



## 13417 - Measuring the Exoplanet Mass Function Beyond the Snow-Line

Cycle: 21, 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	(2) OGLE-2007-BLG-368	WFC3/UVIS	1	05-Aug-2013 21:12:08.0	yes
02	(4) MOA-2008-BLG-379	WFC3/UVIS	1	05-Aug-2013 21:12:28.0	yes
03	(3) MOA-2008-BLG-310	WFC3/UVIS	1	05-Aug-2013 21:12:46.0	yes
04	(1) MOA-2007-BLG-192	WFC3/IR WFC3/UVIS	3	05-Aug-2013 21:13:15.0	yes

6 Total Orbits Used

### ABSTRACT

The dominant theory for the formation of planets is the core accretion theory, and in this theory, the most massive planets are thought to form beyond the snow line where ices have condensed to maximize the solid material available for the formation of planet cores. There are only 7 known

exoplanets with likely masses of less than 50 Earth-masses located beyond the snow line, and all of them been found by gravitational microlensing. Statistical analyses of the early microlensing results indicate that planets with mass ratios in the Neptune-Saturn range are quite common beyond the snow line and that planets with smaller mass ratios are more common. This appears to be in accord with the predictions of the core accretion theory, but precise tests of the theory are hampered by the fact that the mass of only one of these 7 cold, low-mass planets is known. We propose to remedy this difficulty by determining the masses of 4 additional low-mass microlens planets located beyond the snow line to bring the total number of low-mass planets beyond the snow-line to 5. We will apply innovative techniques that rely upon the high angular resolution of HST images and the unique stability of the HST point spread function. The proposed observations will provide individual planet and host star masses and distances for each of the microlensing planetary systems that we observe, and they will allow us to make a first estimate of the exoplanet mass function beyond the snow line.

The propose observations will also demonstrate the primary planetary mass measurement method of the WFIRST mission.

## **OBSERVING DESCRIPTION**

Our observing program aims to identify and characterize the host stars for 4 low-mass planetary microlensing events using the two methods that will be used by the WFIRST mission to determine the masses of planetary microlenses and their host stars. These methods determine the lens properties even though host and source stars are not individually resolved. These methods, the color dependent centroid shift (Bennett et al. 2006) and image elongation (Bennett, Anderson & Gaudi 2007) both require multiple dithered exposures. For most targets, the optimal exposure times are less than the minimum 348 second exposures that allow parallel, full-frame buffer dumps. But fortunately, even a 512 x 512 WFC3/UVIS sub-array will contain >400 bulge G and K-dwarfs, similar to the source stars, which can be used to measure the PSF.

One of the main goals of our observations is to measure the relative proper motion of the lens and source stars. The magnitude of this proper motion is generally predicted by the light curve, but the direction is unknown. But, it is possible for a companion to the source or an unrelated to mimic the signal of a bright lens star. Therefore, we must observe each target in a second epoch to confirm that the motion of the apparent lens is following the microlensing model prediction, so all WFC3/UVIS observations will be repeated in cycle 21.

Two of our targets, OGLE-2007-BLG-368 (Sumi et al. 2010) and MOA-2008-BLG-310 (Janczak et al. 2010), are relatively bright at  $I = 19.51$  and  $19.28$ , respectively, so we request only a single orbit of WFC3/UVIS observations for each of these target. Each orbit will contain 8 dithered exposures in each of the F814W and F555W passbands, so most of the observations will use 512 x 512 sub-arrays in order to avoid serial buffer dumps. These will be sufficient to measure both the color dependent centroid shift and the image elongation to better than 8-sigma for both of these

events if the excess flux seen in the ground-based AO images is indeed due to the planetary host star.

The one target without ground-based AO images is OGLE-2005-BLG-169 (Gould et al. 2006). However, the microlensing model parameters for this event even imply that the lens star will be at least 10% as bright as the source in the I band if the lens is a main sequence star (see the left panel of Fig. 1). This guarantees that the color dependent centroid shift and the image elongation will be detected at better than 20-sigma with a single orbit of observations in the F555W and F814W passbands, with the same strategy as for OGLE-2007-BLG-368 and MOA-2008-BLG-310. However, as the left panel of Fig. 3 shows, the detection of these effects does not necessarily mean that the host star mass can be determined. In particular, the mass-magnitude relation for this event, as well as the V - I centroid shift distributions are flat for  $0.2M_{\text{solar}} < M_L < 0.4M_{\text{solar}}$ . This is a consequence of the fact that the I-band mass- luminosity relation increases with the same slope that the luminosity is decreasing due to distance for this particular event, and the other events in our sample do not have this effect. It implies that we will also need to make measurements in the F438W-band so that we can determine the lens star mass in this range with the B - V centroid shift measurement. Since the target is faint in this band, we will use a series of 6 dithered 350 sec full 4096 x 4096 frame exposures.

