15884 - Confirmation of an Astrometrically Detected Exoplanet Candidate Orbiting the closest Brown Dwarfs

Cycle: 27, Proposal Category: GO

(Availability Mode: SUPPORTED)

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) LUHMAN-16-SFT	WFC3/UVIS	1	11-Oct-2021 19:00:16.0	yes
02	(3) LUHMAN16AB-SFT	WFC3/UVIS	1	11-Oct-2021 19:00:17.0	yes

2 Total Orbits Used

ABSTRACT

At a distance of slightly less than 2 pc WISE 1049-5319 (or Luhman 16 AB) is the closest system to Earth after those of alpha Centauri and Barnard's Star.

The analysis of astrometric measurements collected in 12 HST epochs (between 2014.64 and 2016.76) revealed a weak astrometric signature indicating the presence of an exoplanet in the Luh16AB system. This candidate was reported in 2017. A single additional epoch ---collected in August 2018--- and re-analysis of the data with more advanced methods increased the significance level of the planet candidate.

Here we propose to use HST in the same observing mode to collect data at two new epochs to confirm or disprove the astrometric signature that suggest the presence of a sub-Neptune-mass exoplanet orbiting one component of the closest known brown dwarf system. If confirmed, it would be the first astrometrically detected exoplanet around a brown dwarf and the third closest known exoplanet; a major discovery which only requires a relatively modest investment of two additional HST orbits.

The proposed epochs will extend the temporal coverage of the astrometric monitoring to two planet orbital periods (based on the current orbit fits). Coverage over two periods is required to: (a) confirm that our model of the planetary system is predictive, and (b) verify and refine uncertainty estimates. Furthermore, should the orbit be non-circular, these additional measurements will determine this and significantly improve the orbital semi-major axis measurement.

OBSERVING DESCRIPTION

Each epoch contains three images in point source imaging mode, and four in spatial-scanning mode with WFC3/UVIS.

In addition to the images taken in spatial scan mode and to the short two point-source images at the beginning and at the end of the single orbit-visits --- as requested at the phase I stage --- it turned out possible to fit in the orbit one extra point source images of 348s in F606W. The color information will be a precious to discriminate the nature (and so the distance) of the reference sources in the field (for example to separate slow close by red dwarf from far away giants)

Visit

Proposal 15884, 2019 OCT (01), completed Mon Oct 11 23:00:18 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 225D TO 260 D; BETWEEN 19-OCT-2019 AND 25-OCT-2019

Comments: Epoch 2019 OCT.
This is the epoch is taken at the ricciolo of the cycloid apparent motion.
The epoch must be around 2019-10-20 +/- 15 days

Diagnostics

(2019 OCT (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Exposure 1 (2019 OCT (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 (2019 OCT (01))) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Exposure 7 (2019 OCT (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Fixed Targets

