



14686 - Confirming Planetary Mass Candidate Companions in Ophiuchus

Cycle: 24, 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) CFHTWIR-OPH57	WFC3/IR WFC3/UVIS	1	09-Nov-2016 11:49:53.0	yes
02	(2) GY92-3	WFC3/UVIS	1	09-Nov-2016 11:49:54.0	yes

2 Total Orbits Used

ABSTRACT

We propose for follow-up observations to confirm common proper motion for two candidate planetary mass companions, identified as part of our GO 12944 (PI Allers) search for companions to the youngest (~0.5 Myr) brown dwarfs in the nearby Ophiuchus star-forming region. If confirmed to be co-moving, these would be among the lowest mass planetary mass companions imaged to date, with estimated masses <5 Jupiter Masses and would be vital benchmark objects for evolutionary models at these young ages. With our multi-band optical and IR photometric approach based on the SpT-

Q relation seen for Ophiuchus brown dwarfs (Allers in prep.), we have already estimated the spectral type of our candidate companions. This approach distinguishes substellar objects from background interlopers based on the strength of the 1.4 μm water feature robustly observed in MLTY objects but not in reddened background stars -- both our candidates show clear evidence of absorption at 1.4 μm . If confirmed, these candidate companions would significantly increase the census of young planetary mass companions around extremely young brown dwarfs. These candidate companions are too faint to be observed with ground-based laser guide star adaptive optics (LGS AO) nor is the 1.4 μm water feature observable from the ground for such faint objects due to telluric absorption, thus HST is the only telescope in the world suitable for these observations.

OBSERVING DESCRIPTION

In Cycle 20, we found two low mass candidate companions orbiting a brown dwarf and extremely low mass star respectively in the nearby Ophiuchus star-forming region. Both candidates show evidence of water absorption at 1.4 μm , as expected for substellar or planetary mass objects (and would not be seen if they were background stellar contaminants). However, to confirm these objects as true low mass companions, we must measure common proper motion with their primary, requiring a second epoch of observations.

1) The primary goal of the program is to confirm or refute common proper motion for the two candidate companions. If background objects, with ~ 4 years between observations, we expect ~ 100 mas of motion relative to their primaries since the first epoch. Thus, followup UVIS F850LP observations with a 40 mas platescale will be critical.

2) the secondary goal is to get a measurement of the depth of water absorption for the candidate around Oph57, which dropped out entirely in this filter in the first epoch observation, but was clearly detected in F127M. Thus, to guarantee that we go deep enough for Oph57, we split the observing time solely between F139M and F850LP.

Since the water absorption feature was already well measured in the first epoch GY92-3 observation, we will observe only in F850LP for this target.

The first epoch UVIS observations suffered a bit (in terms of cosmic ray removal issues) from only having 2 dither positions per filter (due to avoiding WFC3 full frame serial buffer dumps), so we have primarily used subapertures with either 3 point dithers or box dithers throughout here. Our science is better served by very high quality imaging of the inner 30" than lower quality, less dithered observations of the full chip.

The other thing is that the first epoch UVIS images suffered strongly from charge transfer efficiency issues. We've tried to mitigate this in a variety

of ways in this observations:

1) For GY92-3, we've chosen the UVIS2_C2K2C_SUB subaperture to place the target as close as possible to the amplifier on the chip. Since we only care about the inner 30", this should be a sufficient field of view. While the UVIS2_C512C_CTE full chip aperture is available too, GY92-3 is bright enough to saturate in less than 349 s, preventing full-frame observations. For the fainter target Oph57 we use the UVIS2_C512C_CTE aperture and the IRSUB512.

