14342 - HST Observations of Astrophysically Important Visual Binaries

Cycle: 23, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

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) PROCYON	WFC3/UVIS	1	22-Aug-2015 21:01:50.0	yes
02	(2) MU-CAS	WFC3/UVIS	1	22-Aug-2015 21:01:55.0	yes
03	(3) SIRIUS	WFC3/UVIS	1	22-Aug-2015 21:01:59.0	yes

3 Total Orbits Used

ABSTRACT

We propose to continue our long-term program of astrometry of close visual binaries, with the primary goal of determining purely dynamical masses for 3 important main-sequence stars and 9 white dwarfs (WDs). A secondary aim is to set limits on third bodies in the systems down to planetary mass. Three of our targets are naked-eye stars with much fainter companions that are extremely difficult to image from the ground. Our other 2 targets are double WDs, whose small separations and faintness likewise make them difficult to measure using ground-based techniques. Observations have been completed for a 3rd double WD.

The bright stars, to be imaged with WFC3, are: (1) Procyon (P = 40.83 yr), containing a bright F star and a much fainter WD companion. With the continued monitoring proposed here, we will obtain masses to an accuracy of better than 1%, providing a testbed for theories of both Sun-like stars and WDs. (2) Sirius (P = 50.14 yr), an A-type star also having a faint WD companion, Sirius B, the nearest and brightest of all WDs. (3) Mu Cas (P = 21.08 yr), a nearby metal-deficient G dwarf for which accurate masses will lead to the stars' helium contents, with cosmological implications.

The faint double WDs, to be observed with FGS, are: (1) G 107-70 (P = 18.84 yr), and (2) WD 1818+126 (P = 12.19 yr). Our astrometry of these systems will add 4 accurate masses to the handful of WD masses that are directly known from dynamical measurements. The FGS measurements will also provide precise parallaxes for the systems, a necessary ingredient in the mass determinations.

OBSERVING DESCRIPTION

This is the Cycle 23 continuation of a program in which we are determining the orbits of visual binaries. The targets for Cycle 23 are Procyon, mu Cas, and Sirius.

Procyon, mu Cas, and Sirius will be observed with WFC3/UVIS. For the two very bright stars, Procyon and Sirius, we will use the long-wavelength F953N filter to reduce the signal. Since even with this filter Procyon A and Sirius A would saturate in the minimum WFC3 exposure, we will let them saturate and use the diffraction spikes to centroid the bright components. For Procyon there will be a series of dithered 38-sec exposures, which will provide good unsaturated exposures for Procyon B at the same telescope pointing. For Sirius there will be a series of 6- and 12-sec dithered exposures.

For mu Cas, we will use 1.5-sec exposures in F225W, which will not be saturated. These will be followed at each dither position with a 265-sec exposure, which will be well exposed for the cool dM companion.

Visit

Proposal 14342, Procyon (01), implementation Sun Aug 23 01:02:01 GMT 2015

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: GYRO MODE 3GOBAD; ORIENT 268.5D TO 295.7 D; AFTER 01-AUG-2016:00:00:00

Comments: ORIENT requirement is done so that companion star will not lie near diffraction spikes or charge bleeding from the very bright primary star. ORIENT updated 8/20/15 based on new plan windows.

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-2 in Procyon (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 2 (Pattern 1, Exps 1-2 in Procyon (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 3 (Pattern 1, Exps 3-4 in Procyon (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 4 (Pattern 1, Exps 3-4 in Procyon (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=true		(1-2), (3-4)

