11512 - Molecules in Exoplanet Atmospheres

Cycle: 16, Proposal Category: GO/DD

(Availability Mode: AVAILABLE)

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) HD-209458	NIC3	5	30-Jun-2009 21:21:22.0	yes
02	(1) HD-209458	NIC3	5	30-Jun-2009 22:21:38.0	yes
03	(1) HD-209458	NIC3	5	30-Jun-2009 22:28:54.0	yes
53	(1) HD-209458	NIC3	5	30-Jun-2009 22:37:02.0	yes

20 Total Orbits Used

ABSTRACT

We propose to characterize the conditions, composition, and chemistry in two transiting exoplanet atmospheres using molecules as probes. This will be accomplished through high precision, near-IR spectroscopy during an interval that spans the primary and/or secondary eclipse events. We have selected the hot-Jovian HD 209458b and the warm-Neptune GJ 436b for spectroscopy from 1.4 to 2.5 microns and we expect to detect the molecules H2O, CH4, CO, CO2, and NH3. We will infer the atmospheric temperature-pressure profiles and determine the abundance of detected molecules;

this will be done by comparing detailed radiative transfer models with emission and transmission spectra of the exoplanet atmospheres. Taken together with the existing observations of HD 189733b, the proposed measurements will probe the diversity of exoplanet atmospheres and the effects of radiation from the stellar primary.

OBSERVING DESCRIPTION

We propose to observe (1) HD 209458b in both primary and secondary eclipses and (2) GL 436b in primary eclipse. In all cases, we will observe the targets both prior to and following the event in order to establish a good baseline. Since the measurements are demanding and must achieve a very high signal to noise (after removal of the inevitable systematics), we require that NICMOS be used in a special mode designed for such observations. Our observations of HD 189733b demonstrated a signal-to-noise ratio of 10^4 per channel in 50 nm-wide spectral channels. This was achieved only after proper modeling and removal of systematics, and is within ~1.2 of the theoretical detection noise limit. The details of this optimization are contained in the Supplementary Information to Swain et al. 2008b. However, successful removal of the systematics can only be achieved if the effect of these on the photometry is small to start with. This requires a stable instrument configuration.

ADDITIONAL COMMENTS

The observation description is from the phase 1 proposal. The awarded time is 15 orbits for primary eclipse observations of HD 209458b. The observations must be phased to the primary eclipse event(s) of this transiting exoplanet. Since the orbital period is every 3.5 days, there are numerous scheduling opportunities.

Visit

Proposal 11512, Visit 01, completed Wed Jul 01 02:37:56 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC3

Special Requirements: Period 3.52474859 D AND ZERO-PHASE HJD2454578.43

Comments: start HD209458 primary eclipse G206 spectra

- visit is 5 orbits long with primary eclipse viewed in orbits 3 & 4

- constraint roll angle held constant

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-209458	RA: 22 03 10.8000 (330.7950000d) Dec: +18 53 4.00 (18.88444d) Equinox: J2000	Proper Motion RA: 0.02890s/yr Proper Motion Dec: -0.01837"/yr Epoch of Position: 2000.00	V=7.65 K=6.62	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	Imaging 1	(1) HD-209458	NIC3, MULTIACCUM, NIC3-FIXD	F190N	SAMP-SEQ=SCAMRR; CAMERA-FOCUS=DEFOCUS; NSAMP=5	PHASE 0.448 TO 0.454		*[==>]*	***[1]***
2	Imaging 2	(1) HD-209458	NIC3, MULTIACCUM, NIC3-FIXD	F190N	SAMP-SEQ=SCAMRR; CAMERA-FOCUS=DEFOCUS; NSAMP=5			*[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***

