



10477 - The Masses of the O-type Binary 15 Monocerotis

Cycle: 14, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Douglas R. Gies (PI)	Georgia State University Research Foundation	
Dr. William G. Bagnuolo Jr. (CoI)	Georgia State University Research Foundation	
Dr. William I. Hartkopf (CoI)	United States Naval Observatory	
Dr. Brian D. Mason (CoI)	United States Naval Observatory	
Dr. Harold A. McAlister (CoI)	Georgia State University Research Foundation	
Dr. Edmund Nelan (CoI)	Space Telescope Science Institute	
Dr. Debra J. Wallace (CoI)	NASA Goddard Space Flight Center	

VISITS

Proposal 10477 - Overview

<i>Visit</i>	<i>Targets</i>	<i>Configurations</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) HD47839 (10) REF4 (4) REF11 (6) REF14 (8) REF2 (9) REF3 (11) REF6 (5) REF13 (2) REF8 (3) REF10 (7) REF15	FGS	1	08-Sep-2005 09:54:19.0	yes
02	(1) HD47839 (10) REF4 (4) REF11 (6) REF14 (8) REF2 (9) REF3 (11) REF6 (5) REF13 (2) REF8 (3) REF10 (7) REF15	FGS	1	08-Sep-2005 09:54:28.0	yes

2 Total Orbits Used

ABSTRACT

Proposal 10477 - Overview

The O-type star 15 Mon (HD 47839) was recently discovered to be an astrometric and spectroscopic binary with a period of 25 years; it is the first known O-star system to bridge the observational gap between the period regimes normally probed by these techniques. An analysis of both the radial velocity curve and astrometric orbit yields the masses of the components and distance to the system. Continuing radial velocity and HST/FGS astrometric measurements will lead to a definitive orbit and yield key information about the masses of O-type stars. FGS TRANS mode measurements of separation, position angle, and magnitude difference (begun in Cycle 5) are needed to link existing speckle observations and anticipated observations with the CHARA Array optical interferometer. In addition, field astrometry measurements (FGS POS mode) will provide the proper motion, parallax, and the binary motion around the center of mass. The POS data will provide an accurate estimate of the mass ratio and an improved estimate of distance, and taken together with the spectroscopic and astrometric orbital data, we will obtain masses for both components accurate to a few percent.

OBSERVING DESCRIPTION

We are continuing our long term program which has successfully run for 2 orbits in each of Cycles 5 - 13. Our first goal is to obtain FGS TRANS mode measurements of the separation, position angle, and magnitude difference of 15 Mon twice each year. We are aiming for a positional accuracy of a few mas and a photometric accuracy of 0.1 mag, both of which have been achieved in recent binary studies with the FGS.

Our second goal is to obtain complementary POS mode observations of nearby reference stars so that we can determine the proper motion, parallax, and stellar orbital motion around the system barycenter. We need two visits each year near the times of maximum parallax shift.

Because of the relative brightness of the star, the observations will be made with the 5 mag neutral density filter, F5ND. We plan to obtain approximately 10 scans in the TRANS mode of operation which should require approximately 20 minutes exposure time. The remaining 13 minutes in the orbit would be used for POS mode observations. The success of the past observations demonstrates the feasibility of the project.

We also need contemporaneous scans of the calibration target, μ Col, but we understand that plans exist for the Observatory to obtain these on a routine basis through future Cycles.

REAL TIME JUSTIFICATION

The observations need to be scheduled near the times of maximum parallax shift (early October) and at a later date near small parallax.

