14225 - Small Magellanic Cloud Ultraviolet Dust Extinction: A Focused Study of Four Sightlines Near a Molecular Cloud with Variable 2175 A bumps

Cycle: 23, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Karl D. Gordon (PI) (Contact)	**Space Telescope Science Institute**	**kgordon@stsci.edu**
Dr. Ralph C. Bohlin (CoI)	Space Telescope Science Institute	bohlin@stsci.edu
Dr. Geoffrey C. Clayton (CoI)	Louisiana State University and A & M College	gclayton@fenway.phys.lsu.edu
Dr. Edward L. Fitzpatrick (CoI)	Villanova University	edward.fitzpatrick@villanova.edu
Dr. Derck L. Massa (CoI)	Space Science Institute	dmassa@spacescience.org
Dr. Karl Misselt (CoI)	University of Arizona	kmisselt@as.arizona.edu
Dr. Karin Sandstrom (CoI)	University of California - San Diego	ksandstrom@as.arizona.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) MR12-STAR08	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	23-Jul-2015 22:57:33.0	yes
02	(2) MR12-STAR09	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	23-Jul-2015 22:57:35.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(3) MR12-STAR10	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	23-Jul-2015 22:57:36.0	yes
04	(4) MR12-STAR11	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	23-Jul-2015 22:57:37.0	yes

4 Total Orbits Used

ABSTRACT

We propose to obtain low-resolution STIS spectra covering the entire ultraviolet for four stars in the SMC to measure their UV extinction curves and HI columns. The SMC is the critical galaxy in which to study the strong 2175 A extinction bump as the this galaxy shows sightlines with and without this feature. This proposal will increase the number of sightlines in the SMC with high quality extinction curves showing a obvious 2175 A bump from one to three. The sightlines proposed here were previously observed by Maiz Apellaniz \& Rubio (2012) at very low resolution in the mid-UV using STIS slitless prism observations in a 25"x25" region centered on a known molecular cloud. They found two sightlines to having obvious 2175 A bumps and two sightlines with very weak to absent bumps. New observations are needed to improve the details of the mid-UV extinction curve (e.g. 2175 A bump centroid), measure the far-UV extinction curve, and measure the HI columns. We will combine these four new high quality extinction curves with the existing 16 SMC curves and use this enhanced sample to study environmental factors that influence the presence of the 2175 A bump (e.g., gas-to-dust ratio, PAH grain mass fraction, & radiation field).

OBSERVING DESCRIPTION

We will obtain STIS low resolution observations in the 1150 to 3180 A wavelength range of 4 reddened SMC stars in a small region in the SMC, where small spatial scale variations in dust properties will be investigated. This will triple the number of sightlines in the SMC with well measured extinction curves having a prominent 2175 A bump.

Our observational goal is to measure the full UV extinction curve of each sightline in our sample allowing the strength of the 2175 A bump and far-UV rise to be determined accurately. These features are broad (the 2175 A bump has a width of around 300-400 A) and can be well measured at a spectral resolution of 10. Our goal is to detect the signature of a 30% 2175 A depression at 3-sigma confidence. Thus, our S/N goal is 10 at a

resolution of 10. STIS/MAMA spectroscopy with the G140L and G230L gratings and the 52x2 slit is the most efficient HST observing strategy (COS would require 2X more time).

Our targets all have similar V-band brightnesses but have different amounts of dust reddening. We used the STIS ETC with the SMC Bar extinction curve (an upper limit as this gives a higher attenuation than other laws) and the appropriate stellar parameters. We have used the UV fluxes from Maiz Apellaniz & Rubio (2012). Note that we used a S/N = 1 in the STIS ETC as this should give approximately a S/N = 10 for resolution 10 (assuming the STIS resolution is 1000). Even for our faintest target, only a single orbit is needed after accounting for the overheads (guide star acq., STIS acq., 2x auto-wavecals, and necessary buffer dumps). Thus, we can get a full UV spectrum (1150-3180 A) of each of our targets in under one orbit. Given the relatively short exposure times for the brightest stars and the length of the visibility of the SMC per orbit, we have increased the exposure times to provide higher S/N detection limits as well as the ability to determine UV spectral types.

We are able to use the 2x2 slit instead of the 52x2 slit to avoid any bright object issues. No bright object issues were identified using the BOT tool. We would prefer the 52x2 slit as it allows for better background/scattered light subtraction.