Exposures	*An item that belongs under the heading Exposures could not be fit on a full page so it will not be displayed. You can look above and below this entry in the table to discover what was omitted.*
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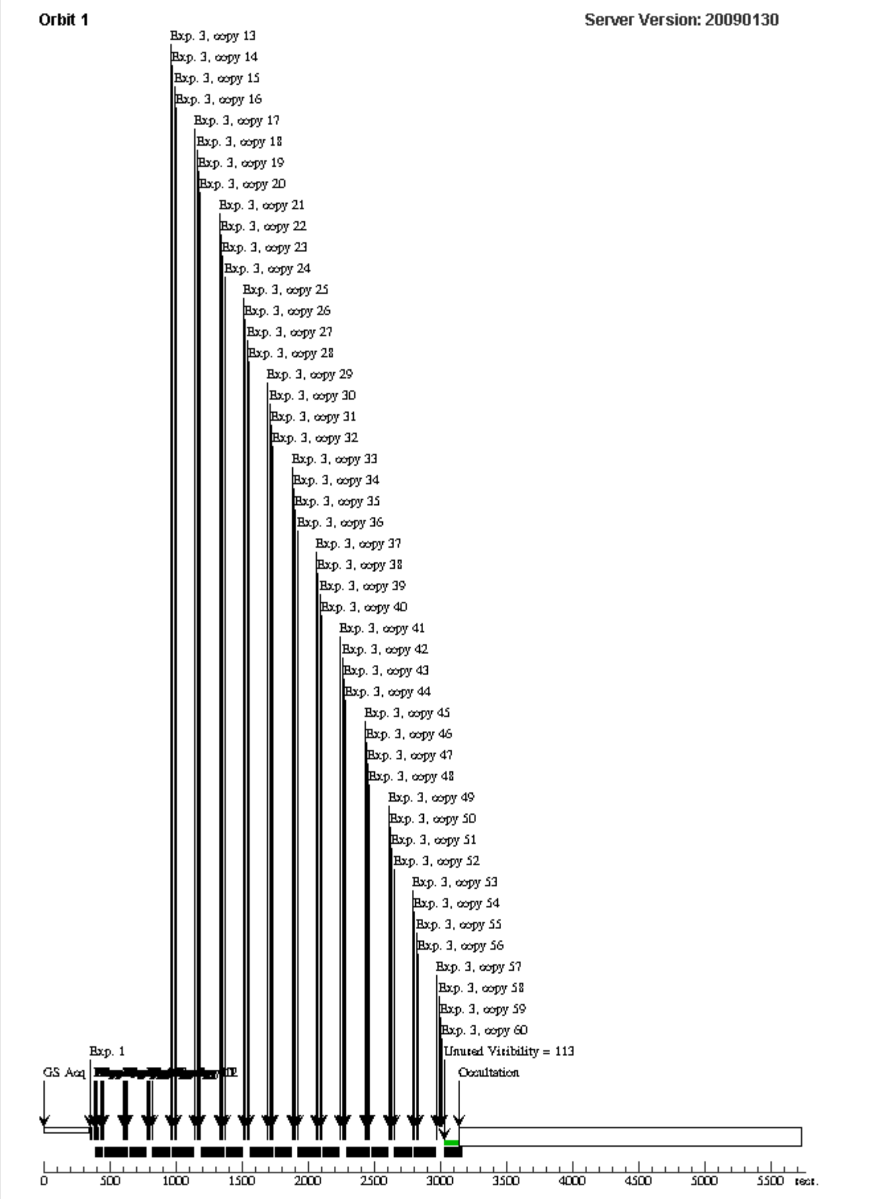
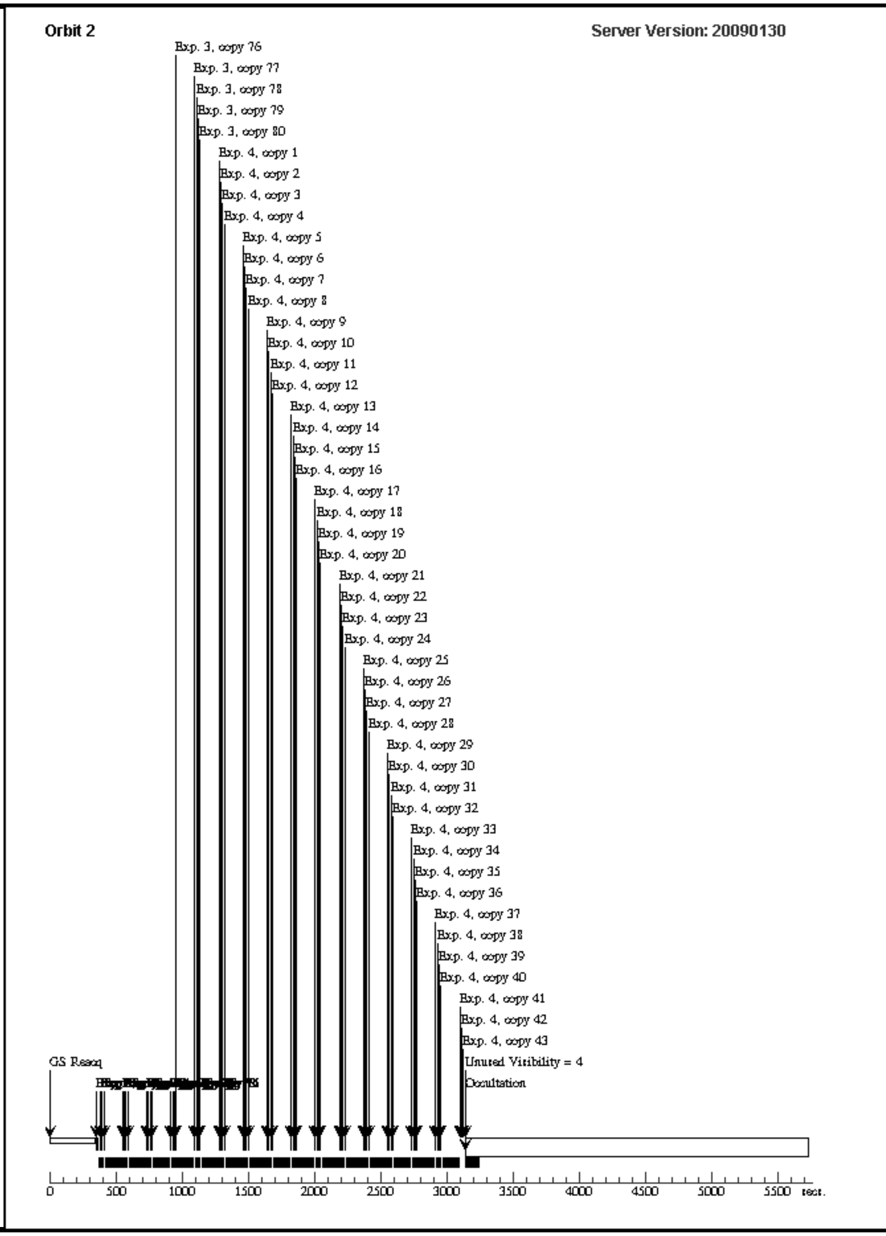
Proposal 11512 - Visit 01 - Molecules in Exoplanet Atmospheres

