13640 - A direct probe of cloud holes at the L/T transition

Cycle: 22, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) WISE-J104915.57-531906.1	WFC3/IR	5	10-Jul-2014 21:11:06.0	yes

5 Total Orbits Used

ABSTRACT

Understanding cloud formation, evolution and dispersal is one of the biggest challenges in the field of substellar atmospheres. At the transition from L to T type brown dwarfs, thick silicate and iron clouds disappear below the visible photosphere and the spectra are altered dramatically despite little change in effective temperature. Observed strengthening of the FeH band through the transition has indicated an opening of cloud holes rather than gradual sinking of the clouds. This view has been supported by the discovery of brown dwarfs with photometric variability attributed to patchy cloud cover. However, our recent spectral variability observations have complicated the picture because patchy cloud models with cloud holes currently cannot reproduce the color variations and spectral variability signatures. Whether this implies an absence of cloud holes (in contradiction to the

interpretation of the observed strengthening of FeH) or is because models neglect other mechanisms that can affect the colors (eg temperature anomalies) remains unclear.

Here, we propose WFC3/G102 spectral variability observations of the very nearby L/T transition benchmark binary Luhman 16AB, the only known variable brown dwarfs in a binary system. These observations target the FeH band. As the FeH molecule contains the cloud forming atom Fe, it is a direct tracer of the cloud holes. By comparing the variability amplitude in the FeH band with the surrounding continuum, as well as between the L and T component at different stages of cloud evolution, we will obtain direct evidence whether the formation of cloud holes is indeed the driving mechanism behind cloud dispersal at the L/T transition.

OBSERVING DESCRIPTION

We are observing a binary Brown Dwarfs with WFC3 IR slitless spectroscopy with grism G102 to search for time variability. The target is observed for 5 consecutive orbits in a single visit. At the beginning of each orbit, a direct image is taken for wavelength calibration. Then, a sequence of exposures in G102 mode without dithering is taken for the rest of each orbit. We are using the 256 subarray mode to avoid buffer dumps during the useful portion of the orbit. The orientation of the space craft has to be such that the two spectra on the detector are well separated.

Proposal 13640 - Visit 01 - A direct probe of cloud holes at the L/T transition

Visit

Proposal 13640, Visit 01 — Fri Jul 11 01:11:16 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 68D TO 108 D; ORIENT 248D TO 288 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WISE-J104915.57-531906.1 Alt Name1: 2MASS-J10491891-5319100	RA: 10 49 15.4270 (162.3142792d) Dec: -53 19 6.30 (-53.31842d) Equinox: J2000	Proper Motion RA: -2.759 arcsec/yr Proper Motion Dec: 0.354 arcsec/yr Parallax: 0.5" Epoch of Position: 2011.0	V=(?) J=11.2, H=10.4	Reference Frame: ICRS

Comments: Coordinates from Luhman et al. 2013, last WISE measurement, Jan 6 2011

Proposal 13640 - Visit 01 - A direct probe of cloud holes at the L/T transition

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) WISE-J104915.57-531906.1	WFC3/IR, MULTIACCUM, GRISM256	F098M	SAMP-SEQ=SPARS10; NSAMP=1		Sequence 1-2 Non-Int in Visit 01	0.277815 Secs X 2 (0.556 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***

	2	(1) WISE-J104915.57-531906.1	WFC3/IR, MULTIACCUM, GRISM256	G102	NSAMP=2; SAMP-SEQ=SPARS25	Sequence 1-2 Non-Int in Visit 01	22.623854 Secs X 72 (1628.917 Secs)	

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	3	(1) WISE-J104915.5 7-531906.1	WFC3/IR, MULTIACCUM, GRISM256	F098M	SAMP-SEQ=SPARS 10; NSAMP=1	Sequence 3-4 Non-In t in Visit 01	0.277815 Secs X 2 (0.556 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***

