



12044 - DD Observations of the Coldest Brown Dwarf

Cycle: 17, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Peter Eisenhardt (PI)	Jet Propulsion Laboratory	peter.r.eisenhardt@jpl.nasa.gov
Dr. Daniel Stern (CoI)	Jet Propulsion Laboratory	stern@zwofkinder.jpl.nasa.gov
Dr. Amanda K. Mainzer (CoI)	Jet Propulsion Laboratory	Amanda.K.Mainzer@jpl.nasa.gov
Prof. Edward L. Wright (CoI)	University of California - Los Angeles	wright@astro.ucla.edu
Mr. Roger Griffith (CoI)	Jet Propulsion Laboratory	griffith.rl@gmail.com
Dr. Matthew L. N. Ashby (CoI)	Smithsonian Institution Astrophysical Observatory	mashby@cfa.harvard.edu
Dr. Mark Brodwin (CoI)	Smithsonian Institution Astrophysical Observatory	brodwin@noao.edu
Dr. Michael J.I. Brown (CoI)	Monash University	Michael.Brown@sci.monash.edu.au
Mr. Shane Busmann (CoI)	University of Arizona	rsbusmann@as.arizona.edu
Dr. Arjun Dey (CoI)	National Optical Astronomy Observatories, AURA	dey@noao.edu
Dr. Andrea M. Ghez (CoI)	University of California - Los Angeles	ghez@astro.ucla.edu
Dr. Eilat Glikman (CoI)	Yale University	eilat.glikman@yale.edu
Dr. Anthony H. Gonzalez (CoI)	University of Florida	anthony@astro.ufl.edu
Dr. J. Davy Kirkpatrick (CoI)	California Institute of Technology	davy@ipac.caltech.edu
Dr. Quinn Konopacky (CoI)	University of California - Los Angeles	quinn@astro.ucla.edu
Mr. David Vollbach (CoI)	University of Florida	vollbach@astro.ufl.edu
Dr. Shelley A. Wright (CoI)	University of California - Berkeley	saw@uci.edu

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) SDWFSJ143356.62+351849.2	WFC3/IR	3	17-Nov-2009 21:14:19.0	yes
02	(1) SDWFSJ143356.62+351849.2	WFC3/IR	4	17-Nov-2009 21:14:26.0	yes

7 Total Orbits Used

ABSTRACT

We request DD observations of the SDWFS J1433+35, which is a strong candidate for the coldest brown dwarf yet discovered and the first example of the elusive "Y-dwarf" spectral class. This source was discovered from a deep, wide-field survey of 10 square degrees with the IRAC instrument on Spitzer, and is redder in both [3.6]-[4.5] and H-[4.5] than any published brown dwarfs. The spectrum falls beyond 5 microns, strongly implying that the red mid-infrared colors are due to methane absorption in the IRAC 3.6 micron channel rather than dust obscuration. The source is undetected in deep, ground-based near-IR images, with a H>24.2 (Vega) limit derived from Keck AO imaging. The proposed WFC3 imaging should provide detections in two near-infrared bands. By showing the target is morphologically unresolved and that it has the non-uniform spectral energy distribution of an ultracool brown dwarf, the proposed observations will definitely show that (i) SDWFS J1433+35 is the coldest brown dwarf known, (ii) test models of ultracool, planet-like, brown dwarf atmospheres, and (iii) refine predictions and strategies for the Wide-Field Infrared Survey Explorer (WISE; planned to launch this December).

OBSERVING DESCRIPTION

We propose multi-band near-IR imaging observations of SDWFS J143356.62+351849.2, the Y-dwarf candidate, with WFC3. Such data will confirm the nature of this source (i) by showing that it is unresolved (as expected for a brown dwarf, but not for a dusty galaxy, the most likely --- but still unlikely --- alternate explanation for the unusual SED), and (ii) by showing that the near-IR portion of the SED has the characteristic and distinguishing SED of an ultracool brown dwarf. Given the faintness of the target, these observations are beyond the capabilities of ground-based observatories, but well within the reach of a modestly sized (7 orbit) HST program.

We have used the WFC3 exposure time calculator to estimate the time needed under default background and detection assumptions to detect a 400 K