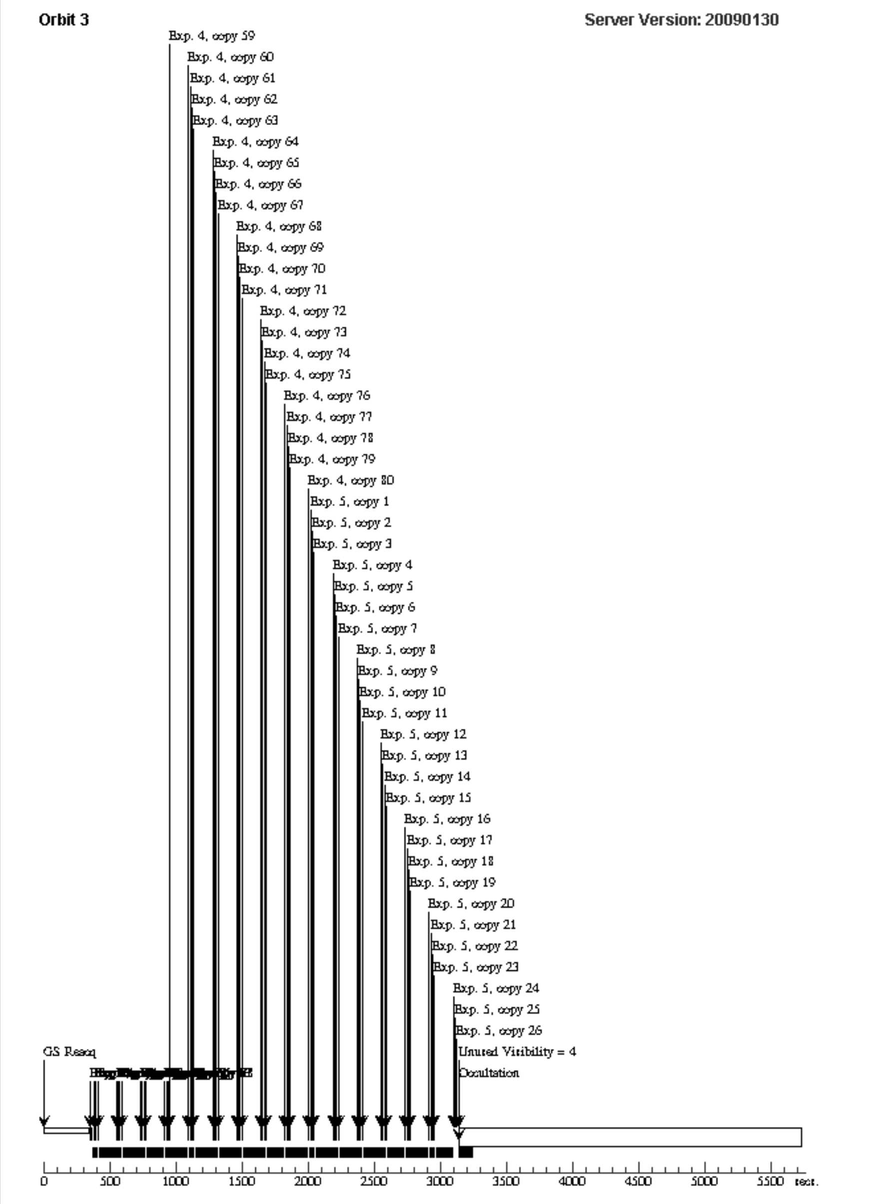
Orbit Structure



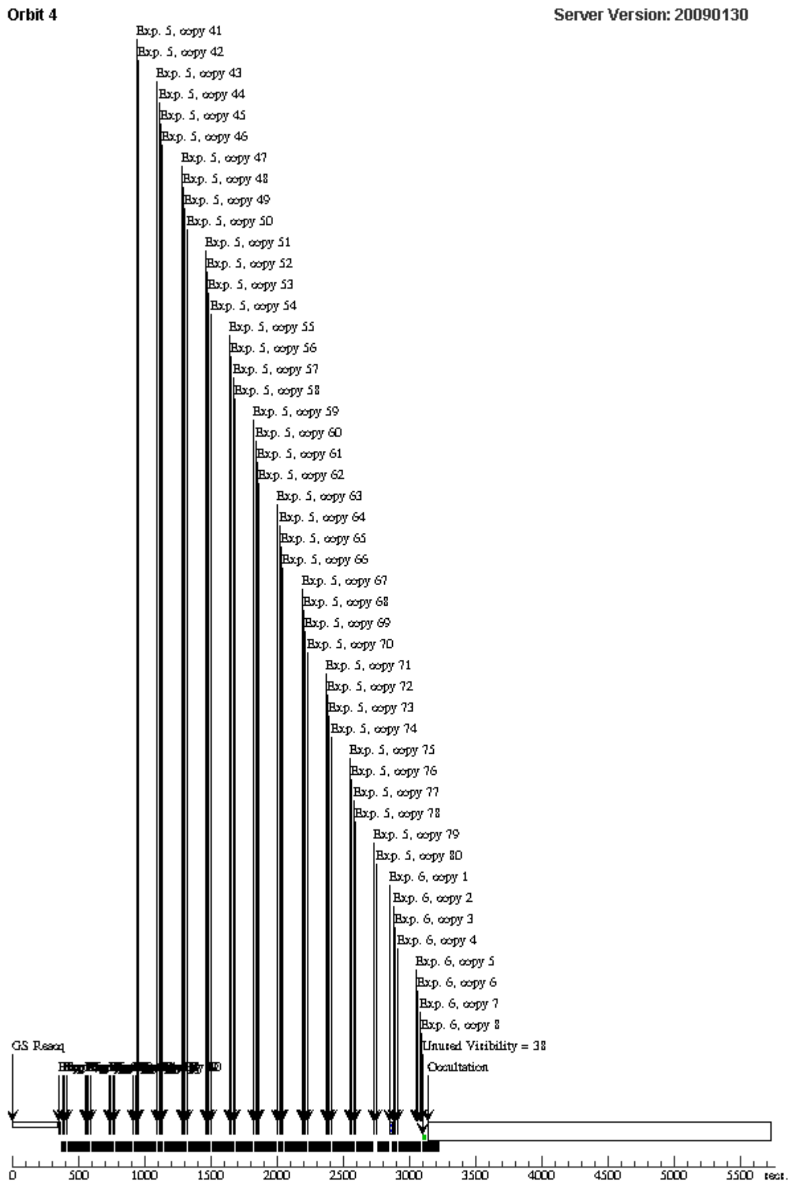
Orbit Structure (continued)



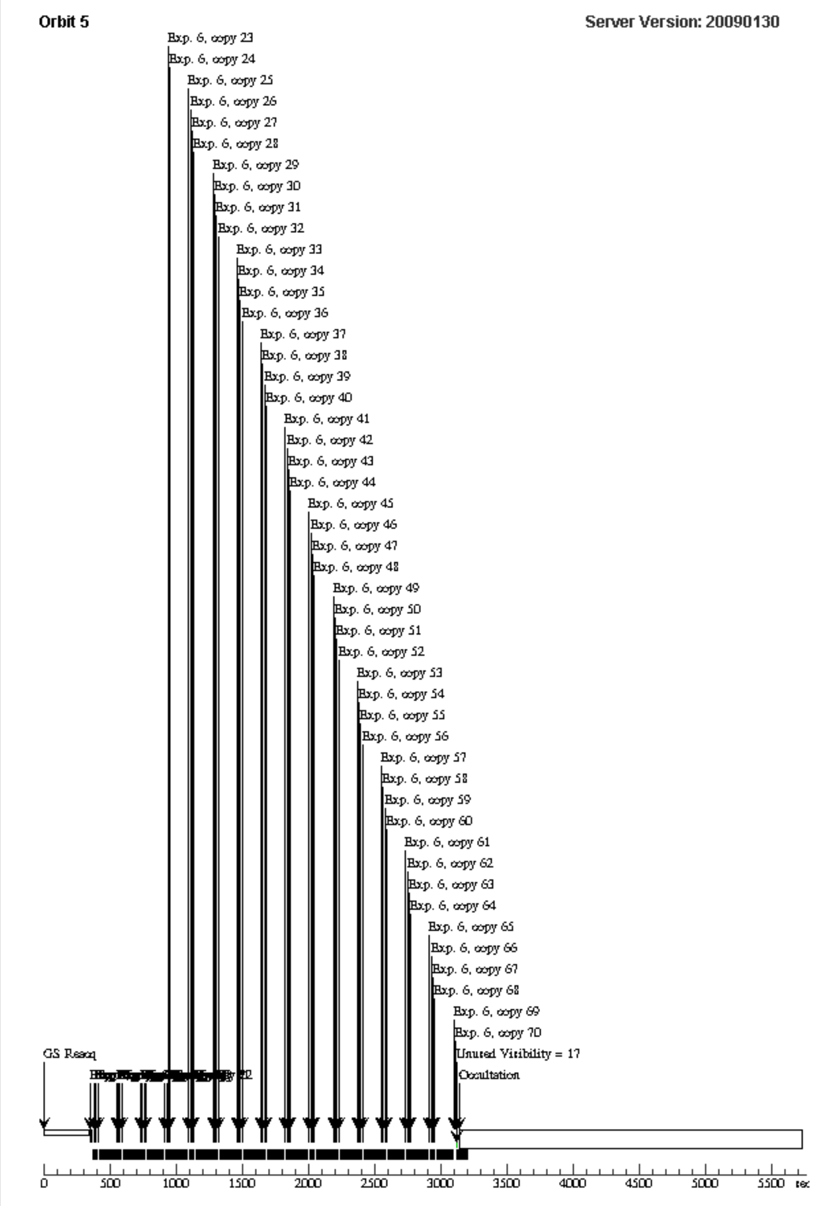
Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)



Proposal 11512 - Visit 02 - Molecules in Exoplanet Atmospheres

Visit

Proposal 11512, Visit 02, completed Wed Jul 01 02:38:01 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC3