	4	(1) WISE-J104915.57-531906.1	WFC3/IR, MULTIACCUM, GRISM256	G102	NSAMP=2; SAMP-SEQ=SPARS25	Sequence 3-4 Non-Int in Visit 01	22.623854 Secs X 75 (1696.789 Secs)	

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	5	(1) WISE-J104915.57-531906.1	WFC3/IR, MULTIACCUM, GRISM256	F098M	SAMP-SEQ=SPARS10; NSAMP=1	Sequence 5-6 Non-Int in Visit 01	0.277815 Secs X 2 (0.556 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***

	6	(1) WISE-J104915.57-531906.1	WFC3/IR, MULTIACCUM, GRISM256	G102	NSAMP=2; SAMP-SEQ=SPARS25	Sequence 5-6 Non-Int in Visit 01	22.623854 Secs X 75 (1696.789 Secs)	

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	7	(1) WISE-J104915.5 7-531906.1	WFC3/IR, MULTIACCUM, GRISM256	F098M	SAMP-SEQ=SPARS 10; NSAMP=1	Sequence 7-8 Non-Int in Visit 01	0.277815 Secs X 2 (0.556 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[4]***

	8	(1) WISE-J104915.57-531906.1	WFC3/IR, MULTIACCUM, GRISM256	G102	NSAMP=2; SAMP-SEQ=SPARS25	Sequence 7-8 Non-Int in Visit 01	22.623854 Secs X 75 (1696.789 Secs)	

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	9	(1) WISE-J104915.57-531906.1	WFC3/IR, MULTIACCUM, GRISM256	F098M	SAMP-SEQ=SPARS10; NSAMP=1	Sequence 9-10 Non-Int in Visit 01	0.277815 Secs X 2 (0.556 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[5]***

	10	(1) WISE-J104915.57-531906.1	WFC3/IR, MULTIACCUM, GRISM256	G102	NSAMP=2; SAMP-SEQ=SPARS25	Sequence 9-10 Non-Int in Visit 01	22.623854 Secs X 75 (1696.789 Secs)	

