16725 - Dynamical Masses of the Coldest Brown Dwarfs

Cycle: 29, 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) WISEJ014656.66+423410.0	ACS/WFC	1	16-Jul-2021 10:01:55.0	yes
02	(2) WISEJ090649.35+473538.5	ACS/WFC	1	16-Jul-2021 10:01:56.0	yes
03	(3) CFBDSIRJ145829+101343	ACS/WFC	1	16-Jul-2021 10:01:56.0	yes
04	(4) WISEPCJ201546.27+664645.1	ACS/WFC	1	16-Jul-2021 10:01:57.0	yes

4 Total Orbits Used

ABSTRACT

On the cusp of the JWST era, we are still lacking mass measurements for the coldest brown dwarfs, even though mass is crucial for testing substellar models. We propose a 3-year orbit monitoring program to obtain the first sample of dynamical masses at temperatures of 400-800 K. With projected separations of only 1-3 AU, our targets are among the tightest and faintest substellar visual binaries ever found, discovered at the extreme limits of

existing facilities. Resolved astrometry, combined with existing parallax data, is needed to measure their orbits, and only HST can deliver the high-precision monitoring required. These systems, composed entirely of T8-Y0 dwarfs, are likely to be the only such binaries amenable to direct mass measurements within the decade.

OBSERVING DESCRIPTION

The goal of our observations is to obtain precise relative astrometry (~3-5 mas) for four brown dwarf binaries. Our data spanning 3 cycles will allow us to determine their orbits and thereby measure their dynamical masses. ACS/WFC offers a finer pixel scale than WFC3/IR and better sensitivity than WFC3/UVIS, both of which (high SNR, and better deblending of our tight 0.07"-0.11" binaries) are key to achieving our science goals.

We use a standard 3-position dither sequence to guard against cosmic rays and to sample different parts of the detector in case our target lands on a bad pixel in a single pointing. We set the exposure times to fill the time available in each visit, which will yield SNR of ~30 for our faintest target (WISE0146, J=20.7) and will still be far from saturating any other of our sources in F850LP (the brightest is J=16.9).

Visit

Proposal 16725, WISE0146 (01) Fri Jul 16 14:01:57 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

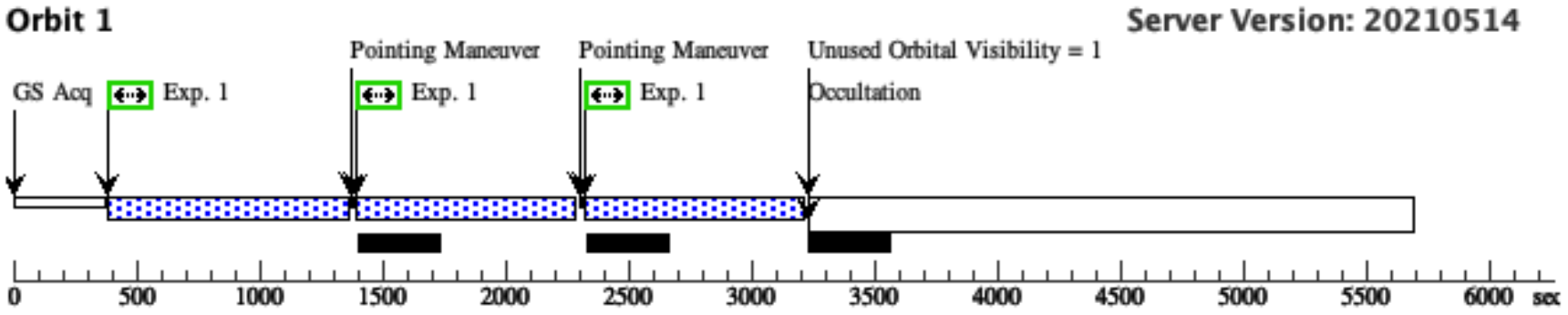
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WISEJ014656.66+423410.0	RA: 01 46 56.2824 (26.7345100d) Dec: +42 34 9.66 (42.56935d) Equinox: J2000	Proper Motion RA: -0.452 arcsec/yr Proper Motion Dec: -0.028 arcsec/yr Parallax: 0.052" Epoch of Position: 2020.542	V=(?) J = 20.69	Reference Frame: ICRS

