



17397 - Confirming the first isolated dark stellar remnant candidate discovered by interferometric microlensing

Cycle: 30, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
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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) KMT-2023-BLG-0025	WFC3/UVIS	1	05-Jul-2024 11:00:38.0	yes
02	(1) KMT-2023-BLG-0025	WFC3/UVIS	1	05-Jul-2024 11:00:39.0	yes

2 Total Orbits Used

ABSTRACT

We propose to confirm an isolated dark stellar remnant candidate identified based on the recently established method of VLTI-GRAVITY interferometric microlensing. The present mass measurement of the lens ($2.20^{+0.31}_{-0.23}$ Msun) is consistent with either a neutron star or a low-mass black hole in the so-called "mass gap", and it will improve to a much better precision of $\sim 5\%$ when the complete light curve becomes available in 2024. However, the lens can also be a normal star blended with the microlensed red giant source, and the possibility of a luminous lens can only be definitively distinguished from a dark lens with the proposed HST observations. If the lens is confirmed to be dark by HST, it will be the

first isolated low-mass dark stellar remnant having a mass measurement, with exciting potential implications on the physics of compact objects and their formation pathways.

OBSERVING DESCRIPTION

We will use the UVIS channel of WFC3 to image the target in both F555W (V) and F814W (I) at two epochs. (An adjustment is made from F606W to F555W proposed in Phase 1 to yield a more precise result.)

The first epoch is very time-critical, and the sooner it is executed, the higher the magnification for leveraging the blended flux constraint. The upcoming available window is in August 2023, and if possible, it should be scheduled by mid-August when the event is magnified with $A \sim 1.2$. The scheduling of first epoch should absolutely be no later than October 2023 when the event is still magnified with $A = 1.1$.

The second epoch needs to be scheduled in 2024 when the event returns to the baseline.

The UVIS2-C1K1C-SUB subarray mode will be used to avoid buffer dumps, optimize observing efficiency, and minimize the CTE effects.

For the first epoch (\sim Aug 15), we expect the target to be at $(V, I) \sim (18.7, 15.2)$, after making careful magnitude calibrations. We plan to take multiple exposures for each filter to mitigate the possible effects of CRs, artifacts, or imperfectly subtracted hot pixels. For F555W and F814W, seven and five exposures will be taken, respectively. For each exposure, we use ETC to ensure obtaining sufficient SNR and also the peak pixel being well below saturation. We will follow the 7-point and 5-point dithering patterns in Instrument Science Report WFC3 2020-07 (Anderson 2020). The seven/five points spread the target around in the pixel phase to obtain a well-sampled image for optimizing high-precision photometry.

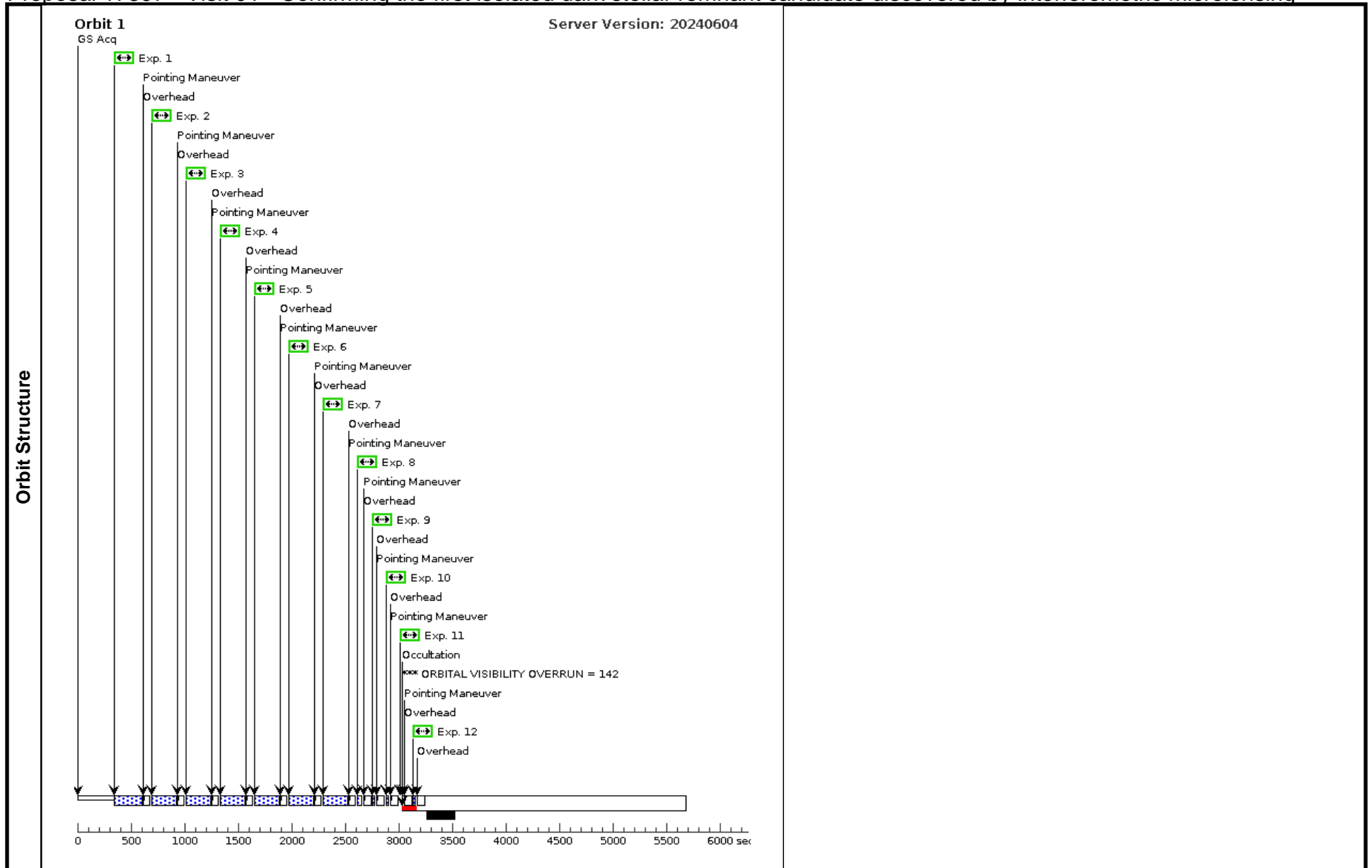
The second epoch has the same observing strategy as the first epoch to optimize differential photometry.