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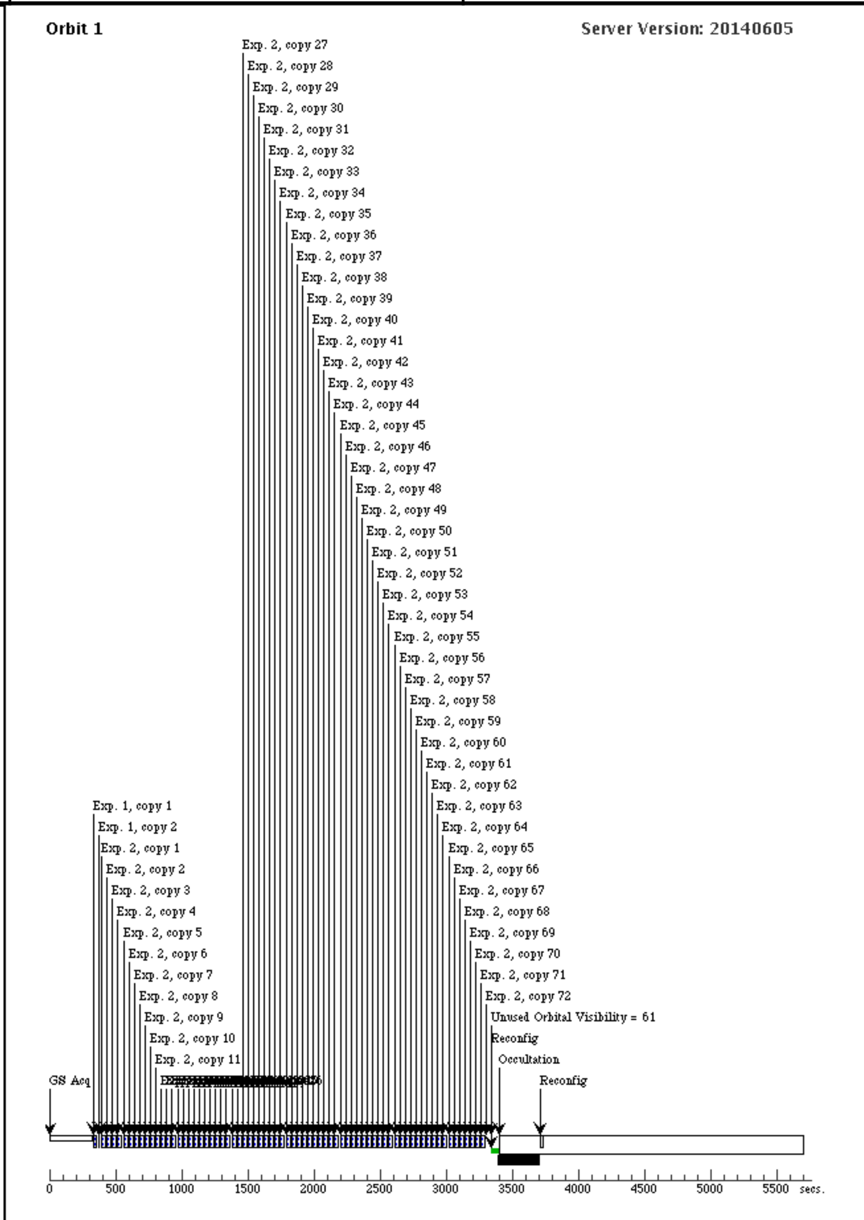
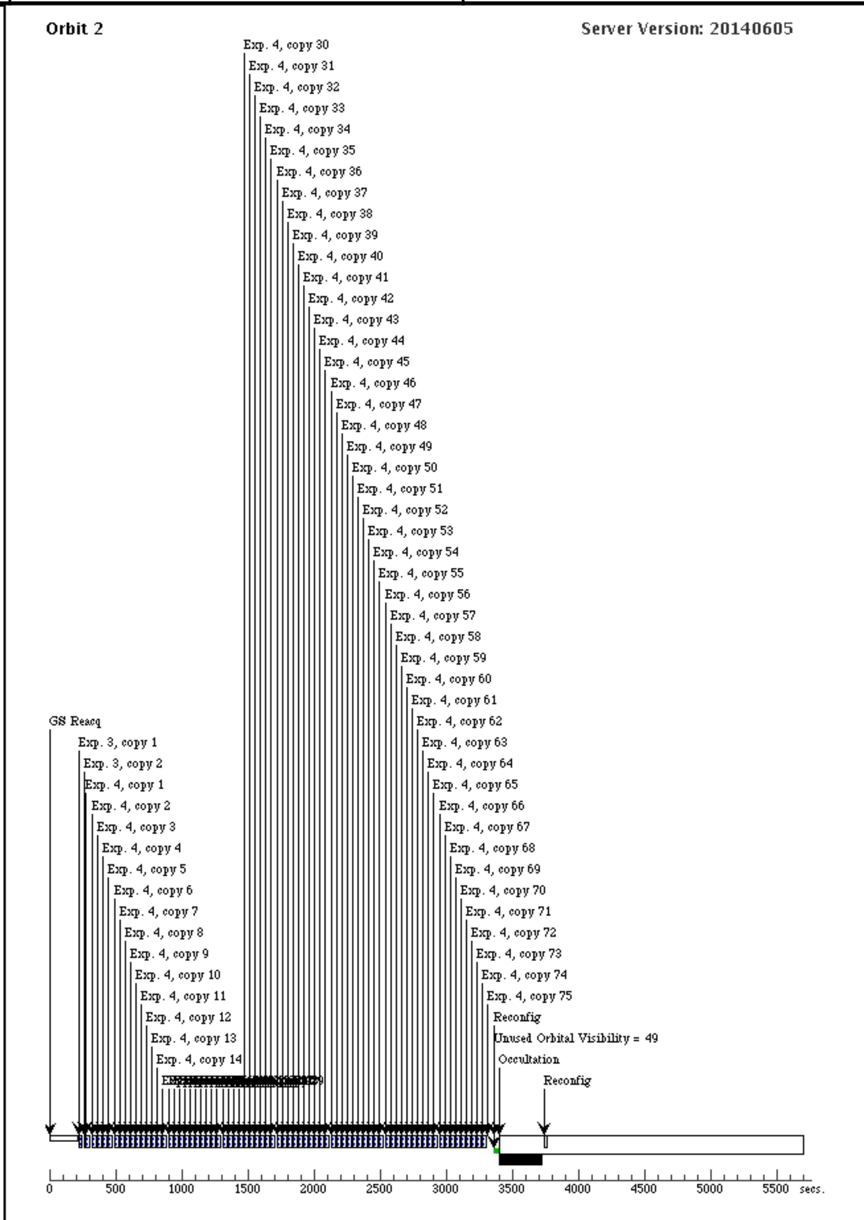
Orbit Structure

