



# 17841 - Tracing the wobble: astrometric monitoring of the first Y+Y brown dwarf binary

Cycle: 32, Proposal Category: GO  
(Availability Mode: SUPPORTED)

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>
<b>Dr. Clemence Fontanive (PI) (CSA Member) (Contact)</b>	<b>Universite de Montreal</b>
Dr. Luigi R. Bedin (CoI) (ESA Member)	INAF - Osservatorio Astronomico di Padova
Dr. Loic Albert (CoI) (CSA Member)	Universite de Montreal
Dr. Matthew De Furio (CoI) (AdminUSPI)	University of Texas at Austin

## 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) WISE0336-0143	WFC3/IR	1	13-Aug-2024 16:00:51.0	yes
02	(1) WISE0336-0143	WFC3/IR	1	13-Aug-2024 16:00:52.0	yes

2 Total Orbits Used

## ABSTRACT

We propose a comprehensive astrometric follow-up of the first Y+Y brown dwarf binary, WISE 0336-0143 AB, a <1-AU separation and low mass ratio system detected with JWST. We aim to follow the ~50-mas astrometric wobble of the photocentre resulting from the binary orbital motion, by exploiting HST's high astrometric precision with WFC3/IR. Our program will accurately measure the system's proper motion, trigonometric parallax, and orbital configuration, at an unprecedented accuracy of <0.5 mas through absolute astrometric calibrations using Gaia.

Capitalising on the three archival HST epochs already available and the recent JWST results, we have a unique opportunity to simultaneously refine

Proposal 17841 (STScI Edit Number: 0, Created: Tuesday, August 13, 2024 at 3:00:52 PM Eastern Standard Time) - Overview

the system's distance and to measure the individual components' dynamical masses, by acquiring only four new HST epochs over the next two years. These additional carefully timed datasets are required to demarcate the absolute astrometric displacement of the barycentre and remaining on-sky offsets due to the orbital motion of the binary components around the centre of mass.

This work will be crucial to anchor current and future observed characteristics of the unique WISE 0336-0143 benchmark, significantly contributing to our understanding of its fundamental and binary properties, and an important step forward in the characterisation and atmospheric modelling of Y-temperature giant exoplanets and brown dwarfs. In addition, this program will also pave the way for future investigations of sub-AU binary systems around faint Y dwarfs, and will provide us with an extensive dataset to develop a framework for joint astrometric analyses linking HST, JWST and Gaia data.

## **OBSERVING DESCRIPTION**

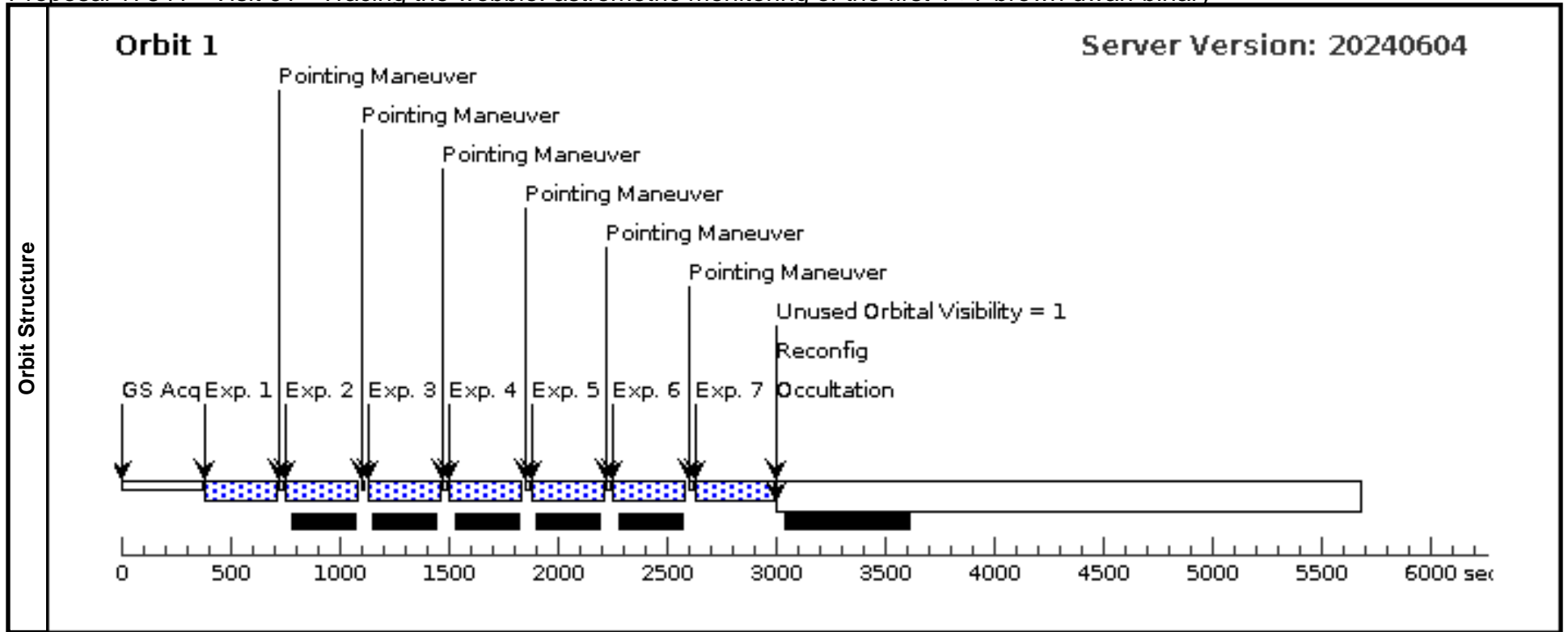
This multi-cycle program consists of 2 orbits of WFC3 IR channel imaging in Cycle 32 (complementing 2 orbits in Cycle 31) for precise astrometric monitoring of a newly discovered Y+Y brown dwarf binary. All orbits are planned as single-orbit visits. We apply large and fractional-pixel dithering patterns to allow both removal of hot pixels and increase the spatial resolution of the datasets. All observations are taken in full frame mode, in order to maximise the number of reference sources in the fields of view.