Special Requirements: Period 3.52474859 D AND ZERO-PHASE HJD2454691.283765

Comments: start HD209458 primary eclipse G206 spectra

- visit is 5 orbits long with primary eclipse viewed on orbit 3

- constraint roll angle held constant

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-209458	RA: 22 03 10.8000 (330.7950000d) Dec: +18 53 4.00 (18.88444d) Equinox: J2000	Proper Motion RA: 0.02890s/yr Proper Motion Dec: -0.01837"/yr Epoch of Position: 2000.00	V=7.65 K=6.62	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	Imaging 1	(1) HD-209458	NIC3, MULTIACCUM, NIC3-FIXD	F190N	SAMP-SEQ=SCAMRR; CAMERA-FOCUS=DEFOCUS; NSAMP=5	PHASE 0.0139 TO 0.0239		*[==>]*	***[1]***
2	Imaging 2	(1) HD-209458	NIC3, MULTIACCUM, NIC3-FIXD	F190N	SAMP-SEQ=SCAMRR; CAMERA-FOCUS=DEFOCUS; NSAMP=5			*[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***

Exposures	*An item that belongs under the heading Exposures could not be fit on a full page so it will not be displayed. You can look above and below this entry in the table to discover what was omitted.*
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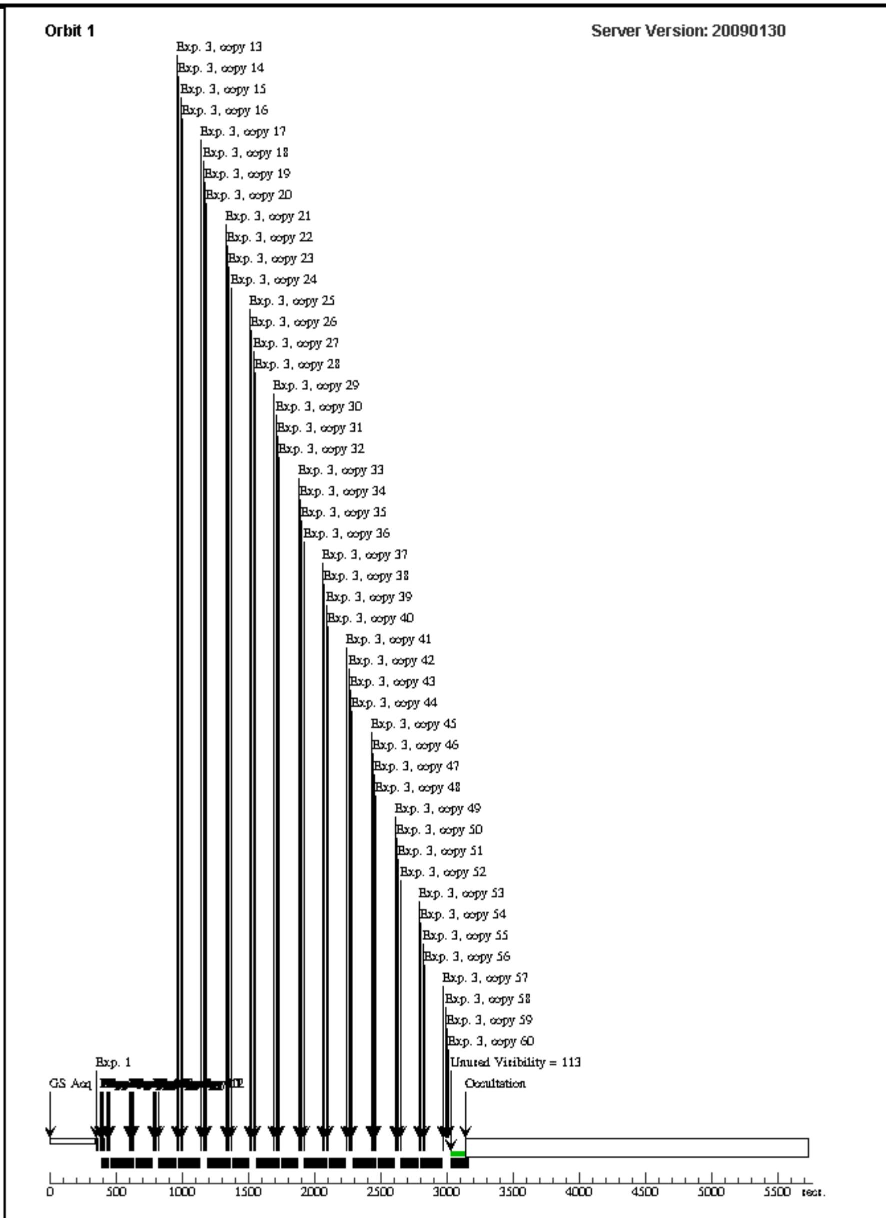
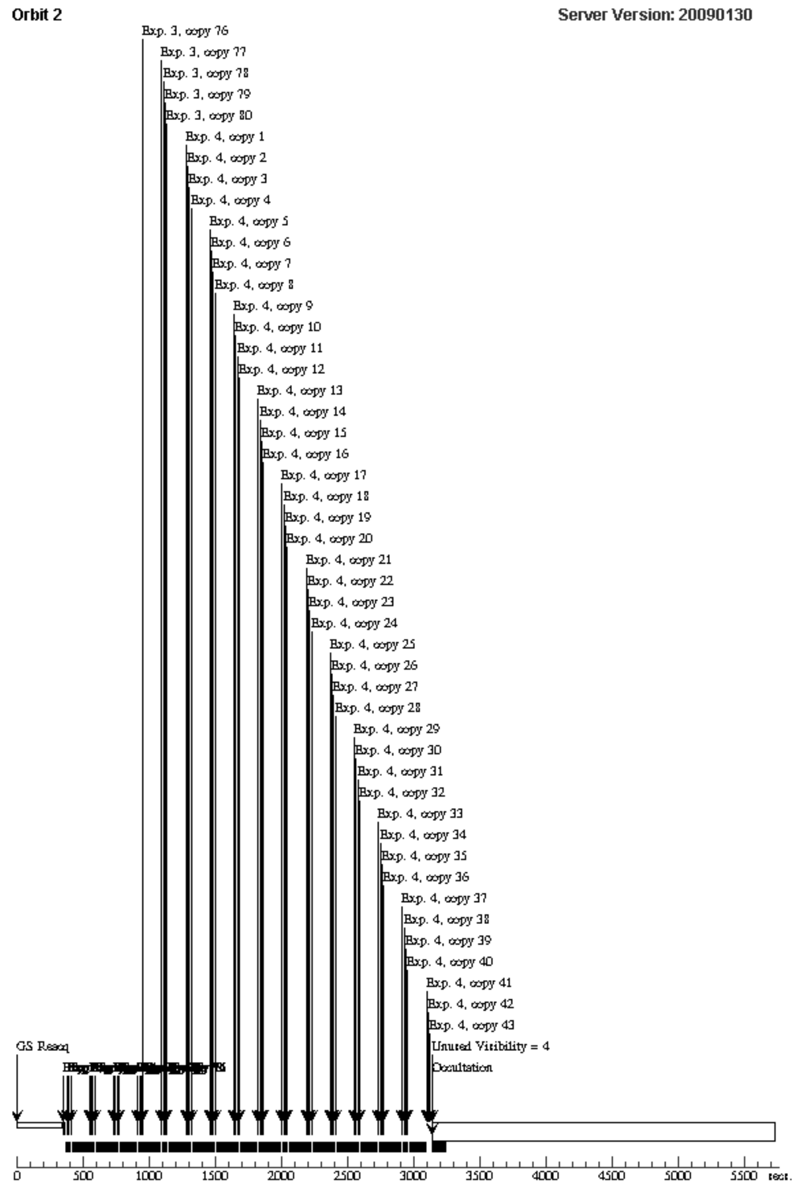
Proposal 11512 - Visit 02 - Molecules in Exoplanet Atmospheres