Perhaps the most interesting event in our sample is MOA-2007-BLG-192. The original analysis of this event (Bennett et al. 2008) indicated that the planetary host star is near or below the bottom of the main sequence based on a microlensing parallax measurement. However, the microlensing parallax signal is not strong enough to give a precise mass because the direction of relative motion is not tightly constrained by the light curve. In addition, although the planetary signal is quite strong, the time coverage of the planetary signal is rather sparse. This means the effects of the finite source is also not strongly constrained. Furthermore, the color of the source star is only weakly constrained by the difference between two very similar passbands (Gould et al. 2010a).

However, ground-based AO images from the VLT/NACO instrument have detected a very red star superimposed upon the source star (Kubas et al. 2011). This implies that the lens star is likely to be a star at the bottom of the main sequence instead of a brown dwarf, but we will need to detect the color dependent centroid shift and image elongation to confirm this. These events will also yield the direction of lens-source relative motion, which will resolve the uncertainty in the microlensing parallax measurement.

The uncertainties in the light curve of this event lead to uncertainties in the mass ratio, so that unlike most events, the mass of the planet is not precisely determined even when the mass of the host star is precisely determined. Fortunately, it is possible to improve this situation by measuring the lens-source relative proper motion,  $\mu_{\text{rel}}$ , with the color dependent centroid shift and image elongation, but to reduce the uncertainty in the planet mass, we also need to measure the color of the source star. This is complicated by the fact that the source is blended with the lens star, but with

Proposal 13417 (STScI Edit Number: 1, Created: Monday, August 5, 2013 8:13:27 PM EST) - Overview

the addition of WFC3/IR observations in the F125W, and F160W observations, we should have enough information to constrain both the color of the planet host star and the source star. This will require one additional orbit for both IR passbands.

Because this star is quite faint, we will require one orbit each for the WFC3/UVIS F814W and F555W observations. For maximum S/N for both photometry and astrometry, we request 4 x 348 second full frame box-dithered exposures with parallel buffer dumps, then 4 x 185 second box dithered exposures, using a 512 x 512 sub-frame to minimize readout time and avoid buffer dump overheads.. The last exposure of each WFC3/UVIS orbit will be a full frame 30 sec exposure that will allow cross-calibration with relatively bright stars that are well observed with the microlensing survey telescopes.