Fixed Targets

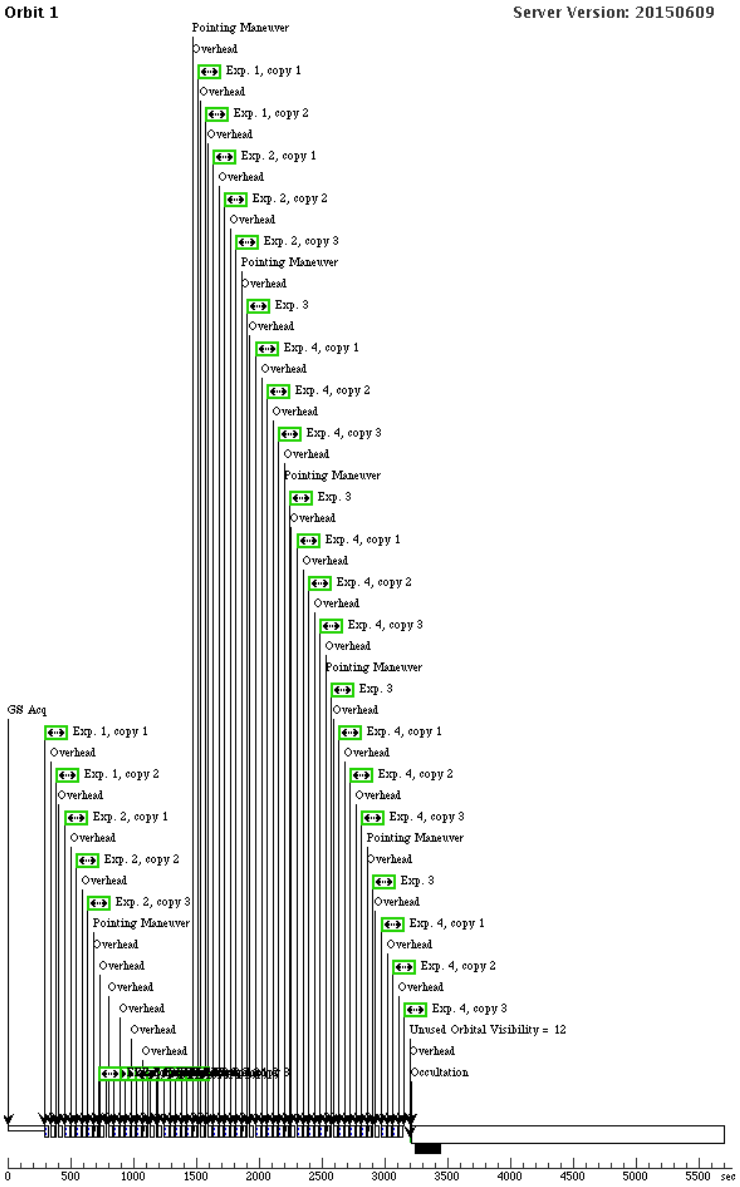
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PROCYON	RA: 07 39 18.3700 (114.8265417d)	Proper Motion RA: -0.04755 sec of time/yr	V=0.36+/-0.0	Reference Frame: ICRS
	Alt Name1: ALPHA-CMI	Dec: +05 13 35.50 (5.22653d)	Proper Motion Dec: -1.0229 arcsec/yr	B-V = 0.42	
	Alt Name2: HR2943	Equinox: J2000	Parallax: 0.283"		
			Epoch of Position: 1995.18		

Comments: Coords are for center of gravity of binary. Accuracy confirmed by 2000 Nov 28 WFPC2 observations. 6/14/06: updated to ICRS system using galex website.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PROCYON	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO; BLADE=A; FLASH=9		Pattern 1, Exps 1-2 in Procyon (01) (1)	0.5 Secs X 2 (4 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]*	***[1]***
2		(1) PROCYON	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO		Pattern 1, Exps 1-2 in Procyon (01) (1)	36 Secs X 3 (432 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 3, Copy 3)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]* *[==>(Pattern 4, Copy 3)]*	***[1]***
3		(1) PROCYON	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO; BLADE=A; FLASH=9	GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 3-4 in Procyon (01) (1)	0.5 Secs (2 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
4		(1) PROCYON	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO		Pattern 1, Exps 3-4 in Procyon (01) (1)	36 Secs X 3 (432 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 3, Copy 3)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]* *[==>(Pattern 4, Copy 3)]*	***[1]***

Orbit Structure



Visit

Proposal 14342, Mu Cas (02), implementation Sun Aug 23 01:02:01 GMT 2015

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: GYRO MODE 3GOBAD; ORIENT 2.4D TO 9.6 D; ORIENT 223.2D TO 279.6 D; BETWEEN 01-MAR-2016:00:00:00 AND 01-OCT-2016:00:00:00

Comments: ORIENT requirement is done so that companion star will not lie near diffraction spikes or charge bleeding of primary star. ORIENT updated 8/20/15 based on new plan windows.

Diagnostics

(Exposure 3 (Pattern 1, Exps 1-3 in Mu Cas (02))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 6 (Pattern 1, Exps 4-6 in Mu Cas (02))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=true		(1-3), (4-6)