Proposal 10477 - Visit 01 - The Masses of the O-type Binary 15 Monocerotis

Thu Sep 08 13:54:32 GMT 2005

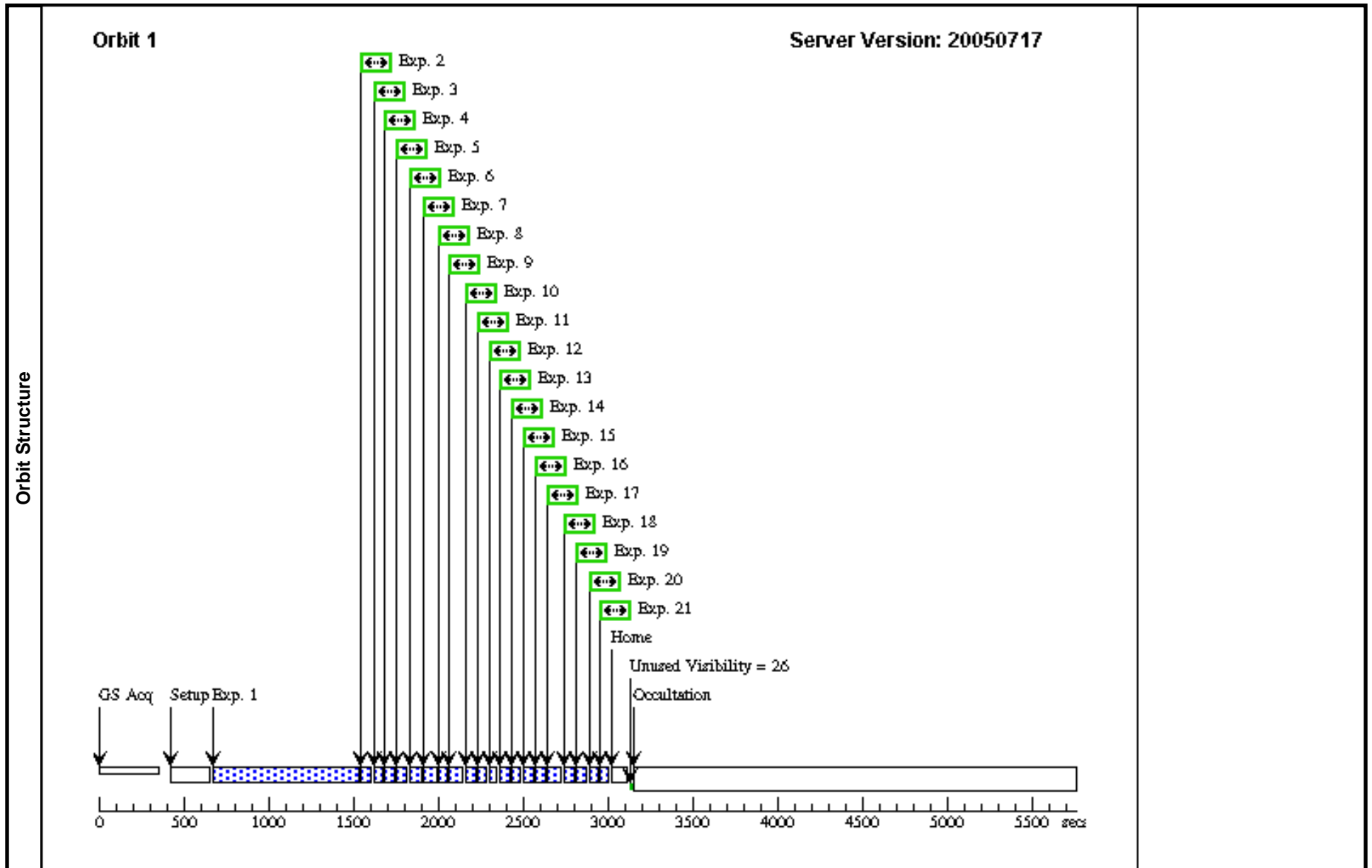
Visit		Proposal 10477, Visit 01 Diagnostic Status: No Diagnostics Scientific Instruments: FGS Special Requirements: SCHED 60%; ORIENT 280.0D TO 290.0 D; BETWEEN 05-OCT-2005:00:00:00 AND 15-OCT-2005:00:00:00					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	
	(1)	HD47839 Alt Name1: 15-MON	RA: 06 40 58.6600 (100.2444167d) Dec: +09 53 44.74 (9.89576d) Equinox: J2000 Plate Id: (?)	Proper Motion RA: -0.00004s/yr Proper Motion Dec: -0.0025"/yr Parallax: 0.001" Epoch of Position: 1991.25 Radial Velocity: 22.0 km/sec	V=4.65+/-0.02	Coordinate Source: HIPPARCOS/TYCHO_CATALOGUE	
	<i>Comments: B-V=-0.25+/-0.02, TYPE=O7V(f), LONG PERIOD BINARY</i>						
	(2)	REF8	RA: 06 41 4.5300 (100.2688750d) Dec: +09 54 44.21 (9.91228d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=10.36+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG	
	<i>Comments: #10 IN DATA FROM 2000 TO 2003</i>						
	(3)	REF10	RA: 06 40 59.2900 (100.2470417d) Dec: +09 55 20.60 (9.92239d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=12.4+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG	
	<i>Comments: #12 IN DATA FROM 2000 TO 2003</i>						
(4)	REF11	RA: 06 41 0.0000 (100.2500000d) Dec: +09 52 18.16 (9.87171d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=9.88+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG		
<i>Comments: #13 IN DATA FROM 2000 TO 2003</i>							
(5)	REF13	RA: 06 41 11.2000 (100.2966667d) Dec: +09 52 54.00 (9.88167d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=10.0+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG		
<i>Comments: #15 IN DATA FROM 2000 TO 2003</i>							
(6)	REF14	RA: 06 41 10.2000 (100.2925000d) Dec: +09 53 2.00 (9.88389d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=9.3+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG		
<i>Comments: #16 IN DATA FROM 2000 TO 2003</i>							

