



17488 - Unraveling the mystery of the rare 2175 Å extinction bump in the SMC

Cycle: 31, 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) SMIDGE-S1	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	10-Sep-2024 11:00:36.0	yes
02	(2) SMIDGE-S2	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	10-Sep-2024 11:00:37.0	yes
03	(3) SMIDGE-S3	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	10-Sep-2024 11:00:38.0	yes
04	(4) SMIDGE-S4 (7) 2MASS-J00462720-7321013	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	10-Sep-2024 11:00:38.0	yes

<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>
05	(5) SMIDGE-S5	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	10-Sep-2024 11:00:39.0	yes
06	(6) SMIDGE-S6	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	10-Sep-2024 11:00:39.0	yes

9 Total Orbits Used

ABSTRACT

Understanding the properties of dust extinction is fundamental to answer questions ranging from how dust grains form to what drives galaxy evolution. The dust extinction curve at ultraviolet (UV) wavelengths is known to vary widely in the Local Group and beyond, but the reason is still not fully understood. It is an open question how, and physical conditions of the interstellar medium (ISM) may affect extinction curve features such as the far-UV rise and the properties of the 2175Å bump. The Small Magellanic Cloud (SMC) is key to studying such variations since it is our best nearby analog to low-metallicity and high-redshift observations, there are plenty of observations of its ISM, and spatially-resolved individual stars and dust/gas complexes enable analyzing correlations between environment and dust extinction properties. The limited number of high-quality SMC UV extinction curve measurements needs to be supplemented with new targeted measurements of sightlines in a variety of ISM physical conditions. We propose to measure UV extinction curves and the HI column densities of a carefully selected sample of 6 reddened, hot stars to evaluate the dependence on environment of the 2175Å bump and the FUV rise. These stars have a high probability of a strong bump in their extinction curves based on modeling their spectral energy distributions from an existing large photometric survey in the SMC Southwest Bar. Our proposed sample will triple the UV extinction curve database of SMC sightlines with a strong bump from 3 to 9 improving the statistical significance of correlations of bump properties with environment.

OBSERVING DESCRIPTION

HST STIS is the most suitable instrument for our proposed observations. We propose to obtain STIS low-resolution spectra with the 52x2 slit and the G140L grating (to measure the FUV extinction curve rise and obtain Ly-alpha to measure the HI column density) and the G230L grating (to measure the properties of the 2175 Å feature). STIS will be able to perform the observations significantly faster than COS. Our targets have $17.62 \leq F475W \leq 19.47$ mag and extinction in the V band of $0.91 \leq AV \leq 1.6$. These correspond to V-band magnitudes from 17.54 to 19.43 mag. We require a

S/N of ~ 10 at $R = 10$ since from previous STIS UV spectra work we know these criteria will allow us to measure the detailed properties of the bump and the strength of the FUV rise.

Using the STIS exposure time calculator, we find that the faintest object will require a 2452s/2407s exposure in G230L/G140L respectively. This and two other objects will require 2 orbits each when taking into consideration the instrument overheads. Our brightest object will require 271s/424s in G230L/G140L respectively, which along with two other bright objects will require one orbit each.

In total, for the 6 targets in our sample we request 9 HST orbits.

Proposal 17488 - s1 (01) - Unraveling the mystery of the rare 2175 A extinction bump in the SMC

Visit	Proposal 17488, s1 (01), completed										Tue Sep 10 15:00:40 GMT 2024
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA										
	Special Requirements: (none)										
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	SMIDGE-S1	RA: 00 45 17.5392 (11.3230800d) Dec: -73 23 44.05 (-73.39557d) Equinox: J2000				V=17.62+/-0.02		Reference Frame: ICRS		
Comments: Category=EXT-STAR Description=[B0-B2 III-I]											
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	Acq (STIS.ta.189 4285)	(1) SMIDGE-S1	STIS/CCD, ACQ, F28X50LP	MIRROR				27.8 Secs (27.8 Secs)		
									[==>]		[1]
	2	STIS-NUV (STIS.sp.18 94211)	(1) SMIDGE-S1	STIS/NUV-MAMA, ACCUM, 52X2	G230L				221.9 Secs (807.9 Secs)		
					2376 A				[==>807.9 Secs]		[1]
	3	STIS-FUV (STIS.sp.18 94214)	(1) SMIDGE-S1	STIS/FUV-MAMA, ACCUM, 52X2D1	G140L				322.6 Secs (908.6 Secs)		
				1425 A				[==>908.5999999999999 Secs]		[1]	
Orbit Structure	Orbit 1 Server Version: 20240604										