Proposal 17397 - Visit 01 - Confirming the first isolated dark stellar remnant candidate discovered by interferometric microlensing

Fri Jul 05 15:00:40 GMT 2024

Visit	Proposal 17397, Visit 01, completed Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: BETWEEN 01-AUG-2023:00:00:00 AND 31-OCT-2023:00:00:00 <i>Comments: This visit must be made as soon as possible, by mid-August 2023 if at all possible, but absolutely no later than October 2023.</i>									
	(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	KMT-2023-BLG-0025	RA: 17 31 42.6125 (262.9275521d) Dec: -30 46 17.02 (-30.77139d) Equinox: J2000	Proper Motion RA: 2.043 mas/yr Proper Motion Dec: -5.642 mas/yr Epoch of Position: 2016.0	V=18.7+/-0.2 I ~ 15.2+/-0.1	Reference Frame: ICRS				
<i>Comments: Category=STAR Description=[K III-I]</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0,0		236 Secs (231 Secs) [==>231.0 Secs]	[1]
	2	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.0894,0.3341		236 Secs (231 Secs) [==>231.0 Secs]	[1]
	3	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.1785,0.1908		236 Secs (231 Secs) [==>231.0 Secs]	[1]
	4	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.2679,0.5249		236 Secs (231 Secs) [==>231.0 Secs]	[1]
	5	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.3173,0.3591		236 Secs (231 Secs) [==>231.0 Secs]	[1]
	6	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.4100,0.6967		236 Secs (231 Secs) [==>231.0 Secs]	[1]
	7	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.5024,0.5158		236 Secs (231 Secs) [==>231.0 Secs]	[1]
	8	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0,0		30 Secs (25 Secs) [==>25.0 Secs]	[1]
	9	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0.1719,0.1837		30 Secs (25 Secs) [==>25.0 Secs]	[1]
	10	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0.3437,0.3674		30 Secs (25 Secs) [==>25.0 Secs]	[1]
	11	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0.4760,0.5286		30 Secs (25 Secs) [==>25.0 Secs]	[1]
	12	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0.6544,0.6796		30 Secs (25 Secs) [==>25.0 Secs]	[1]

Proposal 17397 - Visit 01 - Confirming the first isolated dark stellar remnant candidate discovered by interferometric microlensing



Proposal 17397 - Visit 02 - Confirming the first isolated dark stellar remnant candidate discovered by interferometric microlensing

Fri Jul 05 15:00:40 GMT 2024

Visit	Proposal 17397, Visit 02, pi Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 34.6D TO 104.6 D; ORIENT 124.6D TO 194.6 D; ORIENT 214.6D TO 284.6 D; ORIENT 304.6D TO 14.6 D; BETWEEN 01-FEB-2024:00:00:00 AND 31-OCT-2025:00:00:00 Comments: We apply various Orient constraints to avoid diffraction spikes landing near our target.									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(1)	KMT-2023-BLG-0025	RA: 17 31 42.6125 (262.9275521d) Dec: -30 46 17.02 (-30.77139d) Equinox: J2000	Proper Motion RA: 2.043 mas/yr Proper Motion Dec: -5.642 mas/yr Epoch of Position: 2016.0	V=18.7+/-0.2 I ~ 15.2+/-0.1	Reference Frame: ICRS				
	Comments: Category=STAR Description=[K III-I]									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0,0		236 Secs (211 Secs) [==>211.0 Secs]	[1]
	2	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.0894,0.3341		236 Secs (211 Secs) [==>211.0 Secs]	[1]
	3	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.1785,0.1908		236 Secs (211 Secs) [==>211.0 Secs]	[1]
	4	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.2679,0.5249		236 Secs (211 Secs) [==>211.0 Secs]	[1]
	5	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.3173,0.3591		236 Secs (211 Secs) [==>211.0 Secs]	[1]
	6	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=14	POS TARG 0.4100,0.6967		236 Secs (211 Secs) [==>211.0 Secs]	[1]
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	8	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0,0		30 Secs (25 Secs) [==>25.0 Secs]	[1]
	9	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0.1719,0.1837		30 Secs (25 Secs) [==>25.0 Secs]	[1]
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	11	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0.4760,0.5286		30 Secs (25 Secs) [==>25.0 Secs]	[1]
12	(1) KMT-2023-BLG-0025	(1) KMT-2023-BLG-0025	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=20	POS TARG 0.6544,0.6796		30 Secs (25 Secs) [==>25.0 Secs]	[1]	

Proposal 17397 - Visit 02 - Confirming the first isolated dark stellar remnant candidate discovered by interferometric microlensing