Orbit Structure

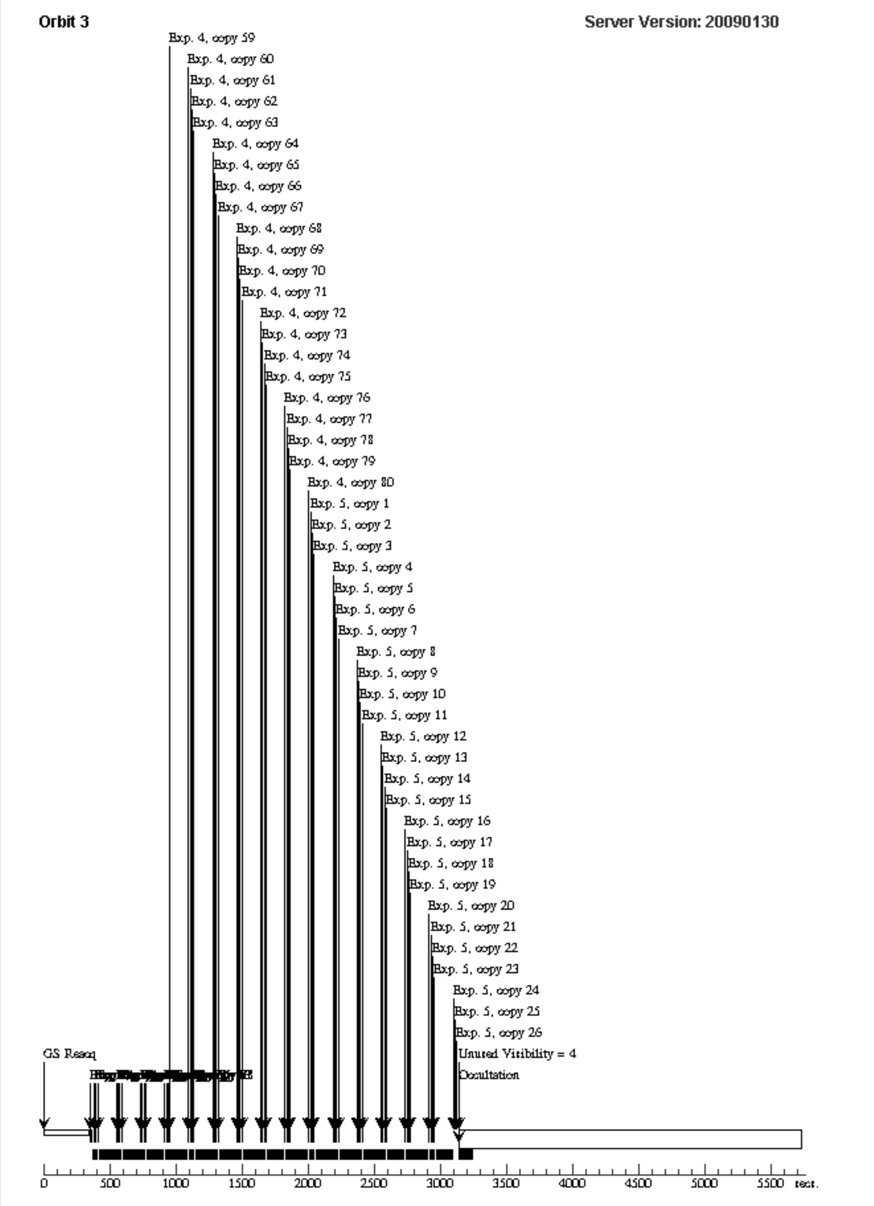


Proposal 11512 - Visit 02 - Molecules in Exoplanet Atmospheres

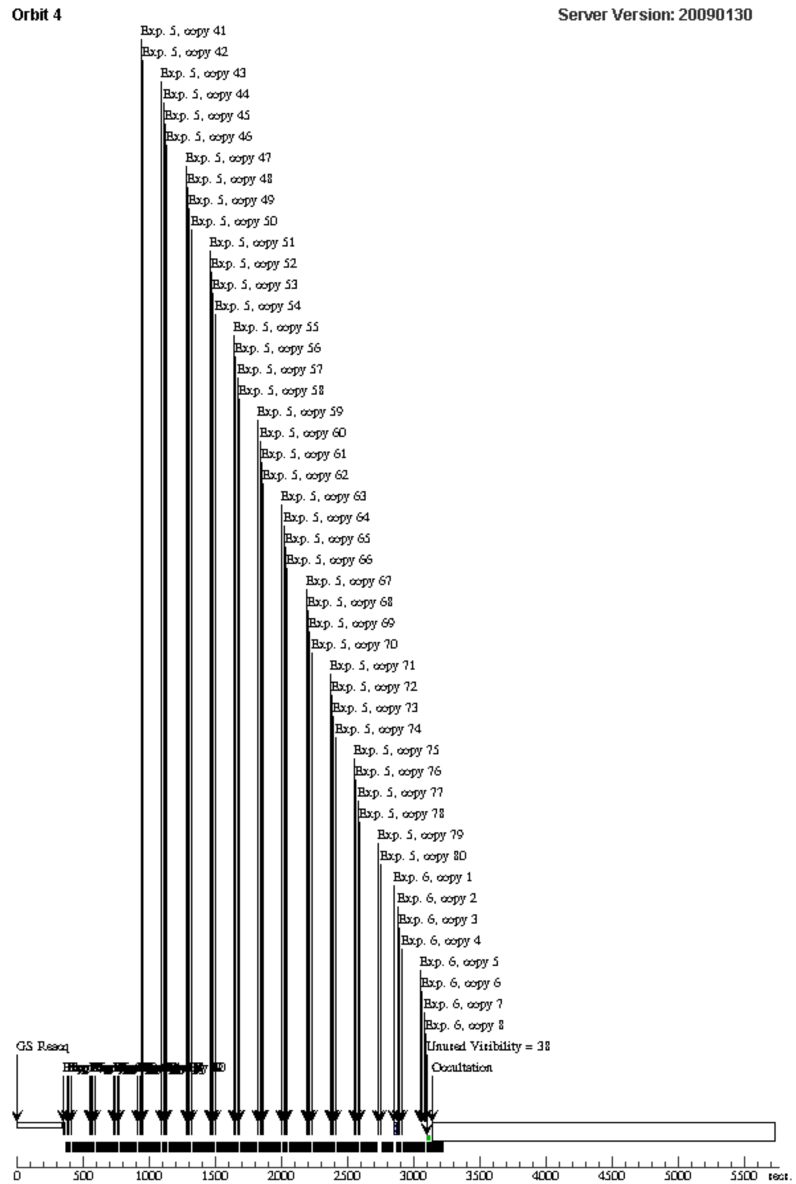
Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)