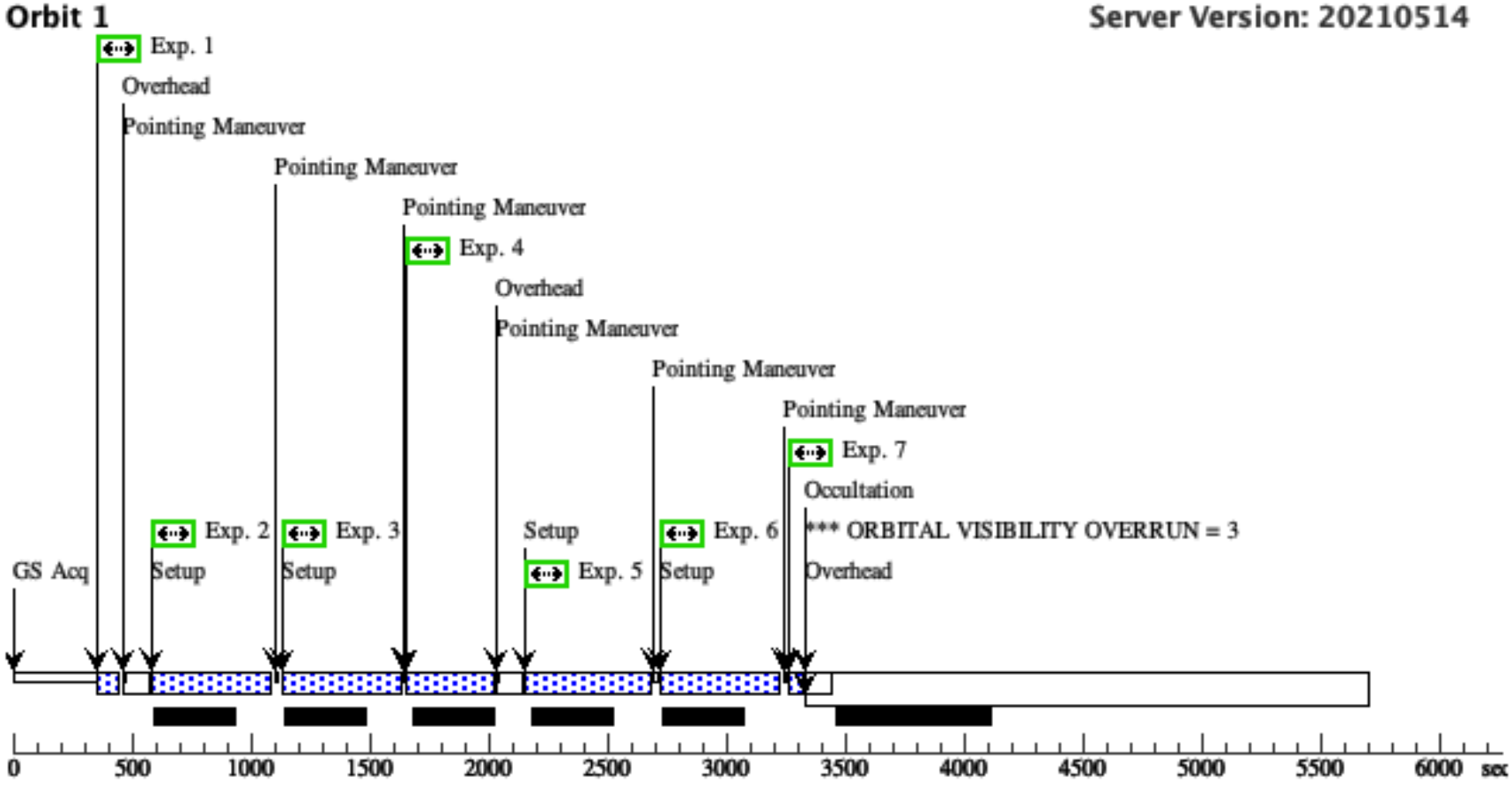
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LUHMAN-16-SFT Alt Name1: WISE1049-5319	RA: 10 49 12.1430 (162.3005958d) Dec: -53 19 34.59 (-53.32628d) Equinox: J2000	Proper Motion RA: -0.3079031198719211 sec of time/yr Proper Motion Dec: 0.354 arcsec/yr Epoch of Position: 2015.5	V=16.2	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
This a binary with the two component at ~ 1 arcsec separation
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) LUHMAN-16-SFT	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=12	POS TARG -4,4		60 Secs (60 Secs) *[==>]*	 ***[1]***
2		(1) LUHMAN-16-SFT	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=12	POS TARG -4,4; SPATIAL SCAN 0.0 12,270.0 Degrees,Forward,0.45 Arcsec,6		378 Secs (378 Secs) *[==>]*	 ***[1]***
3		(1) LUHMAN-16-SFT	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=12	POS TARG -4,-4; SPATIAL SCAN 0.0 12,0.0 Degrees,Forward,0.45 Arcsec,6		378 Secs (378 Secs) *[==>]*	 ***[1]***
4		(1) LUHMAN-16-SFT	WFC3/UVIS, ACCUM, UVIS1	F606W	FLASH=12	POS TARG 0,0		348 Secs (348 Secs) *[==>]*	 ***[1]***
5		(1) LUHMAN-16-SFT	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=12	POS TARG 4,4; SPATIAL SCAN 0.0 12,180.0 Degrees,Forward,0.45 Arcsec,6		378 Secs (378 Secs) *[==>]*	 ***[1]***
6		(1) LUHMAN-16-SFT	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=12	POS TARG 4,-4; SPATIAL SCAN 0.0 12,90.0 Degrees,Forward,0.45 Arcsec,6		378 Secs (378 Secs) *[==>]*	 ***[1]***
7		(1) LUHMAN-16-SFT	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=12	POS TARG 4,-4		60 Secs (60 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 15884, 2021 NOV (02), implementation Mon Oct 11 23:00:18 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 345D TO 35 D; AFTER 01-NOV-2021:00:00:00

Comments: Epoch 2021 NOV
This is the epoch is taken at the ricciolo of the cycloid apparent motion.
The epoch must be after 2021-11-01

Diagnostics

(2021 NOV (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Exposure 4 (2021 NOV (02))) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	LUHMAN16AB-SFT	RA: 10 49 15.5000 (162.3145833d) Dec: -53 19 20.60 (-53.32239d) Equinox: J2000		V=24+/-1 Sloan-i = 15 +/- .5	Reference Frame: ICRS

Comments: We have mapped the relative path of Luhman 16AB between 2014 and 2016
Category=STAR
Description=[BROWN DWARF]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) LUHMAN16AB-SFT	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=18	POS TARG -4,4		59 Secs (59 Secs) *[==>]*	 ***[1]***
2		(3) LUHMAN16AB-SFT	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=12	POS TARG -4,4; SPATIAL SCAN 0.0 12,270.0 Degrees,Forward,0.45 Arcsec,6		378 Secs (378 Secs) *[==>]*	 ***[1]***
3		(3) LUHMAN16AB-SFT	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=12	POS TARG -4,-4; SPATIAL SCAN 0.0 12,0.0 Degrees,Forward,0.45 Arcsec,6		378 Secs (378 Secs) *[==>]*	 ***[1]***
4		(3) LUHMAN16AB-SFT	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0,0		348 Secs (348 Secs) *[==>]*	 ***[1]***
5		(3) LUHMAN16AB-SFT	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=12	POS TARG 4,4; SPATIAL SCAN 0.0 12,180.0 Degrees,Forward,0.45 Arcsec,6		378 Secs (378 Secs) *[==>]*	 ***[1]***
6		(3) LUHMAN16AB-SFT	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=12	POS TARG 4,-4; SPATIAL SCAN 0.0 12,90.0 Degrees,Forward,0.45 Arcsec,6		378 Secs (378 Secs) *[==>]*	 ***[1]***
7		(3) LUHMAN16AB-SFT	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=18	POS TARG 4,-4		58 Secs (58 Secs) *[==>]*	 ***[1]***

Orbit Structure