Fixed Targets

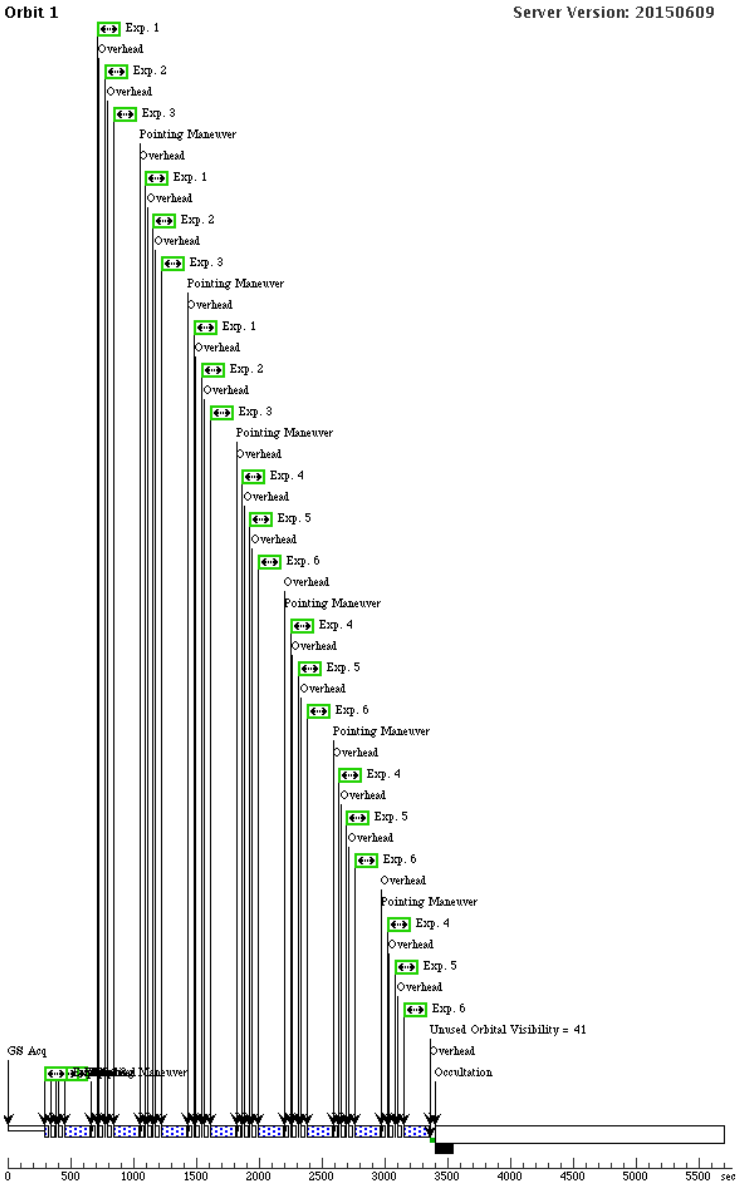
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	MU-CAS	RA: 01 08 16.3700 (17.0682083d)	Proper Motion RA: 0.3972 sec of time/yr	V=5.15+/-0.0	Reference Frame: ICRS
	Alt Name1: HR321	Dec: +54 55 13.20 (54.92033d)	Proper Motion Dec: -1.596 arcsec/yr	B-V = 0.70	
	Alt Name2: HD6582	Equinox: J2000	Parallax: 0.134"		
			Epoch of Position: 2000.0		

Comments: Coordinate accuracy confirmed by 2000-01 WFPC2 observations.
6/14/06: updated to ICRS system using galex website.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 1-3 in Mu Cas (02) (1)	0.5 Secs (2 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 1-3 in Mu Cas (02) (1)	2.5 Secs (10 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
3		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO; FLASH=6		Pattern 1, Exps 1-3 in Mu Cas (02) (1)	200 Secs (800 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
4		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 4-6 in Mu Cas (02) (1)	0.5 Secs (2 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
5		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 4-6 in Mu Cas (02) (1)	2.5 Secs (10 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
6		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO; FLASH=6		Pattern 1, Exps 4-6 in Mu Cas (02) (1)	200 Secs (800 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 14342, Sirius (03), implementation Sun Aug 23 01:02:02 GMT 2015

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: GYRO MODE 3GOBAD; ORIENT 217.3D TO 250.5 D; ORIENT 258.1D TO 340.5 D; AFTER 01-AUG-2016:00:00:00

Comments: ORIENT requirement is done so that companion star will not lie near diffraction spikes or charge bleeding from the very bright primary star. ORIENT updated 8/20/15 based on new plan windows.

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-2 in Sirius (03))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 2 (Pattern 1, Exps 1-2 in Sirius (03))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 3 (Pattern 1, Exps 3-4 in Sirius (03))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 4 (Pattern 1, Exps 3-4 in Sirius (03))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=true		(1-2), (3-4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	SIRIUS Alt Name1: ALPHA-CMA Alt Name2: HR2491	RA: 06 45 8.6300 (101.2859583d) Dec: -16 43 7.40 (-16.71872d) Equinox: J2000	Proper Motion RA: -0.038011 sec of time/yr Proper Motion Dec: -1.22308 arcsec/yr Parallax: 0.379" Epoch of Position: 2008.007	V=-1.47	Reference Frame: ICRS

Comments: Coordinates are for center of mass of the Sirius A-B binary, determined from a WFPC2 observation in January 2008 and a WFC3 observation in September 2012..

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) SIRIUS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F953N	CR-SPLIT=NO; BLADE=A		Pattern 1, Exps 1-2 in Sirius (03) (1)	6 Secs X 2 (48 Secs)	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]*	***[1]***
2		(3) SIRIUS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F953N	CR-SPLIT=NO; BLADE=A		Pattern 1, Exps 1-2 in Sirius (03) (1)	12 Secs X 2 (96 Secs)	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]*	***[1]***
3		(3) SIRIUS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F953N	CR-SPLIT=NO; BLADE=A		Pattern 1, Exps 3-4 in Sirius (03) (1)	6 Secs (24 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
4		(3) SIRIUS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F953N	CR-SPLIT=NO; BLADE=A		Pattern 1, Exps 3-4 in Sirius (03) (1)	12 Secs X 2 (96 Secs)	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]*	***[1]***

Orbit Structure