Proposal 17488 - s2 (02) - Unraveling the mystery of the rare 2175 A extinction bump in the SMC

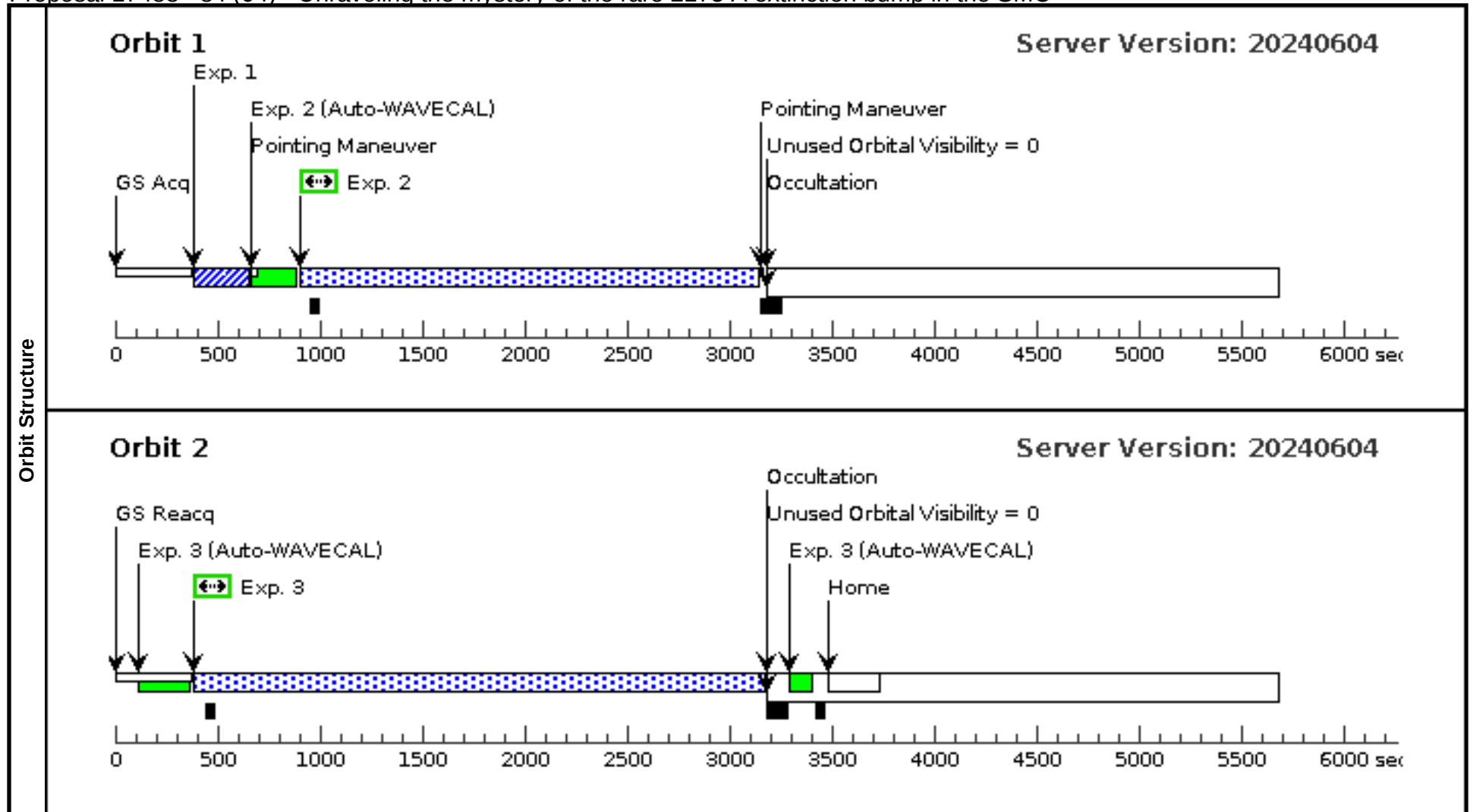
Visit	Proposal 17488, s2 (02), completed										Tue Sep 10 15:00:40 GMT 2024										
	Diagnostic Status: No Diagnostics																				
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA																				
	Special Requirements: (none)																				
Fixed Targets	#	Name		Target Coordinates				Targ. Coord. Corrections				Fluxes				Miscellaneous					
	(2)	SMIDGE-S2		RA: 00 45 10.1400 (11.2922500d) Dec: -73 21 0.29 (-73.35008d) Equinox: J2000								V=18.06+/-0.02				Reference Frame: ICRS					
	Comments: Category=EXT-STAR Description=[B3-B5 V-IV]																				
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture				Spectral Els.		Opt. Params.		Special Reqs.		Groups		Exp. Time (Total)/[Actual Dur.]				Orbit	
	1	Acq (STIS.ta.189 4286)	(2) SMIDGE-S2	STIS/CCD, ACQ, F28X50LP				MIRROR								57 Secs (57 Secs)					
																[==>]				[1]	
	2	STIS-NUV (STIS.sp.18 94287)	(2) SMIDGE-S2	STIS/NUV-MAMA, ACCUM, 52X2				G230L 2376 A								488 Secs (720 Secs)					
																[==>720.0 Secs]				[1]	
	3	STIS-FUV (STIS.sp.18 94288)	(2) SMIDGE-S2	STIS/FUV-MAMA, ACCUM, 52X2D1				G140L 1425 A								646 Secs (878 Secs)					
															[==>878.0 Secs]				[1]		
Orbit Structure	Orbit 1 Server Version: 20240604 Pointing Maneuver Exp. 2 (Auto-WAVECAL) Pointing Maneuver Exp. 3 (Auto-WAVECAL) Occultation Unused Orbital Visibility = 1 Home GS Acq Exp. 1 Exp. 2 Exp. 3 <																				