Visit

Proposal 14225, Star08 (01) Fri Jul 24 02:57:38 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA, STIS/NUV-MAMA

Special Requirements: (none)

Fixed Targets

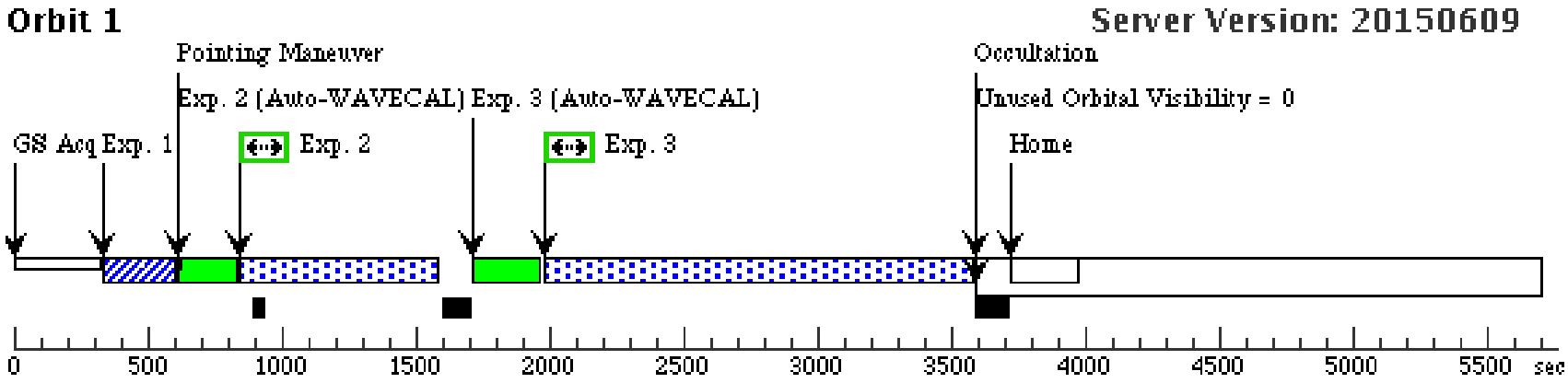
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	MR12-STAR08	RA: 00 45 33.5628 (11.3898450d) Dec: -73 18 30.56 (-73.30849d) Equinox: J2000		V=18.86+/-0.05 F(2200) ~ 6e-17, F(1500) ~ 7e-17	Reference Frame: ICRS

Comments: E(B-V) = 0.51
Extended=NO

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.731015)	(1) MR12-STAR08	STIS/CCD, ACQ, 50CCD	MIRROR				5.5 Secs (5.5 Secs) *[==>]*	*[1]*
2	STIS-NUV (STIS.sp.731019)	(1) MR12-STAR08	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A				700 Secs (700 Secs) *[==>]*	*[1]*
3	STIS-FUV (STIS.sp.731020)	(1) MR12-STAR08	STIS/FUV-MAMA, ACCUM, 52X2	G140L 1425 A				1547 Secs (1547 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 14225, Star09 (02) Fri Jul 24 02:57:38 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA, STIS/NUV-MAMA

Special Requirements: (none)

Fixed Targets

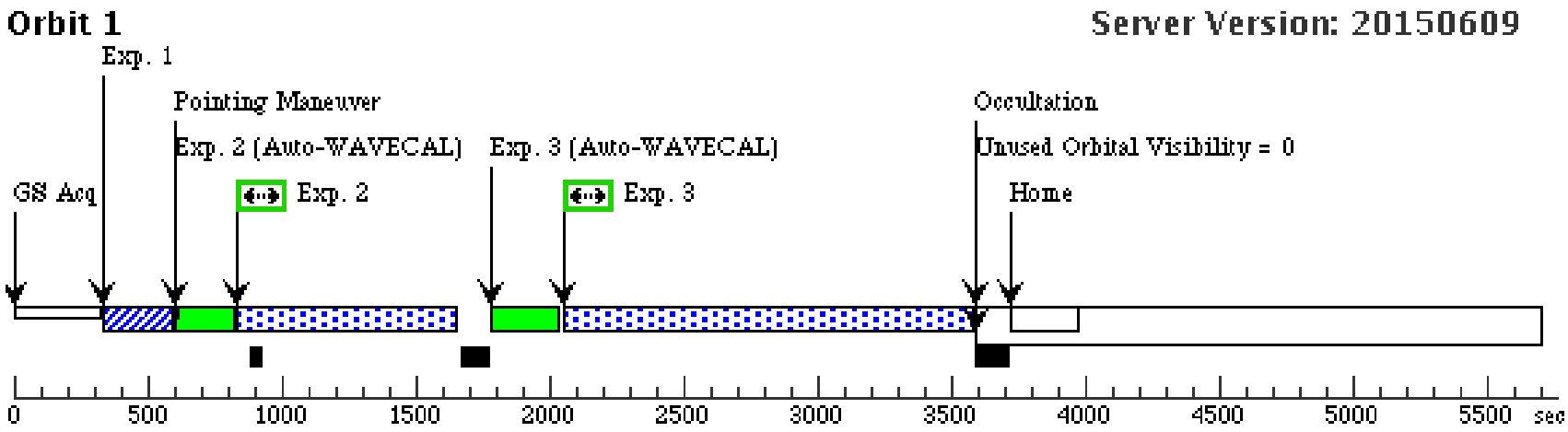
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	MR12-STAR09	RA: 00 45 35.1029 (11.3962621d) Dec: -73 18 35.87 (-73.30996d) Equinox: J2000		V=18.28+/-0.13 F(2200) ~ 4e-16, F(1500) ~ 5e-16	Reference Frame: ICRS