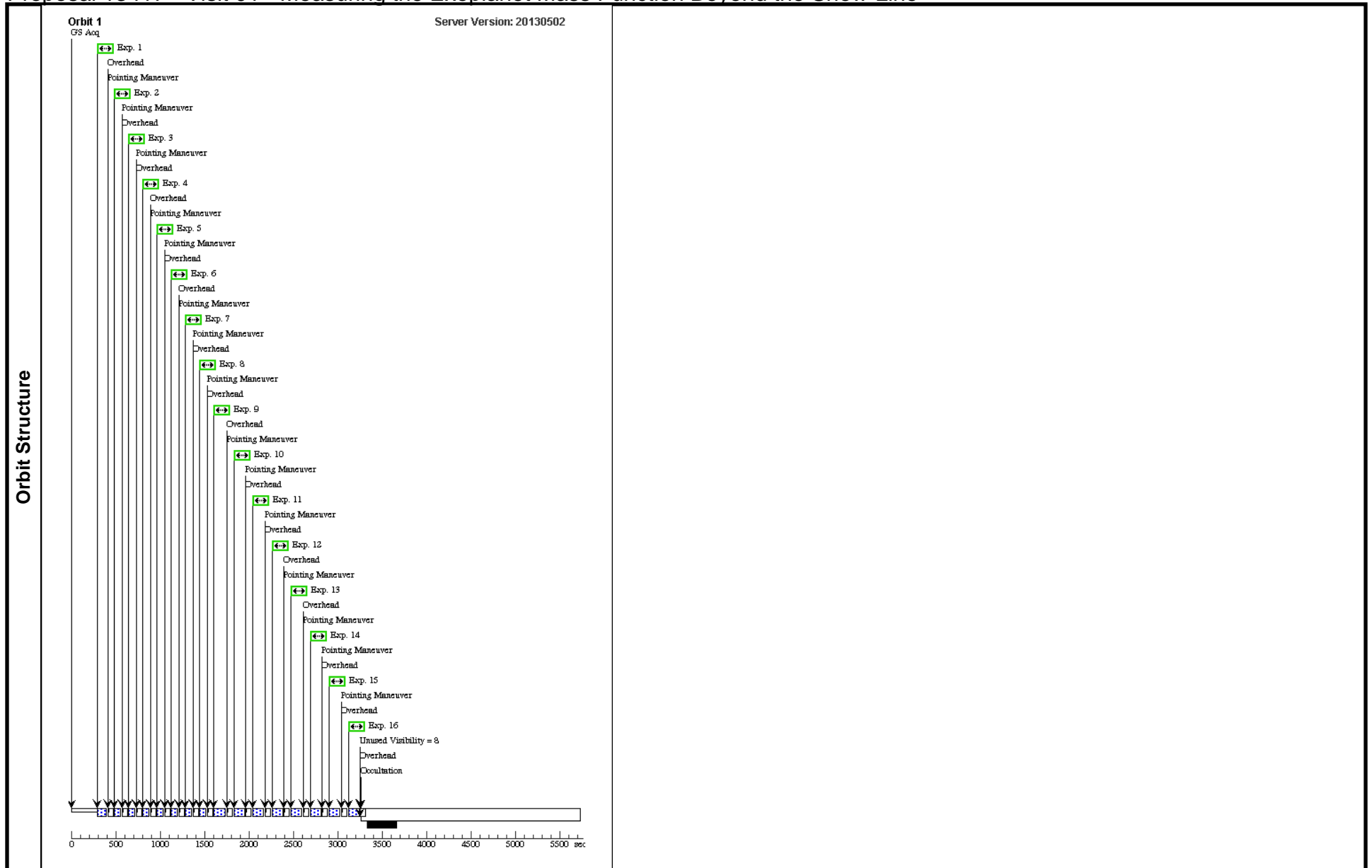
The uncertainty in the planetary mass determined by this procedure will depend on the results of the actual measurements, but it should reduce the uncertainty in the mass of the planet from a factor of  $\sim 2.5$  (Kubas et al. 2011) to about 25%.

Proposal 13417 - Visit 01 - Measuring the Exoplanet Mass Function Beyond the Snow-Line

Tue Aug 06 01:13:28 GMT 2013

Fixed Targets	Visit									
	Proposal 13417, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 264.88D TO 264.98 D									
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous					
(2)	OGLE-2007-BLG-368	RA: 17 56 25.9600 (269.1081667d) Dec: -32 14 14.70 (-32.23742d) Equinox: J2000		V=21.40+/-0.05 I = 19.51	Reference Frame: ICRS					
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0,null		70 Secs (70 Secs) [==>]	[1]
	2		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.03993, 0.18187		70 Secs (70 Secs) [==>]	[1]
	3		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.09982, 0.40488		70 Secs (70 Secs) [==>]	[1]
	4		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.17948, 0.11141		70 Secs (70 Secs) [==>]	[1]
	5		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.20944, 0.30258		70 Secs (70 Secs) [==>]	[1]
	6		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.36889, 0.09403		70 Secs (70 Secs) [==>]	[1]
	7		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.34899, 0.23212		70 Secs (70 Secs) [==>]	[1]
	8		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.38893, 0.45382		70 Secs (70 Secs) [==>]	[1]
	9		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0,null		125 Secs (125 Secs) [==>]	[1]
	10		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.03993, 0.18187		125 Secs (125 Secs) [==>]	[1]
	11		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.09982, 0.40488		125 Secs (125 Secs) [==>]	[1]
	12		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.17948, 0.11141		125 Secs (125 Secs) [==>]	[1]
	13		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.20944, 0.30258		125 Secs (125 Secs) [==>]	[1]
	14		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.36889, 0.09403		125 Secs (125 Secs) [==>]	[1]
	15		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.34899, 0.23212		125 Secs (125 Secs) [==>]	[1]
16		(2) OGLE-2007-BL G-368	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.38893, 0.45382		125 Secs (125 Secs) [==>]	[1]	