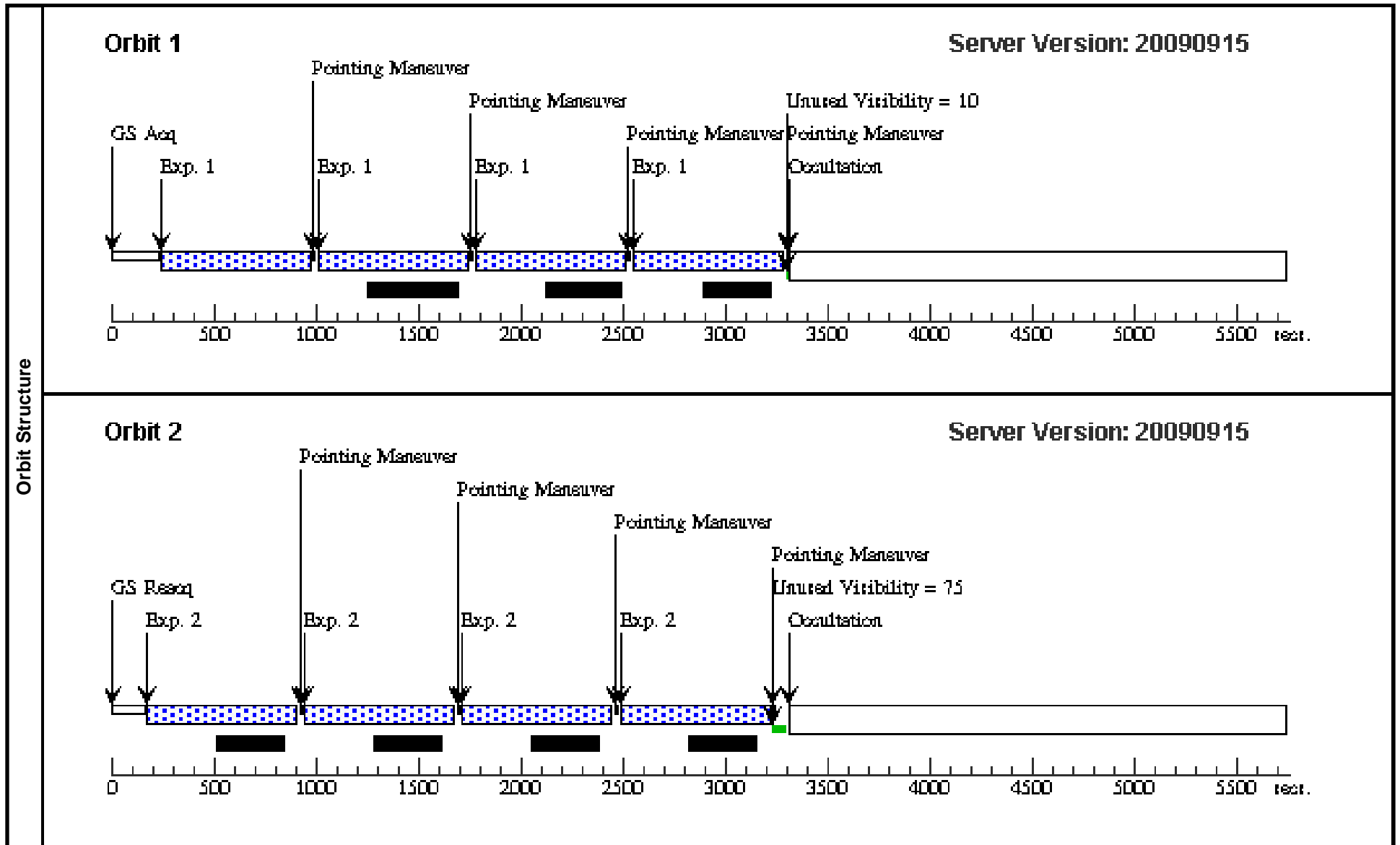
Burrows et al. (2003) non-equilibrium brown dwarf model, normalized to $H=26$. This is an order of magnitude deeper than our Keck AO derived limit (Figure~3). We investigated models with temperatures ranging from 400 to 600 K assuming both equilibrium or non-equilibrium conditions, and the 400 K non-equilibrium model was found to be the most conservative (e.g., the most challenging) case. The most sensitive filter for this model is F140W. To achieve a signal-to-noise (SNR) of 5 in F140W will require 1.9 hours of exposure time and should provide adequate sensitivity to determine whether the source is morphologically unresolved. Assuming 40 usable minutes of integration per orbit, this is achievable in 3 orbits.