Comments: Astrometry measured from je4o01010_drz.fits;
Proper motion and parallax from 2019ApJS..240...19K
Category=STAR
Description=[BROWN DWARF, T]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) WISEJ014656.66 +423410.0	ACS/WFC, ACCUM, WFC1-CTE	F850LP			Pattern 1, Exps 1-1 in WISE0146 (01) (1)	700 Secs (2310 Secs) *[==>770.0 Secs (Pattern 1)]* *[==>770.0 Secs (Pattern 2)]* *[==>770.0 Secs (Pattern 3)]*	***[1]***

Orbit Structure



Visit

Proposal 16725, WISE0906 (02) Fri Jul 16 14:01:58 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: AFTER 01-NOV-2021:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

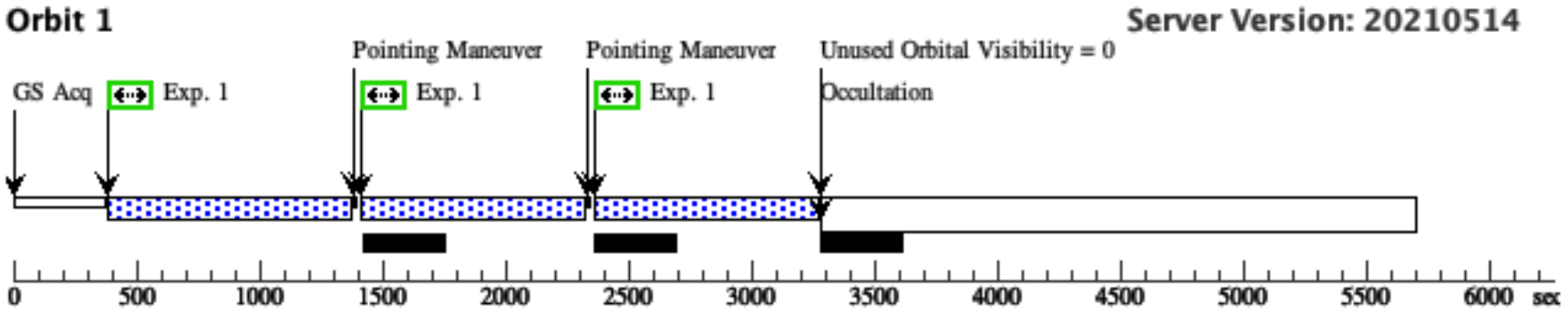
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	WISEJ090649.35+473538.5	RA: 09 06 48.7872 (136.7032800d) Dec: +47 35 31.06 (47.59196d) Equinox: J2000	Proper Motion RA: -0.546 arcsec/yr Proper Motion Dec: -0.710 arcsec/yr Parallax: 0.048" Epoch of Position: 2020.951	V=(?) J = 17.87	Reference Frame: ICRS

Comments: Astrometry measured from je4o03010_drz.fits;
Proper motion and parallax from 2019ApJS..240...19K
Category=STAR
Description=[BROWN DWARF, T]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) WISEJ090649.35+473538.5	ACS/WFC, ACCUM, WFC1-CTE	F850LP			Pattern 1, Exps 1-1 in WISE0906 (02) (1)	700 Secs (2358 Secs) *[==>786.0 Secs (Pattern 1)]* *[==>786.0 Secs (Pattern 2)]* *[==>786.0 Secs (Pattern 3)]*	*[1]*

Orbit Structure



Visit

Proposal 16725, CFBDSIR1458 (03) Fri Jul 16 14:01:58 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