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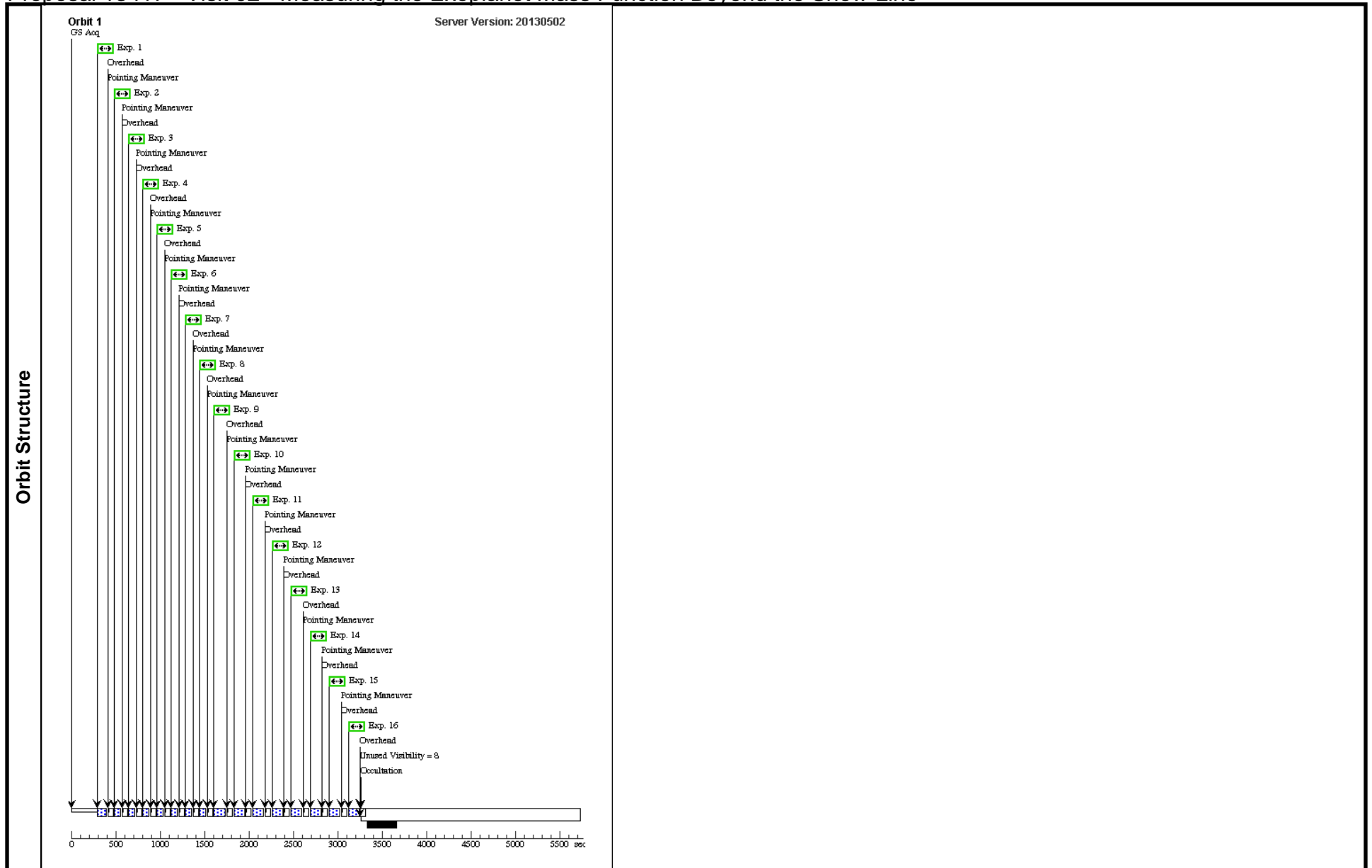


Proposal 13417 - Visit 02 - Measuring the Exoplanet Mass Function Beyond the Snow-Line