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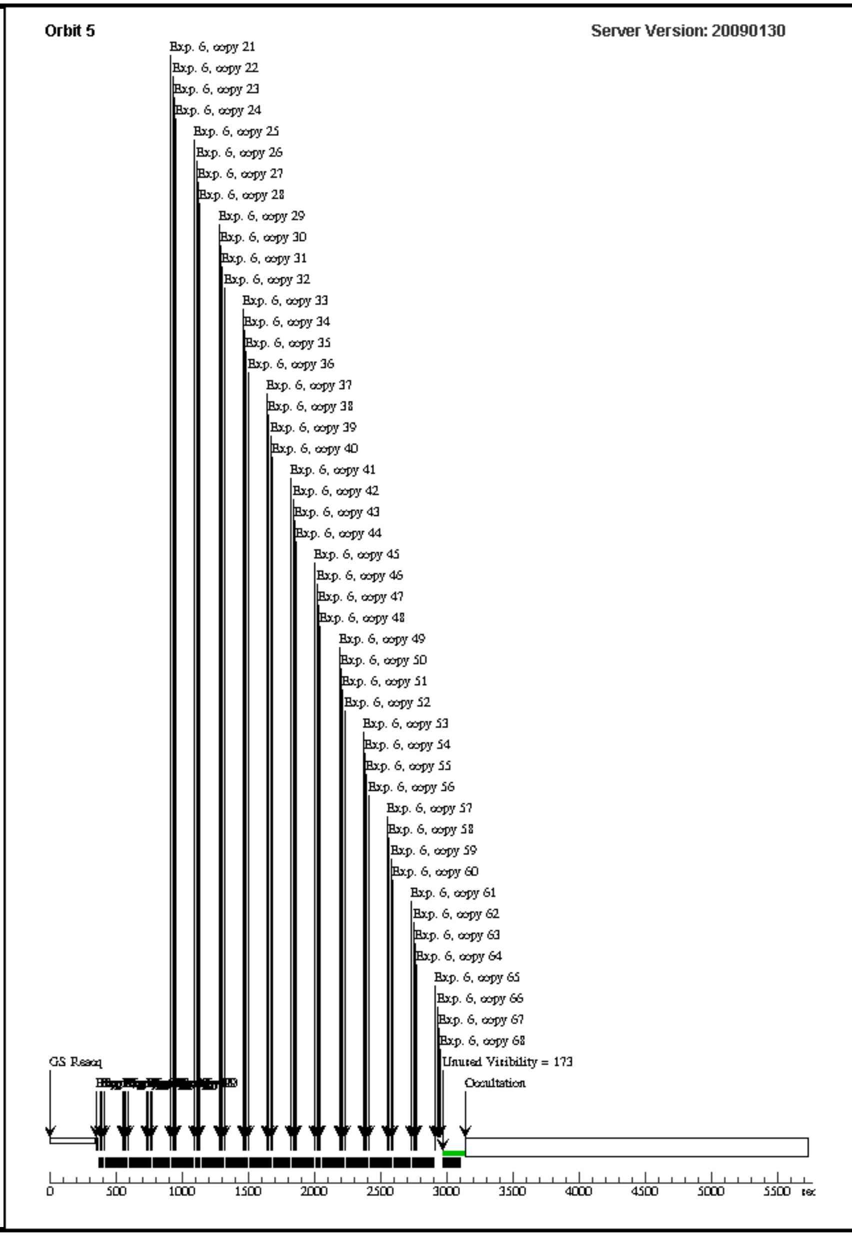

Visit

Proposal 11512, Visit 03, failed — Wed Jul 01 02:38:06 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC3

Special Requirements: Period 3.52474859 D AND ZERO-PHASE HJD2454691.283765

Comments: start HD209458 primary eclipse G206 spectra

- visit is 5 orbits long with primary eclipse viewed on orbit 3

- constraint roll angle held constant

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-209458	RA: 22 03 10.8000 (330.7950000d) Dec: +18 53 4.00 (18.88444d) Equinox: J2000	Proper Motion RA: 0.02890s/yr Proper Motion Dec: -0.01837"/yr Epoch of Position: 2000.00	V=7.65 K=6.62	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	Imaging 1	(1) HD-209458	NIC3, MULTIACCUM, NIC3-FIXD	F190N	SAMP-SEQ=SCAMRR; CAMERA-FOCUS=DEFOCUS; NSAMP=5	PHASE 0.0184 TO 0.0378		*[==>]*	***[1]***
2	Imaging 2	(1) HD-209458	NIC3, MULTIACCUM, NIC3-FIXD	F190N	SAMP-SEQ=SCAMRR; CAMERA-FOCUS=DEFOCUS; NSAMP=5			*[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***