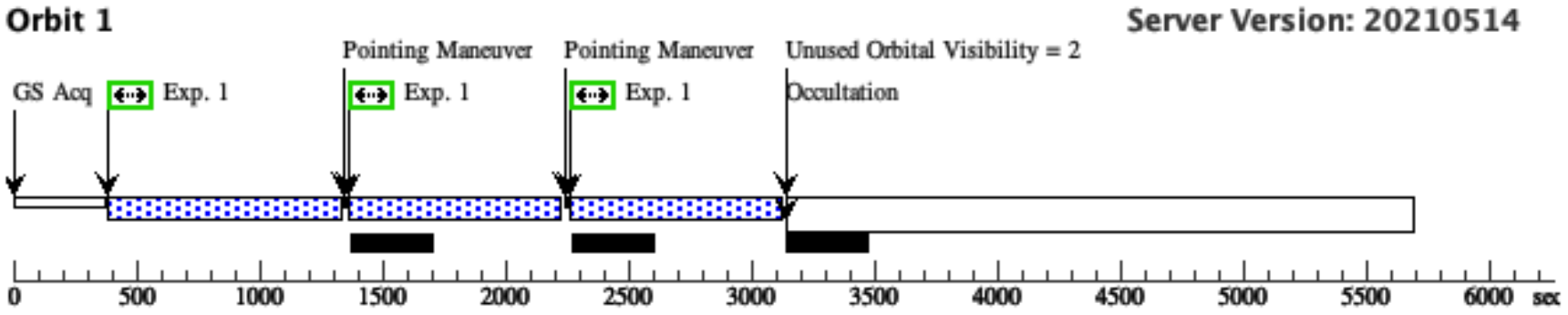
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	CFBDSIRJ145829+101343	RA: 14 58 29.4888 (224.6228700d) Dec: +10 13 37.96 (10.22721d) Equinox: J2000	Proper Motion RA: 0.174 arcsec/yr Proper Motion Dec: -0.380 arcsec/yr Parallax: 0.031" Epoch of Position: 2020.489	V=(?) J = 19.66	Reference Frame: ICRS

Comments: Astrometry measured from je4o05010_drz.fits;
Proper motion and parallax from 2012ApJS..201...19D
Category=STAR
Description=[BROWN DWARF, T]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) CFBDSIRJ145829+101343	ACS/WFC, ACCUM, WFC1-CTE	F850LP			Pattern 1, Exps 1-1 in CFBDSIR1458 (03) (1)	700 Secs (2220 Secs) *[==>740.0 Secs (Pattern 1)]* *[==>740.0 Secs (Pattern 2)]* *[==>740.0 Secs (Pattern 3)]*	*[1]*

Orbit Structure



Visit

Proposal 16725, WISE2015 (04) Fri Jul 16 14:01:58 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: AFTER 01-NOV-2021:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	WISEPCJ201546.27+664645.1	RA: 20 15 46.5384 (303.9439100d) Dec: +66 46 48.90 (66.78025d) Equinox: J2000	Proper Motion RA: 0.290 arcsec/yr Proper Motion Dec: 0.428 arcsec/yr Parallax: 0.43" Epoch of Position: 2020.435	V=(?) J = 16.91	Reference Frame: ICRS

Comments: Astrometry measured from je4o09010_drz.fits;
Proper motion and parallax from 2019ApJS..240...19K
Category=STAR
Description=[BROWN DWARF, T]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) WISEPCJ201546.27+664645.1	ACS/WFC, ACCUM, WFC1-CTE	F850LP			Pattern 1, Exps 1-1 in WISE2015 (04) (1)	700 Secs (2559 Secs) *[==>853.0 Secs (Pattern 1)]* *[==>853.0 Secs (Pattern 2)]* *[==>853.0 Secs (Pattern 3)]*	 ***[1]***

Orbit Structure