Tue Aug 06 01:13:32 GMT 2013

Visit	<b>Proposal 13417, Visit 02, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: BEFORE 01-DEC-2013:00:00:00									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(4)	MOA-2008-BLG-379	RA: 17 58 49.4350 (269.7059792d) Dec: -30 11 48.95 (-30.19693d) Equinox: J2000		V=23.6+/-0.2 I = 21.3 +- 0.1	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0,null		70 Secs (70 Secs) [==>]	[1]
	2	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.03993, 0.18187		70 Secs (70 Secs) [==>]	[1]
	3	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.09982, 0.40488		70 Secs (70 Secs) [==>]	[1]
	4	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.17948, 0.11141		70 Secs (70 Secs) [==>]	[1]
	5	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.20944, 0.30258		70 Secs (70 Secs) [==>]	[1]
	6	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.36889, 0.09403		70 Secs (70 Secs) [==>]	[1]
	7	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.34899, 0.23212		70 Secs (70 Secs) [==>]	[1]
	8	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.38893, 0.45382		70 Secs (70 Secs) [==>]	[1]
	9	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0,null		125 Secs (125 Secs) [==>]	[1]
	10	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.03993, 0.18187		125 Secs (125 Secs) [==>]	[1]
	11	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.09982, 0.40488		125 Secs (125 Secs) [==>]	[1]
	12	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.17948, 0.11141		125 Secs (125 Secs) [==>]	[1]
	13	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.20944, 0.30258		125 Secs (125 Secs) [==>]	[1]
	14	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.36889, 0.09403		125 Secs (125 Secs) [==>]	[1]
	15	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.34899, 0.23212		125 Secs (125 Secs) [==>]	[1]
16	(4) MOA-2008-BLG-379	(4) MOA-2008-BLG-379	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.38893, 0.45382		125 Secs (125 Secs) [==>]	[1]	