Comments: E(B-V) = 0.20
Extended=NO

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.731040)	(2) MR12-STAR09	STIS/CCD, ACQ, 50CCD	MIRROR				3.2 Secs (3.2 Secs) *[==>]*	*[1]*
2	STIS-NUV (STIS.sp.731038)	(2) MR12-STAR09	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A				780 Secs (780 Secs) *[==>]*	*[1]*
3	STIS-FUV (STIS.sp.731036)	(2) MR12-STAR09	STIS/FUV-MAMA, ACCUM, 52X2	G140L 1425 A				1477 Secs (1477 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 14225, Star10 (03) Fri Jul 24 02:57:38 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA, STIS/NUV-MAMA

Special Requirements: (none)

Fixed Targets

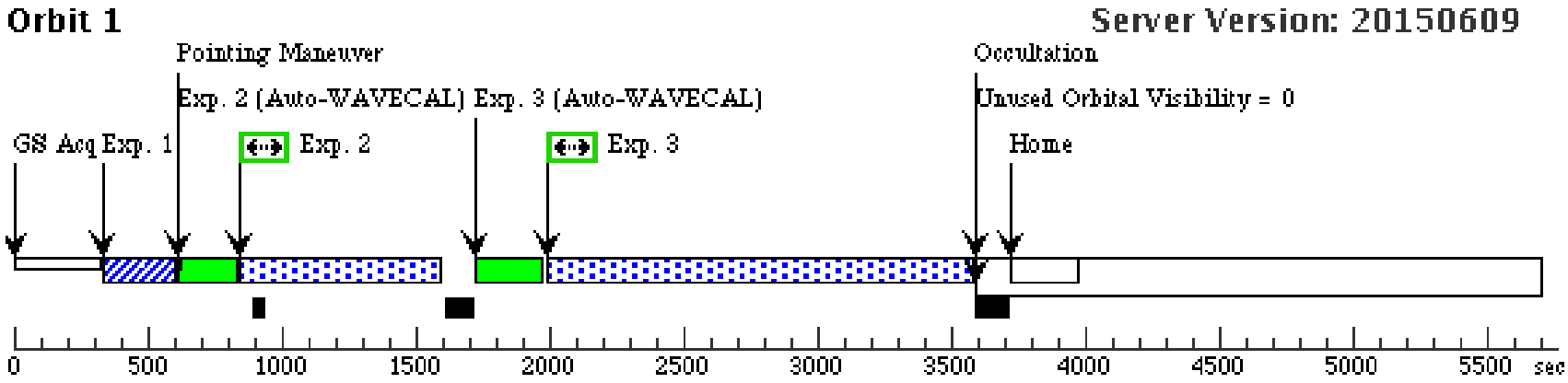
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	MR12-STAR10	RA: 00 45 37.1600 (11.4048333d) Dec: -73 18 39.95 (-73.31110d) Equinox: J2000		V=18.85+/-0.04 F(2200) ~ 1e-16, F(1500) ~ 1e-16	Reference Frame: ICRS

Comments: E(B-V) = 0.38

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.731046)	(3) MR12-STAR10	STIS/CCD, ACQ, 50CCD	MIRROR				5.6 Secs (5.6 Secs) *[==>]*	*[1]*
2	STIS-NUV (STIS.sp.731047)	(3) MR12-STAR10	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A				712 Secs (712 Secs) *[==>]*	*[1]*
3	STIS-FUV (STIS.sp.731048)	(3) MR12-STAR10	STIS/FUV-MAMA, ACCUM, 52X2	G140L 1425 A				1535 Secs (1535 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 14225, Star11 (04) Fri Jul 24 02:57:39 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA, STIS/NUV-MAMA

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	MR12-STAR11	RA: 00 45 34.4196 (11.3934150d) Dec: -73 18 41.63 (-73.31156d) Equinox: J2000		V=18.43+/-0.05 F(2200) ~ 2e-16, F(1500) ~ 3e-16	Reference Frame: ICRS

Comments: E(B-V) = 0.27

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.731052)	(4) MR12-STAR11	STIS/CCD, ACQ, 50CCD	MIRROR				3.6 Secs (3.6 Secs) *[==>]*	*[1]*
2	STIS-NUV (STIS.sp.731054)	(4) MR12-STAR11	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A				800 Secs (800 Secs) *[==>]*	*[1]*
3	STIS-FUV (STIS.sp.731056)	(4) MR12-STAR11	STIS/FUV-MAMA, ACCUM, 52X2	G140L 1425 A				1455 Secs (1455 Secs) *[==>]*	*[1]*

Orbit Structure