Proposal 17488 - s3 (03) - Unraveling the mystery of the rare 2175 A extinction bump in the SMC

Visit	Proposal 17488, s3 (03), completed										Tue Sep 10 15:00:40 GMT 2024										
	Diagnostic Status: No Diagnostics																				
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA																				
	Special Requirements: (none)																				
Fixed Targets	#	Name		Target Coordinates				Targ. Coord. Corrections				Fluxes				Miscellaneous					
	(3)	SMIDGE-S3		RA: 00 46 23.9256 (11.5996900d) Dec: -73 16 38.24 (-73.27729d) Equinox: J2000								V=17.96+/-0.02				Reference Frame: ICRS					
	Comments: Category=EXT-STAR Description=[B3-B5 V-IV]																				
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture				Spectral Els.		Opt. Params.		Special Reqs.		Groups		Exp. Time (Total)/[Actual Dur.]				Orbit	
	1	Acq (STIS.ta.189 4289)	(3) SMIDGE-S3	STIS/CCD, ACQ, F28X50LP				MIRROR								35 Secs (35 Secs)					
														[==>]				[1]			
	2	STIS-NUV (STIS.sp.18 94290)	(3) SMIDGE-S3	STIS/NUV-MAMA, ACCUM, 52X2				G230L 2376 A								660 Secs (736 Secs)					
														[==>736.0 Secs]				[1]			
	3	STIS-FUV (STIS.sp.18 94291)	(3) SMIDGE-S3	STIS/FUV-MAMA, ACCUM, 52X2D1				G140L 1425 A								874 Secs (950 Secs)					
															[==>950.0 Secs]				[1]		
Orbit Structure	Orbit 1 Server Version: 20240604																				