Proposal 10477 - Visit 01 - The Masses of the O-type Binary 15 Monocerotis

Fixed Targets (continued)	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(7)	REF15	RA: 06 40 56.4000 (100.2350000d) Dec: +09 54 7.50 (9.90208d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=12.4+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG				
	<i>Comments: #17 IN DATA FROM 2000 TO 2003</i>									
	(8)	REF2	RA: 06 41 16.4700 (100.3186250d) Dec: +09 52 13.80 (9.87050d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=12.65+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG				
	<i>Comments: #4 IN DATA FROM 2000 TO 2003</i>									
	(9)	REF3	RA: 06 40 41.3100 (100.1721250d) Dec: +09 54 14.58 (9.90405d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=13.56+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG				
<i>Comments: #5 IN DATA FROM 2000 TO 2003</i>										
(10)	REF4	RA: 06 41 12.5400 (100.3022500d) Dec: +09 52 31.91 (9.87553d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=13.74+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG					
<i>Comments: #6 IN DATA FROM 2000 TO 2003</i>										
(11)	REF6	RA: 06 40 49.4900 (100.2062083d) Dec: +09 53 23.42 (9.88984d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=11.38+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG					
<i>Comments: #8 IN DATA FROM 2000 TO 2003</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	#10	(1) HD47839	FGS, TRANS, 1	F5ND	SCANS=23; STEP-SIZE=1.0	POS TARG 0,0	Sequence 1-21 Non-Int	488.0 Secs [==>]	[1]
	2	#20	(1) HD47839	FGS, POS, 1	F5ND		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	3	#30	(7) REF15	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	4	#40	(4) REF11	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	5	#50	(11) REF6	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	6	#60	(9) REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]

Proposal 10477 - Visit 01 - The Masses of the O-type Binary 15 Monocerotis

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
Exposures (continued)	7	#70	(1) HD47839	FGS, POS, 1	F5ND	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	8	#80	(7) REF15	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	9	#90	(8) REF2	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	10	#100	(10) REF4	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	11	#110	(5) REF13	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	12	#120	(6) REF14	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	13	#130	(4) REF11	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	14	#140	(1) HD47839	FGS, POS, 1	F5ND	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	15	#150	(2) REF8	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	16	#160	(3) REF10	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	17	#170	(9) REF3	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	18	#180	(11) REF6	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	19	#190	(4) REF11	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	20	#200	(1) HD47839	FGS, POS, 1	F5ND	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	21	#210	(7) REF15	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]