# Proposal 13417 - Visit O2 - Measuring the Exoplanet Mass Function Beyond the Snow-Line

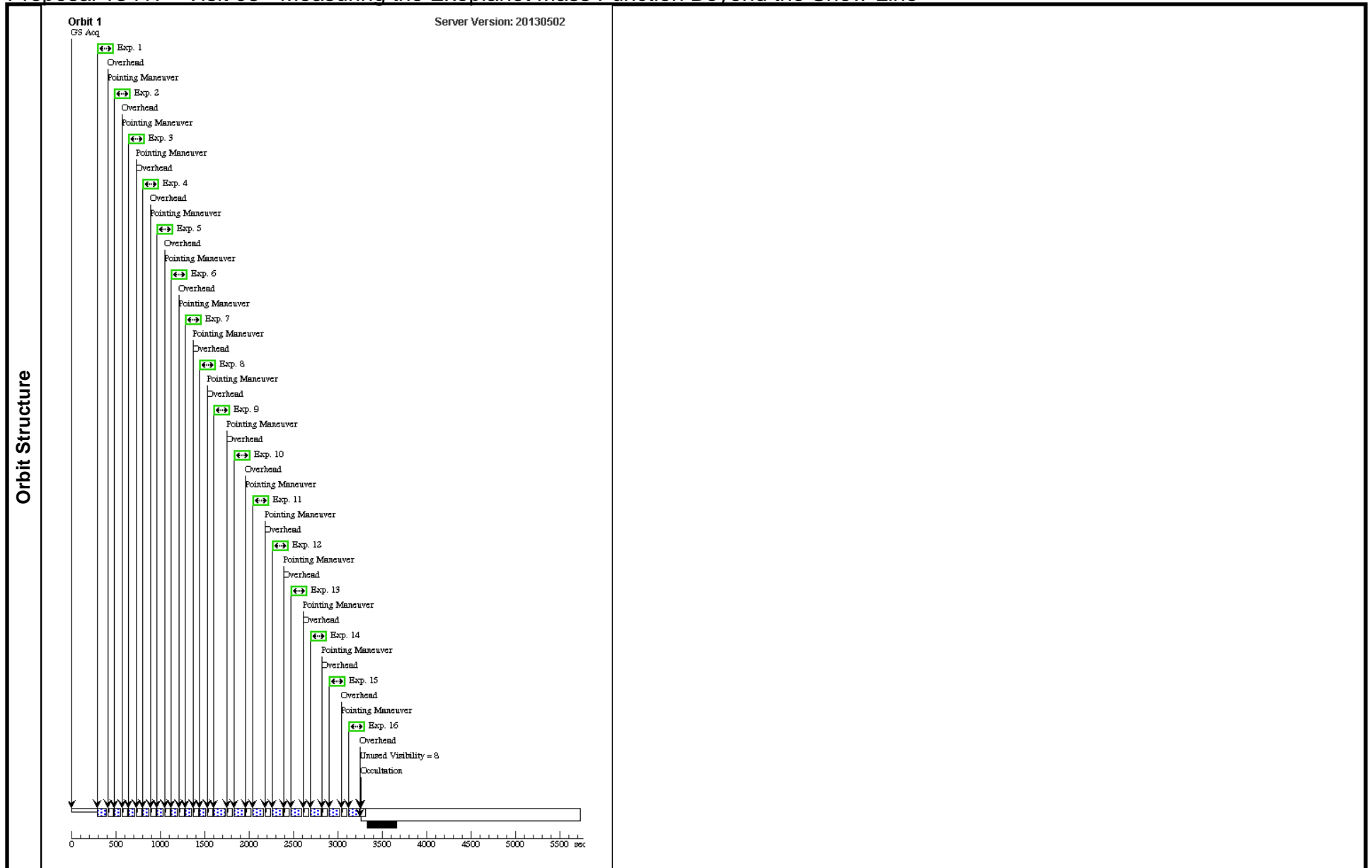


Proposal 13417 - Visit 03 - Measuring the Exoplanet Mass Function Beyond the Snow-Line

Tue Aug 06 01:13:34 GMT 2013

Fixed Targets	Visit									
	Proposal 13417, Visit 03, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 265.0D TO 265.1 D									
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous					
(3)	MOA-2008-BLG-310	RA: 17 54 14.5250 (268.5605208d) Dec: -34 46 40.99 (-34.77805d) Equinox: J2000		V=20.76+/-0.05 I = 19.28, H = 17.46	Reference Frame: ICRS					
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0,null		70 Secs (70 Secs) [==>]	[1]
	2	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.03993, 0.18187		70 Secs (70 Secs) [==>]	[1]
	3	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.09982, 0.40488		70 Secs (70 Secs) [==>]	[1]
	4	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.17948, 0.11141		70 Secs (70 Secs) [==>]	[1]
	5	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.20944, 0.30258		70 Secs (70 Secs) [==>]	[1]
	6	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.36889, 0.09403		70 Secs (70 Secs) [==>]	[1]
	7	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.34899, 0.23212		70 Secs (70 Secs) [==>]	[1]
	8	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W		POS TARG 0.38893, 0.45382		70 Secs (70 Secs) [==>]	[1]
	9	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0,null		125 Secs (125 Secs) [==>]	[1]
	10	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.03993, 0.18187		125 Secs (125 Secs) [==>]	[1]
	11	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.09982, 0.40488		125 Secs (125 Secs) [==>]	[1]
	12	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.17948, 0.11141		125 Secs (125 Secs) [==>]	[1]
	13	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.20944, 0.30258		125 Secs (125 Secs) [==>]	[1]
	14	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.36889, 0.09403		125 Secs (125 Secs) [==>]	[1]
	15	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.34899, 0.23212		125 Secs (125 Secs) [==>]	[1]
16	(3) MOA-2008-BLG-310	(3) MOA-2008-BLG-310	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W		POS TARG 0.38893, 0.45382		125 Secs (125 Secs) [==>]	[1]	

# Proposal 13417 - Visit 03 - Measuring the Exoplanet Mass Function Beyond the Snow-Line



Proposal 13417 - Visit 04 - Measuring the Exoplanet Mass Function Beyond the Snow-Line

Tue Aug 06 01:13:35 GMT 2013

<b>Visit</b>	<b>Proposal 13417, Visit 04, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: ORIENT 267.15D TO 267.25 D					
	<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>
	(1)	MOA-2007-BLG-192	RA: 18 08 3.7980 (272.0158250d) Dec: -27 09 0.27 (-27.15008d) Equinox: J2000		V=23.4+/-0.30 I = 21.44 +/- 0.08	Reference Frame: ICRS