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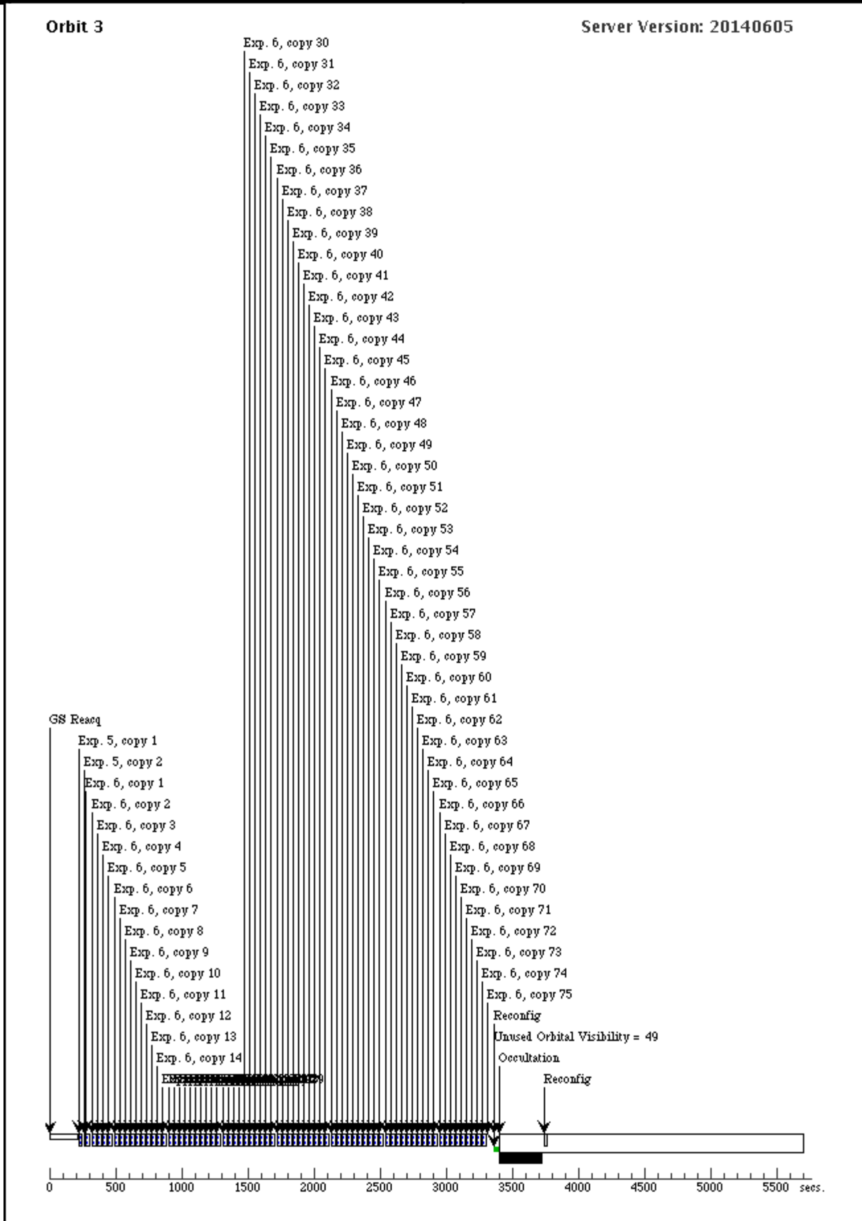
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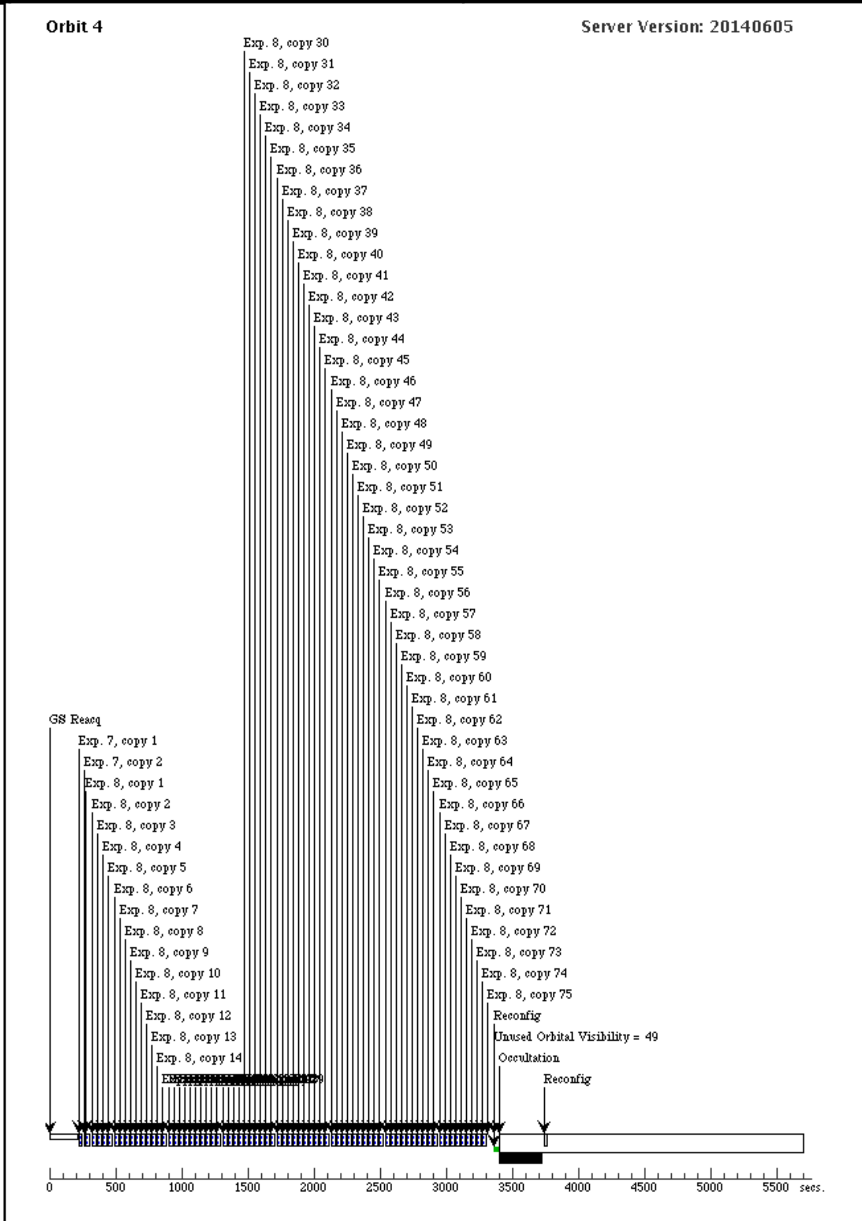
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Reconfig
Exp. 8, copy 13
Unused Orbital Visibility = 49
Exp. 8, copy 14
Occultation
Reconfig
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 secs.

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