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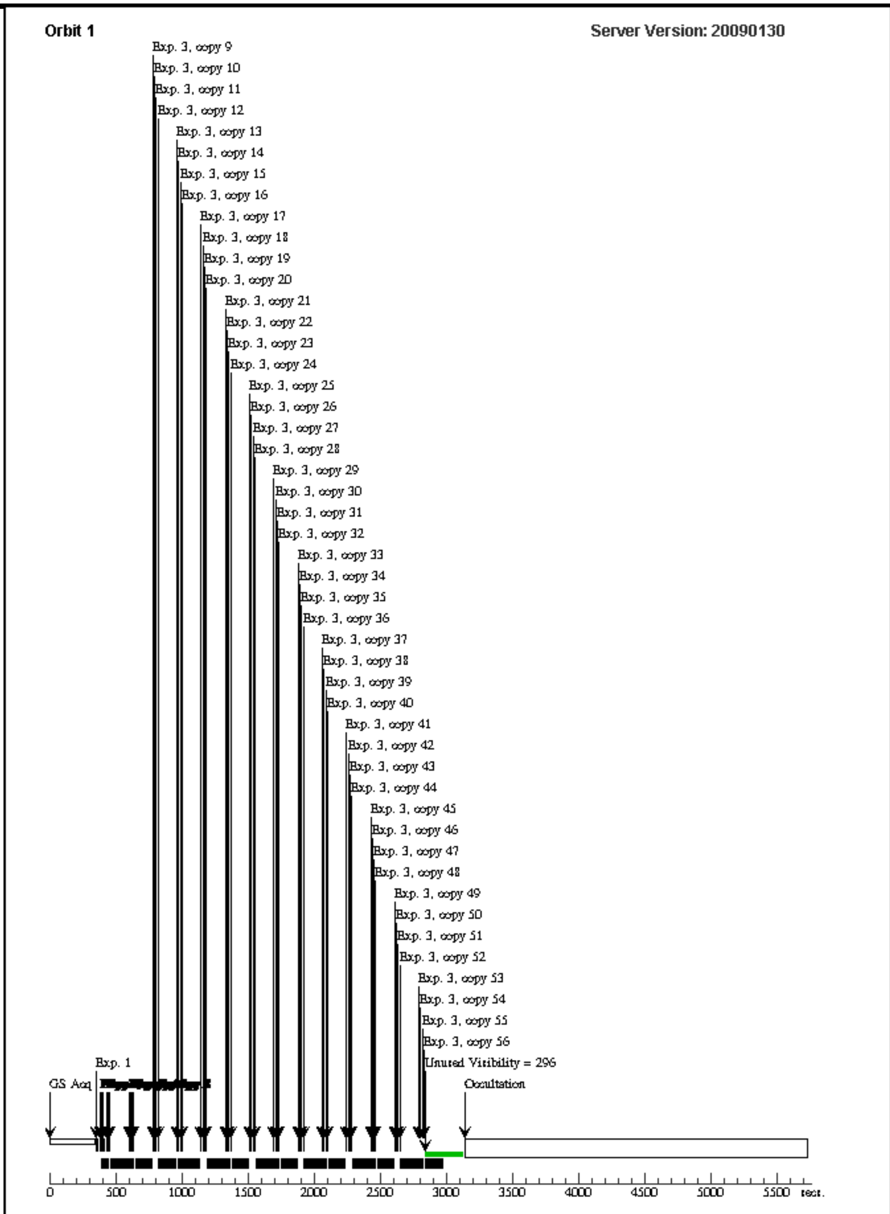
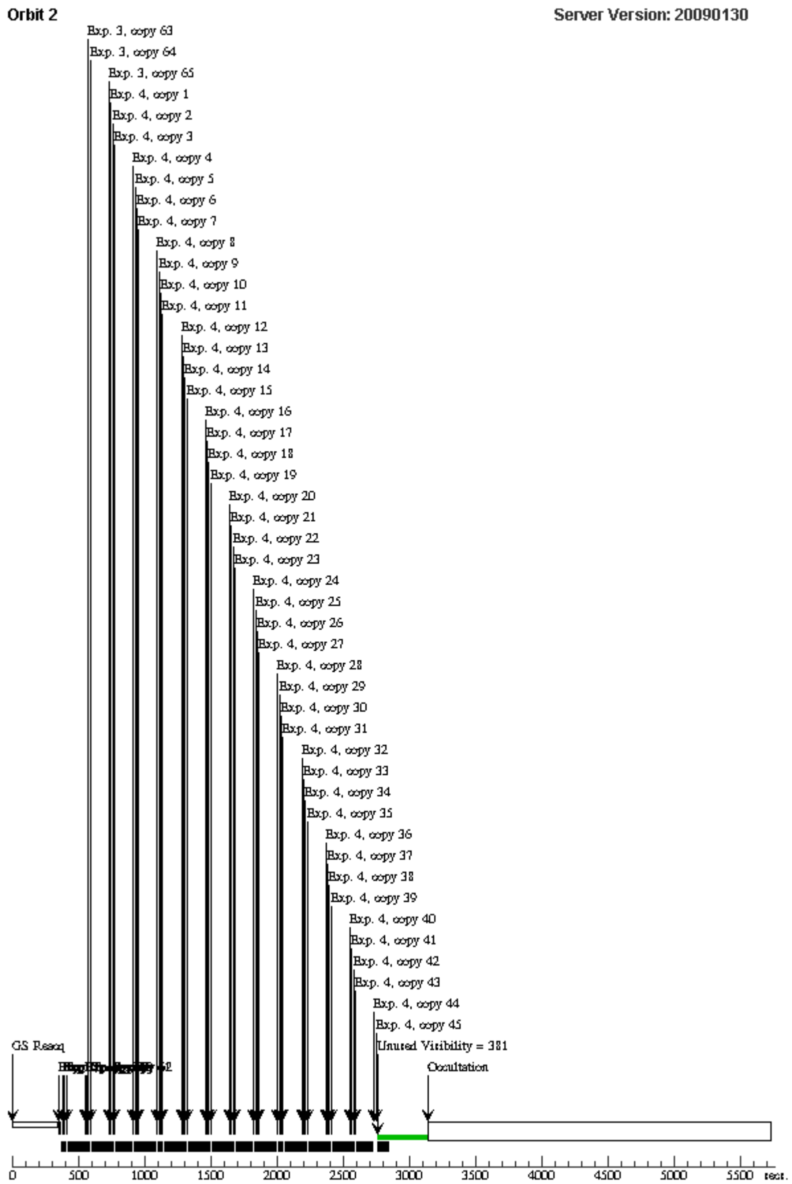
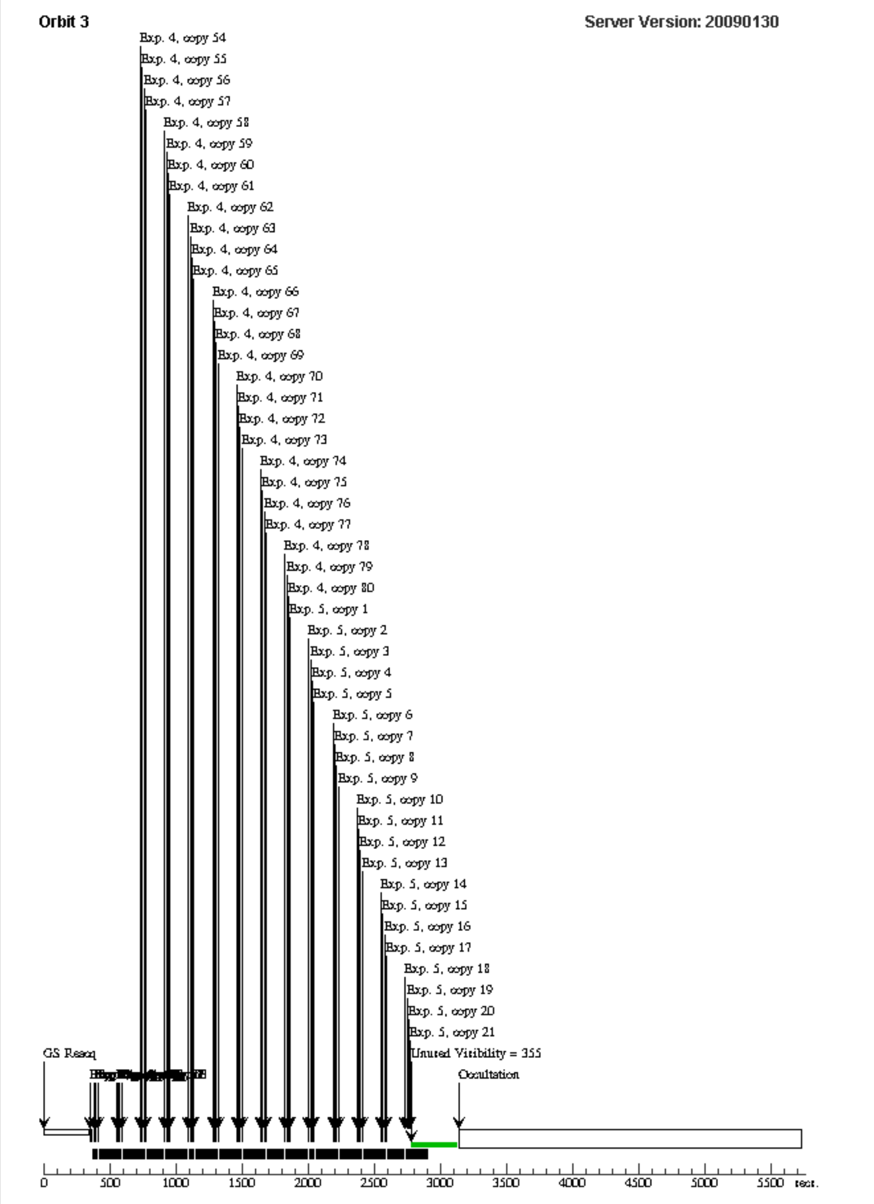
Orbit Structure