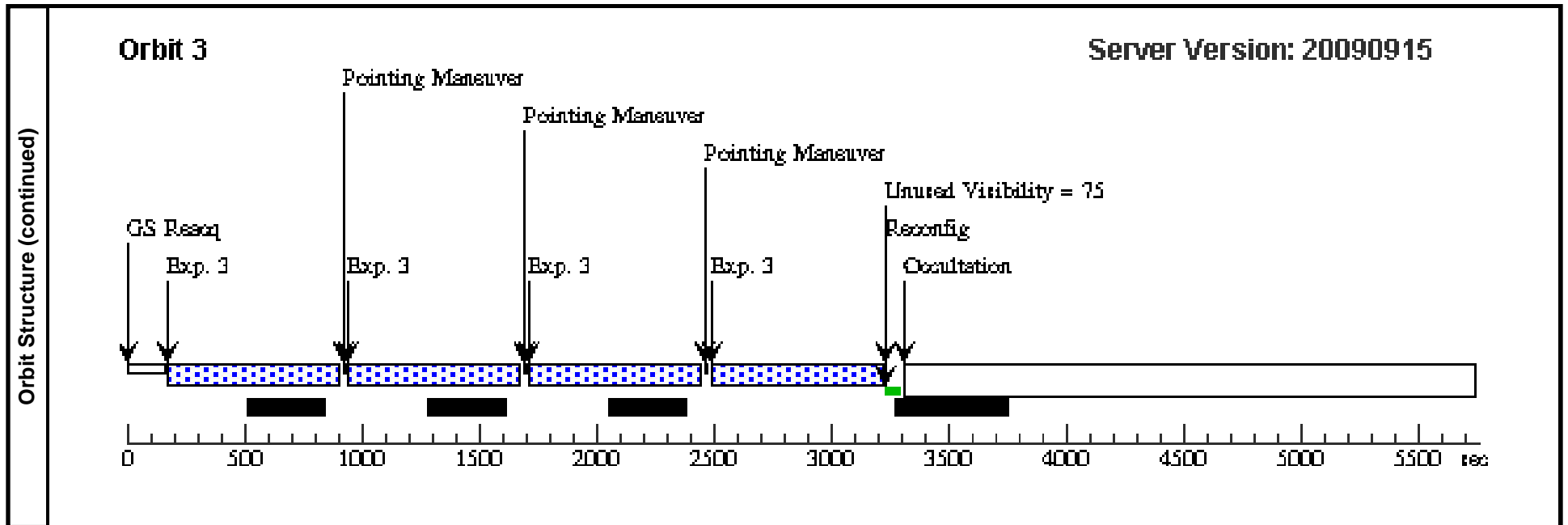
To further distinguish between the Y-dwarf and DOG hypotheses, we request 2.6 hours (4 orbits) with F127M which will achieve SNR of 5 for the brown dwarf spectrum, but substantially less on a DOG, since the brown dwarf spectra peak up in F127M.

Proposal 12044 - Visit 01 - DD Observations of the Coldest Brown Dwarf

Wed Nov 18 02:14:33 GMT 2009

Visit		Proposal 12044, Visit 01, scheduling Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: BEFORE 01-JAN-2010:00:00:00 Comments: F140W imaging								
Patterns	#	Primary Pattern		Secondary Pattern	Exposures					
	(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=5.725 Line Spacing=3.655	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1), (2), (3)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SDWFSJ143356.62+351849.2	RA: 14 33 56.6200 (218.4859167d) Dec: +35 18 49.20 (35.31367d) Equinox: J2000		V=35.+/-5 J>21.9, H>24.2, Ks>18.8, [3.6]=20.71, [4.5]=18.47	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	F140W imaging	(1) SDWFSJ143356.62+351849.2	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS 50; NSAMP=15	GS ACQ SCENARIO SINGLE	Pattern 1, Exps 1-1 (1)	[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2	F140W imaging	(1) SDWFSJ143356.62+351849.2	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS 50; NSAMP=15	POS TARG 1.,1.	Pattern 1, Exps 2-2 (1)	[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	3	F140W imaging	(1) SDWFSJ143356.62+351849.2	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS 50; NSAMP=15	POS TARG -1.,-1.	Pattern 1, Exps 3-3 (1)	[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]





Proposal 12044 - Visit 02 - DD Observations of the Coldest Brown Dwarf

Wed Nov 18 02:14:35 GMT 2009

Visit	Proposal 12044, Visit 02, scheduling Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: BEFORE 01-JAN-2010:00:00:00 Comments: F127M imaging									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=5.725 Line Spacing=3.655	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false					(1), (2)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SDWFSJ143356.62+351849.2	RA: 14 33 56.6200 (218.4859167d) Dec: +35 18 49.20 (35.31367d) Equinox: J2000		V=35.+/-5 J>21.9, H>24.2, Ks>18.8, [3.6]=20.71, [4.5]=18.47	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	F127M imaging	(1) SDWFSJ143356.62+351849.2	WFC3/IR, MULTIACCUM, IR	F127M	SAMP-SEQ=SPARS 100; NSAMP=15	GS ACQ SCENARIO SINGLE	Pattern 1, Exps 1-1 (1)	[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	[2]
									[==>(Pattern 3)]	[3]
2	F127M imaging	(1) SDWFSJ143356.62+351849.2	WFC3/IR, MULTIACCUM, IR	F127M	SAMP-SEQ=SPARS 100; NSAMP=15	POS TARG 1.,1.	Pattern 1, Exps 2-2 (1)	[==>(Pattern 4)]	[4]	
								[==>(Pattern 1)]	[3]	
								[==>(Pattern 2)]	[4]	
								[==>(Pattern 3)]	[4]	
								[==>(Pattern 4)]	[4]	