Following the strategy from GO 16229 for the same target, adapted to fit within the shorter visibility windows with the new reduced gyro mode, we will acquire 2 F105W exposures and a set of 5 F160W images. The F105W images will be placed in the middle of the sequences, to avoid problems associated with contaminating scattered Earthlight at low limb angles at those wavelengths. We will use 302 s exposures in MULTIACCUM mode, with suitable sampling times and sequence to maximise to total exposure times.

Proposal 17841 - Visit 01 - Tracing the wobble: astrometric monitoring of the first Y+Y brown dwarf binary

Tue Aug 13 20:00:52 GMT 2024

Visit	<b>Proposal 17841, Visit 01, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR Special Requirements: ON HOLD <i>On Hold Comments: We request to wait until after the last orbit from this multi-cycle program in Cycle 31 (GO-17466) is executed before scheduling the Cycle 32 visits. As justified in the proposal, the science results will be best optimised if we can schedule the latest visits based on preliminary results with the first two epochs of this program. Unfortunately visit#2 from GO-17466 has been delayed from August to November 2024, which means that we cannot take a preliminary look into what the best observing windows for the GO-17841 epochs might be.</i>												
	Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>WISE0336-0143</td> <td>RA: 03 36 5.0062 (54.0208592d) Dec: -01 43 55.80 (-1.73217d) Equinox: J2000</td> <td>Proper Motion RA: -257.8 mas/yr Proper Motion Dec: -1212.3 mas/yr Epoch of Position: 2014.0</td> <td>V=(?) H=22</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table> <p>Comments: Category=STAR Description=[BROWN DWARF]</p>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	WISE0336-0143	RA: 03 36 5.0062 (54.0208592d) Dec: -01 43 55.80 (-1.73217d) Equinox: J2000	Proper Motion RA: -257.8 mas/yr Proper Motion Dec: -1212.3 mas/yr Epoch of Position: 2014.0	V=(?) H=22
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Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit			
	1	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG 7.34,7.30	Sequence 1-7 Non-Int in Visit 01	302.938471 Secs (302.938 Secs) [==>]	[1]			
	2	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -5.34,-1.73	Sequence 1-7 Non-Int in Visit 01	302.938471 Secs (302.938 Secs) [==>]	[1]			
	3	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -7.24,-7.16	Sequence 1-7 Non-Int in Visit 01	302.938471 Secs (302.938 Secs) [==>]	[1]			
	4	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG 3.69,-3.57	Sequence 1-7 Non-Int in Visit 01	302.938471 Secs (302.938 Secs) [==>]	[1]			
	5	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -3.59,3.65	Sequence 1-7 Non-Int in Visit 01	302.938471 Secs (302.938 Secs) [==>]	[1]			
	6	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -1.69,-5.45	Sequence 1-7 Non-Int in Visit 01	302.938471 Secs (302.938 Secs) [==>]	[1]			
	7	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S25	POS TARG 1.83,5.50	Sequence 1-7 Non-Int in Visit 01	327.938986 Secs (327.939 Secs) [==>]	[1]			



Proposal 17841 - Visit 02 - Tracing the wobble: astrometric monitoring of the first Y+Y brown dwarf binary

Tue Aug 13 20:00:52 GMT 2024

Visit	<b>Proposal 17841, Visit 02, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR Special Requirements: ON HOLD <i>On Hold Comments: We request to wait until after the last orbit from this multi-cycle program in Cycle 31 (GO-17466) is executed before scheduling the Cycle 32 visits. As justified in the proposal, the science results will be best optimised if we can schedule the latest visits based on preliminary results with the first two epochs of this program. Unfortunately visit#2 from GO-17466 has been delayed from August to November 2024, which means that we cannot take a preliminary look into what the best observing windows for the GO-17841 epochs might be.</i>												
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