Proposal 10477 - Visit 02 - The Masses of the O-type Binary 15 Monocerotis

Thu Sep 08 13:54:33 GMT 2005

Visit		Proposal 10477, Visit 02 Diagnostic Status: No Diagnostics Scientific Instruments: FGS Special Requirements: SCHED 60%; ORIENT 280.0D TO 290.0 D; BETWEEN 01-DEC-2005:00:00:00 AND 17-DEC-2005:00:00:00				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	HD47839 Alt Name1: 15-MON	RA: 06 40 58.6600 (100.2444167d) Dec: +09 53 44.74 (9.89576d) Equinox: J2000 Plate Id: (?)	Proper Motion RA: -0.00004s/yr Proper Motion Dec: -0.0025"/yr Parallax: 0.001" Epoch of Position: 1991.25 Radial Velocity: 22.0 km/sec	V=4.65+/-0.02	Coordinate Source: HIPPARCOS/TYCHO_CATALOGUE
	<i>Comments: B-V=-0.25+/-0.02, TYPE=O7V(f), LONG PERIOD BINARY</i>					
	(2)	REF8	RA: 06 41 4.5300 (100.2688750d) Dec: +09 54 44.21 (9.91228d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=10.36+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG
	<i>Comments: #10 IN DATA FROM 2000 TO 2003</i>					
	(3)	REF10	RA: 06 40 59.2900 (100.2470417d) Dec: +09 55 20.60 (9.92239d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=12.4+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG
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	(4)	REF11	RA: 06 41 0.0000 (100.2500000d) Dec: +09 52 18.16 (9.87171d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=9.88+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG
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	(5)	REF13	RA: 06 41 11.2000 (100.2966667d) Dec: +09 52 54.00 (9.88167d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=10.0+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG
	<i>Comments: #15 IN DATA FROM 2000 TO 2003</i>					
	(6)	REF14	RA: 06 41 10.2000 (100.2925000d) Dec: +09 53 2.00 (9.88389d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=9.3+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG
	<i>Comments: #16 IN DATA FROM 2000 TO 2003</i>					

Proposal 10477 - Visit 02 - The Masses of the O-type Binary 15 Monocerotis

Fixed Targets (continued)	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(7)	REF15	RA: 06 40 56.4000 (100.2350000d) Dec: +09 54 7.50 (9.90208d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=12.4+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG				
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	(8)	REF2	RA: 06 41 16.4700 (100.3186250d) Dec: +09 52 13.80 (9.87050d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=12.65+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG				
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	(9)	REF3	RA: 06 40 41.3100 (100.1721250d) Dec: +09 54 14.58 (9.90405d) Equinox: J2000 Plate Id: 03QQ	Parallax: 0.0" Epoch of Position: Radial Velocity: 0.0 km/sec	V=13.56+/-0.1	Coordinate Source: GUIDE_STAR_CATALOG				
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<i>Comments: #8 IN DATA FROM 2000 TO 2003</i>										
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	3	#30	(7) REF15	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	4	#40	(4) REF11	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	5	#50	(11) REF6	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	6	#60	(9) REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]

Proposal 10477 - Visit 02 - The Masses of the O-type Binary 15 Monocerotis

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
Exposures (continued)	7	#70	(1) HD47839	FGS, POS, 1	F5ND	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	8	#80	(7) REF15	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	9	#90	(8) REF2	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	10	#100	(10) REF4	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	11	#110	(5) REF13	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	12	#120	(6) REF14	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	13	#130	(4) REF11	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	14	#140	(1) HD47839	FGS, POS, 1	F5ND	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	15	#150	(2) REF8	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	16	#160	(3) REF10	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	17	#170	(9) REF3	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	18	#180	(11) REF6	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	19	#190	(4) REF11	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	20	#200	(1) HD47839	FGS, POS, 1	F5ND	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]
	21	#210	(7) REF15	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-21 Non-Int	10.0 Secs [==>]	[1]

