 1995 WFPC2 Planetary Camera image through F502N. Typical [O III]4959,5007 surface brightnesses range from ~10**-14 ergs/s/cm2/arcsec2 in knots and <10**-16 ergs/s/cm2/arcsec2 in fainter filaments. A continuum image through the F550M filter was obtained during HST PID 12001 (2003) and can be aligned to the PID 12858 (2013) and new F475W images to help distinguish emission knots from stars as necessary. There are no critical timing or ORIENT constraints associated with this program.

Visit

Proposal 17917, E0102 (01), failed

Wed May 14 20:00:25 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Comments: Single orbit of F475W imaging of E0102 with LINE dithering to fill interchip gap and reject CR's.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

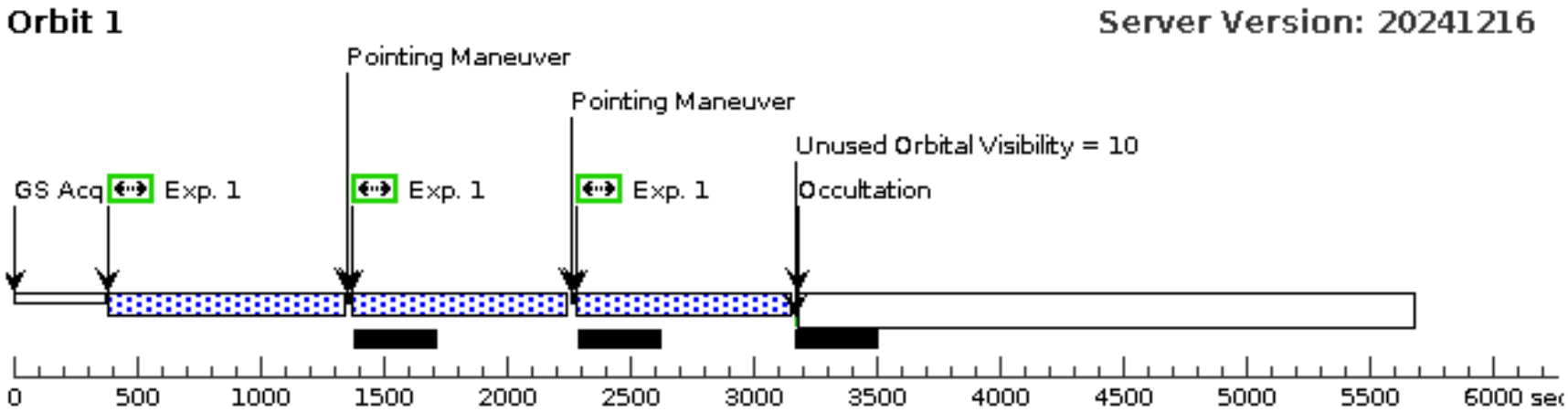
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SNR-B0102-72.3	RA: 01 04 1.2000 (16.0050000d) Dec: -72 01 52.00 (-72.03111d) Equinox: J2000	Epoch of Position: 2000	V=(?) 1.5e-14	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=ISM
Description=[SNR]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SNR-B0102-72.3	ACS/WFC, ACCUM, WFC-FIX	F475W			Pattern 1, Exps 1-1 in E0102 (01) (1)	3000 Secs (2250 Secs) *[==>750.0 Secs (Pattern 1)]* *[==>750.0 Secs (Pattern 2)]* *[==>750.0 Secs (Pattern 3)]*	***[1]***

Orbit Structure



Visit

Proposal 17917, E0102 (02) Wed May 14 20:00:26 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Comments: Single orbit of F475W imaging of E0102 with LINE dithering to fill interchip gap and reject CR's.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SNR-B0102-72.3	RA: 01 04 1.2000 (16.0050000d) Dec: -72 01 52.00 (-72.03111d) Equinox: J2000	Epoch of Position: 2000	V=(?) 1.5e-14	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=ISM
Description=[SNR]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SNR-B0102-72.3	ACS/WFC, ACCUM, WFC-FIX	F475W			Pattern 1, Exps 1-1 in E0102 (02) (1)	3000 Secs (2250 Secs) *[==>750.0 Secs (Pattern 1)]* *[==>750.0 Secs (Pattern 2)]* *[==>750.0 Secs (Pattern 3)]*	***[1]***

Orbit Structure