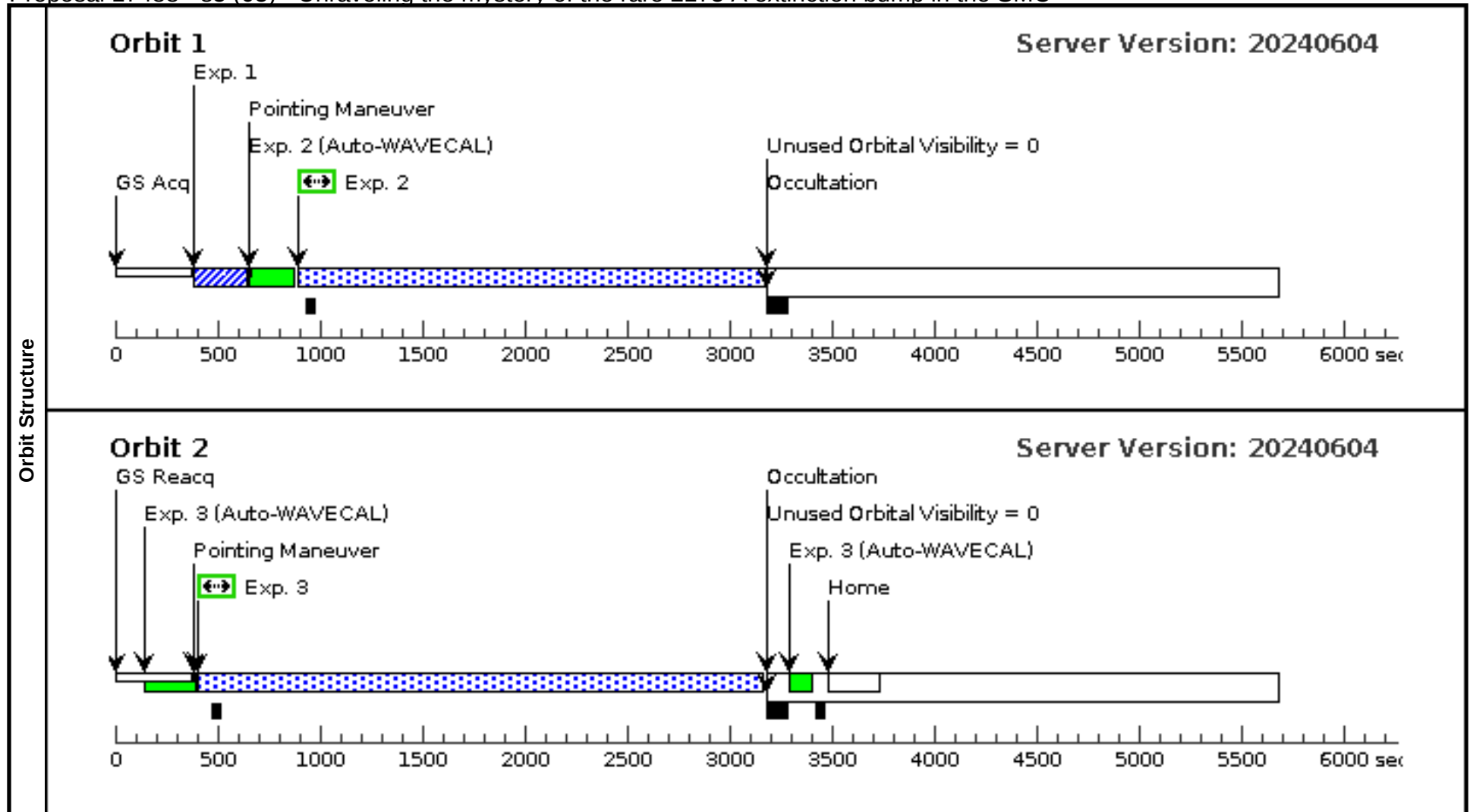
Proposal 17488 - s4 (04) - Unraveling the mystery of the rare 2175 A extinction bump in the SMC