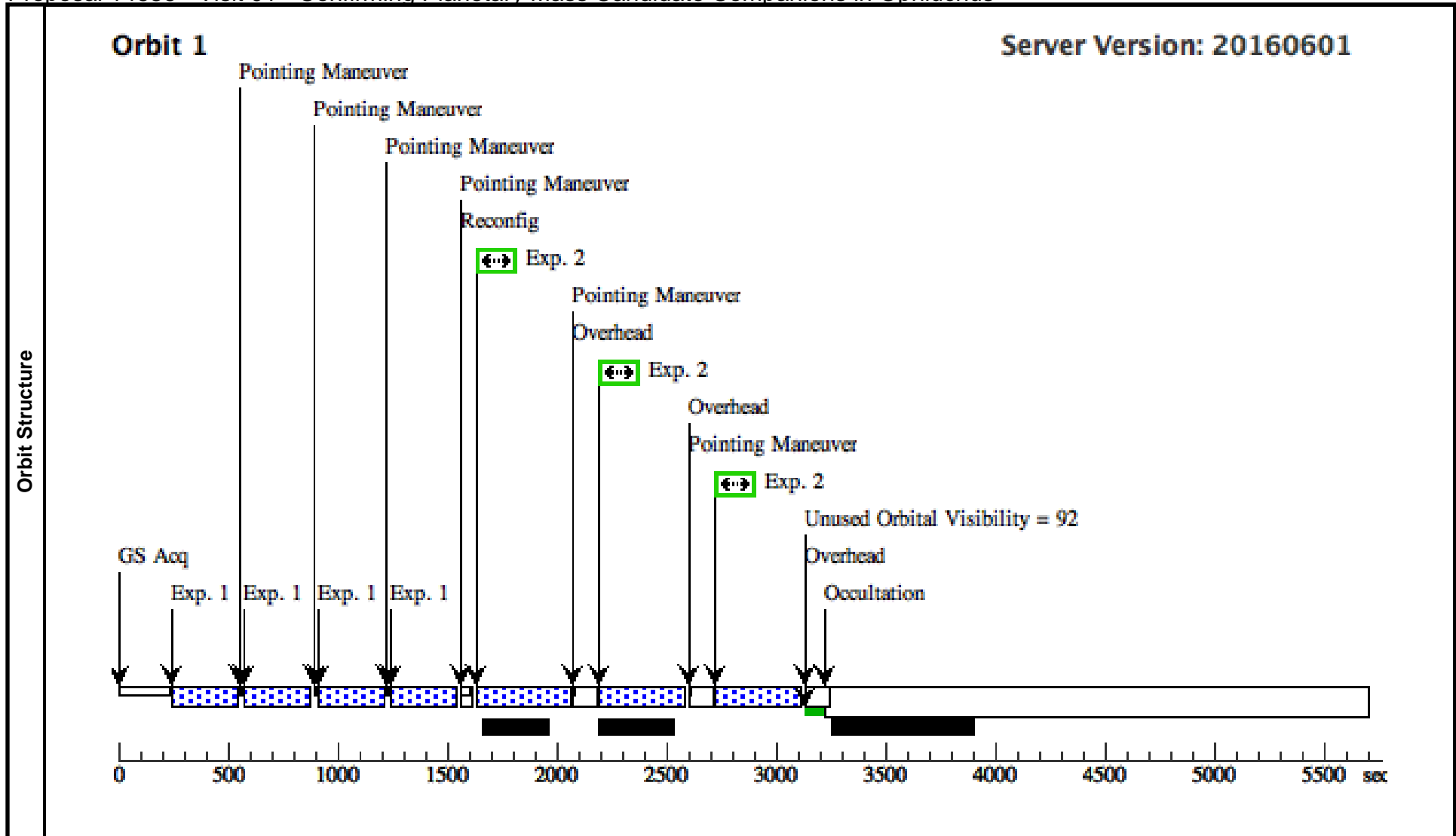
2) We've tried to make the exposures reasonably long to increase the background and have also added a postflash of 10 e- for both targets.

We've also set ORIENT ranges to avoid the candidate companions accidentally falling into the diffraction spikes.

Proposal 14686 - Visit 01 - Confirming Planetary Mass Candidate Companions in Ophiuchus

Wed Nov 09 16:49:55 GMT 2016

Visit	Proposal 14686, Visit 01, pi Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: ORIENT 0D TO 70 D; ORIENT 90D TO 160 D; ORIENT 180D TO 250 D; ORIENT 270D TO 340 D									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
		(3)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)				
	(4)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(2)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	CFHTWIR-OPH57	RA: 16 27 4.0230 (246.7667625d) Dec: -24 02 46.90 (-24.04636d) Equinox: J2000		V=(?) SpT=M7.25, J=15.06, H=13.92, K=13.18	Reference Frame: SIMBAD				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) CFHTWIR-OPH57	WFC3/IR, MULTIACCUM, IRSUB512	F139M	SAMP-SEQ=SPARS 25; NSAMP=13	GS ACQ SCENARIO SINGLE	Pattern 3, Exps 1-1 in Visit 01 (3)	275.908039 Secs (1103.632 Secs)	
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]	
2		(1) CFHTWIR-OPH57	WFC3/UVIS, ACCUM, UVIS2-C512C-CTE	F850LP	FLASH=10	POS TARG 20,20	Pattern 4, Exps 2-2 in Visit 01 (4)	396 Secs (1188 Secs)		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]	



Proposal 14686 - Visit 02 - Confirming Planetary Mass Candidate Companions in Ophiuchus

Wed Nov 09 16:49:55 GMT 2016

Visit	Proposal 14686, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 43D TO 113 D; ORIENT 133D TO 203 D; ORIENT 223D TO 293 D; ORIENT 313D TO 23 D									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
		(2)	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=false		(2)				
	(4)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	GY92-3	RA: 16 26 21.8990 (246.5912458d) Dec: -24 44 39.76 (-24.74438d) Equinox: J2000		V=(?) SpT=M6.5, I=15.62, J=12.3, H=11.5, K=10.9	Reference Frame: SIMBAD				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) GY92-3	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F850LP	FLASH=10			Pattern 4, Exps 1-1 in Visit 02 (4)	254 Secs (762 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]
2		(2) GY92-3	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F850LP	FLASH=10		POS TARG 0.28,0.20	Pattern 2, Exps 2-2 in Visit 02 (2)	254 Secs (1016 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]