Proposal 13417 - Visit 04 - Measuring the Exoplanet Mass Function Beyond the Snow-Line

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
Exposures	1	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W		POS TARG 0,null		205 Secs (205 Secs) [==>]	[1]	
	2	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W		POS TARG 0.03993, 0.18187		205 Secs (205 Secs) [==>]	[1]	
	3	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W		POS TARG 0.09982, 0.40488		205 Secs (205 Secs) [==>]	[1]	
	4	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W		POS TARG 0.17948, 0.11141		205 Secs (205 Secs) [==>]	[1]	
	5	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W		POS TARG 0.20944, 0.30258		205 Secs (205 Secs) [==>]	[1]	
	6	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W		POS TARG 0.36889, 0.09403		205 Secs (205 Secs) [==>]	[1]	
	7	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W		POS TARG 0.34899, 0.23212		205 Secs (205 Secs) [==>]	[1]	
	8	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W		POS TARG 0.38893, 0.45382		205 Secs (205 Secs) [==>]	[1]	
	9	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F555W		POS TARG 0,null		220 Secs (220 Secs) [==>]	[2]	
	10	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F555W		POS TARG 0.03993, 0.18187		220 Secs (220 Secs) [==>]	[2]	
	11	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F555W		POS TARG 0.09982, 0.40488		220 Secs (220 Secs) [==>]	[2]	
	12	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F555W		POS TARG 0.17948, 0.11141		220 Secs (220 Secs) [==>]	[2]	
	13	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F555W		POS TARG 0.20944, 0.30258		220 Secs (220 Secs) [==>]	[2]	
	14	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F555W		POS TARG 0.36889, 0.09403		220 Secs (220 Secs) [==>]	[2]	
	15	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F555W		POS TARG 0.34899, 0.23212		220 Secs (220 Secs) [==>]	[2]	
	16	(1) MOA-2007-BLG-192	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F555W		POS TARG 0.38893, 0.45382		220 Secs (220 Secs) [==>]	[2]	
	17	(1) MOA-2007-BLG-192	WFC3/IR, MULTIACCUM, IR	F125W		SAMP-SEQ=SPARS 25; NSAMP=13	POS TARG 0,0		302.938471 Secs (302.938 Secs) [==>]	[3]
	18	(1) MOA-2007-BLG-192	WFC3/IR, MULTIACCUM, IR	F125W		SAMP-SEQ=SPARS 25; NSAMP=13	POS TARG 0.61181, -0.00001		302.938471 Secs (302.938 Secs) [==>]	[3]
	19	(1) MOA-2007-BLG-192	WFC3/IR, MULTIACCUM, IR	F125W		SAMP-SEQ=SPARS 25; NSAMP=13	POS TARG 0.30681, 0.27324		302.938471 Secs (302.938 Secs) [==>]	[3]
	20	(1) MOA-2007-BLG-192	WFC3/IR, MULTIACCUM, IR	F125W		SAMP-SEQ=SPARS 25; NSAMP=14	POS TARG 0.91864, 0.27326		327.938986 Secs (327.939 Secs) [==>]	[3]

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21	(1) MOA-2007-BLG -192	WFC3/IR, MULTIACCUM, IR	F125W	SAMP-SEQ=SPARS 25; NSAMP=14	POS TARG 0.00178, 0.54654	327.938986 Secs (327.939 Secs)	
						[==>]	[3]
22	(1) MOA-2007-BLG -192	WFC3/IR, MULTIACCUM, IR	F125W	SAMP-SEQ=SPARS 25; NSAMP=14	POS TARG 0.61365, 0.54653	327.938986 Secs (327.939 Secs)	
						[==>]	[3]
23	(1) MOA-2007-BLG -192	WFC3/IR, MULTIACCUM, IR	F125W	SAMP-SEQ=SPARS 25; NSAMP=14	POS TARG 0.30862, 0.81985	327.938986 Secs (327.939 Secs)	
						[==>]	[3]
24	(1) MOA-2007-BLG -192	WFC3/IR, MULTIACCUM, IR	F125W	SAMP-SEQ=SPARS 25; NSAMP=14	POS TARG 0.92052, 0.81987	327.938986 Secs (327.939 Secs)	
						[==>]	[3]