Visit	Proposal 17488, s4 (04), implementation								Tue Sep 10 15:00:40 GMT 2024	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(4)	SMIDGE-S4	RA: 00 46 26.7980 (11.6116583d) Dec: -73 20 20.45 (-73.33901d) Equinox: J2000			V=17.99+/-0.001		Reference Frame: ICRS		
	Comments: replaced original S4 which was located in the N13 nebula due to bright UV sources and extended emission nearby. The new target is brighter and is does not appear to have other bright nearby objects of concern. Category=EXT-STAR Description=[B0-B2 V-IV]									
	(7)	2MASS-J00462720-7321013	RA: 00 46 27.2030 (11.6133458d) Dec: -73 21 1.40 (-73.35039d) Equinox: J2000			V=17.090		Reference Frame: ICRS		
Comments: 2MASS J00462720-7321013 1 00 46 27.203 -73 21 01.40 RGB*_Candidate MIR NIR RB? B= 18.390 V=17.090 J=14.966 H=14.247 K=14.269 Category=EXT-STAR Description=[K III-I]										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Acq (STIS.ta.193 5718)	(7) 2MASS-J004627 20-7321013	STIS/CCD, ACQ, F28X50LP	MIRROR				12 Secs (12 Secs)	
									[==>]	[1]
	2	STIS-NUV (STIS.sp.19 35716)	(4) SMIDGE-S4	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A				244 Secs (2199 Secs)	
									[==>2199.0 Secs]	[1]
	3	STIS-FUV (STIS.sp.19 35717)	(4) SMIDGE-S4	STIS/FUV-MAMA, ACCUM, 52X2D1	G140L 1425 A				371 Secs (2736 Secs)	
								[==>2736.0 Secs]	[2]	



Proposal 17488 - s5 (05) - Unraveling the mystery of the rare 2175 A extinction bump in the SMC

Visit	Proposal 17488, s5 (05), scheduling								Tue Sep 10 15:00:40 GMT 2024	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(5)	SMIDGE-S5	RA: 00 46 6.4704 (11.5269600d) Dec: -73 17 28.98 (-73.29138d) Equinox: J2000			V=18.275+/-0.002		Reference Frame: ICRS		
	Comments: Replaced SMIDGE-S5 with a star with similar parameters for the science proposed, and better observation parameters: J004606.4704-731728.978 Target is 9.4" away from a brighter object with V=17.7 mag. Is within or close to 5" away from objects with V=19.7 mag and 19.1 mag, resepectively. log(T) = 4.14 dex; log(g) = 3.52 dex; Av = 1.15; Rv = 2.74; => E(B-V) =~ 0.38 Category=EXT-STAR Description=[B3-B5 V-IV]									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Acq (STIS.ta.193 5424)	(5) SMIDGE-S5	STIS/CCD, ACQ, F28X50LP	MIRROR				9 Secs (9 Secs)	
									[==>]	[1]
	2	STIS-NUV (STIS.sp.19 35421)	(5) SMIDGE-S5	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A				1678 Secs (2239 Secs)	
									[==>2239.0 Secs]	[1]
	3	STIS-FUV (STIS.sp.19 35423)	(5) SMIDGE-S5	STIS/FUV-MAMA, ACCUM, 52X2D1	G140L 1425 A				2179 Secs (2708 Secs)	
								[==>2708.0 Secs]	[2]	



Proposal 17488 - s6 (06) - Unraveling the mystery of the rare 2175 A extinction bump in the SMC

Visit	Proposal 17488, s6 (06), scheduling								Tue Sep 10 15:00:40 GMT 2024	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(6)	SMIDGE-S6	RA: 00 45 19.8960 (11.3329000d) Dec: -73 22 13.80 (-73.37050d) Equinox: J2000			V=18.35+/-0.002		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[B0-B2 V-IV]									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Acq (STIS.ta.189 4398)	(6) SMIDGE-S6	STIS/CCD, ACQ, F28X50LP	MIRROR				59 Secs (59 Secs)	
									[==>]	[1]
	2	STIS-NUV (STIS.sp.18 94302)	(6) SMIDGE-S6	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A				1069 Secs (2039 Secs)	
									[==>2039.0 Secs]	[1]
	3	STIS-FUV (STIS.sp.18 94298)	(6) SMIDGE-S6	STIS/FUV-MAMA, ACCUM, 52X2D1	G140L 1425 A				1190 Secs (2708 Secs)	
								[==>2708.0 Secs]	[2]	