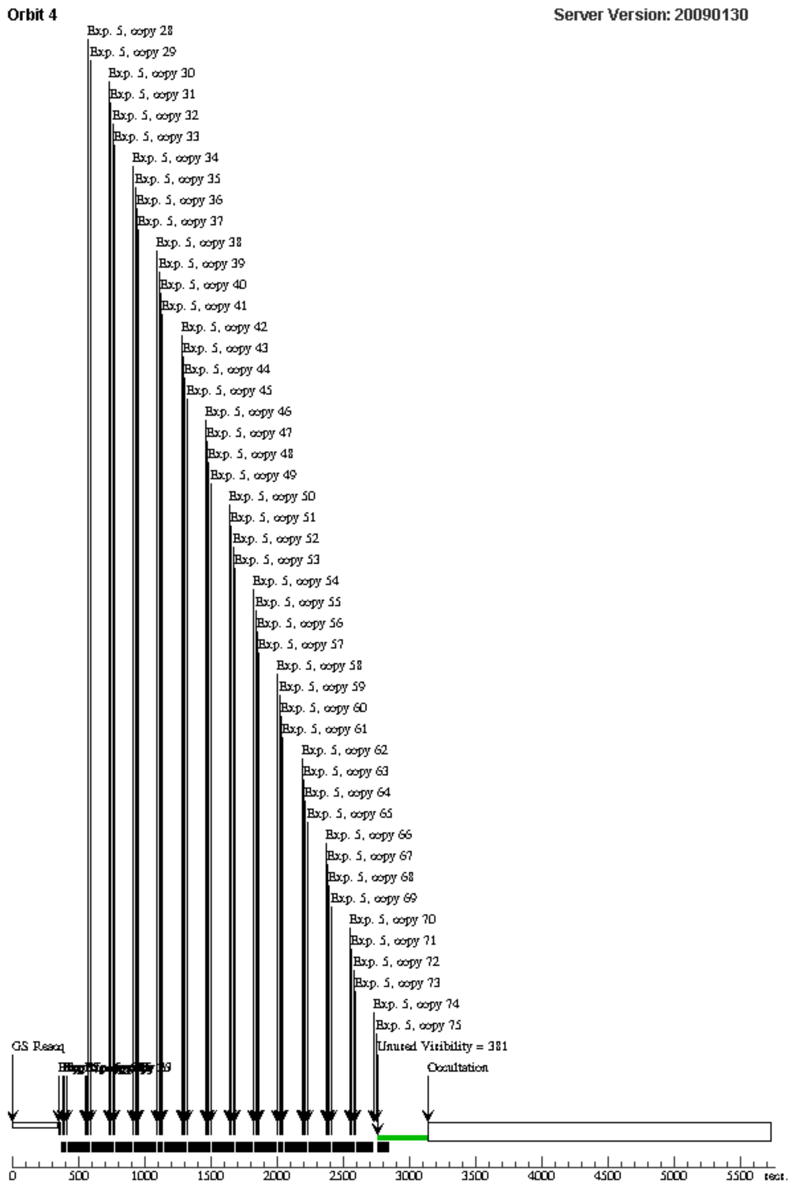
Orbit Structure (continued)



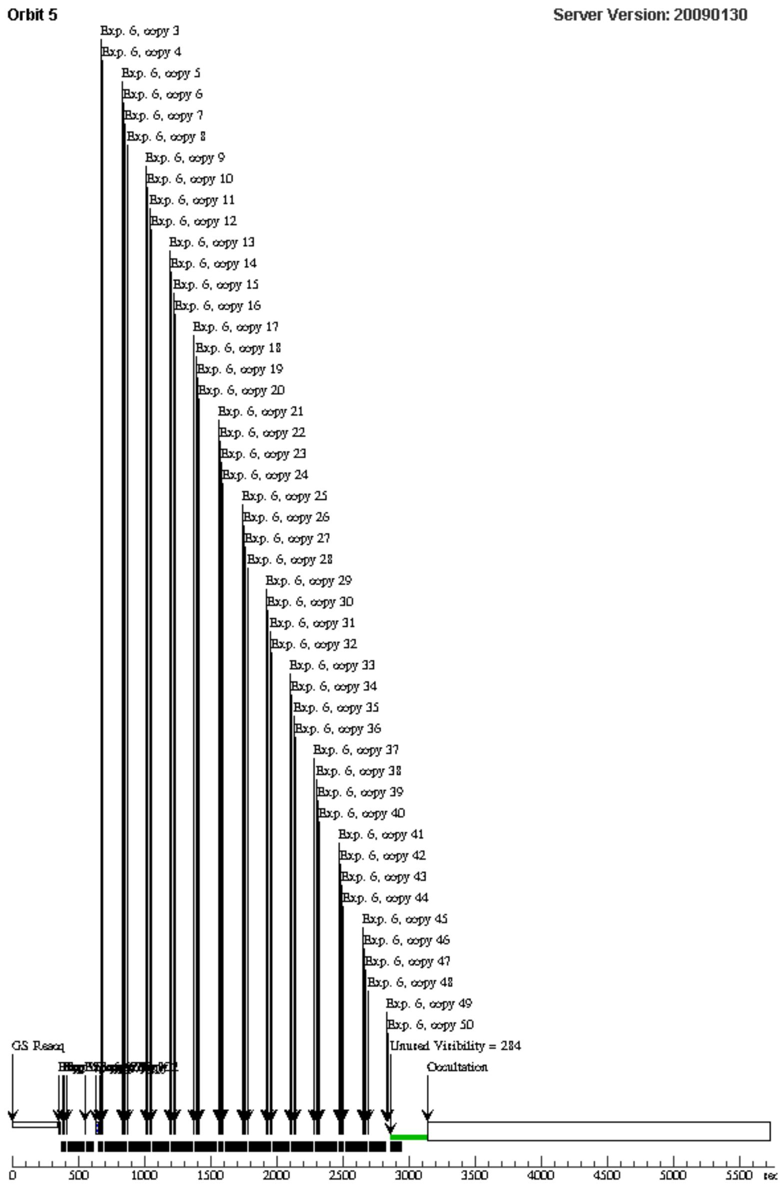
Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)



Visit

Proposal 11512, Visit 53, implementation Wed Jul 01 02:38:09 GMT 2009

Diagnostic Status: Warning

Scientific Instruments: NIC3

Special Requirements: GYRO MODE 3GOBAD; Period 3.52474859 D AND ZERO-PHASE HJD2454691.283765

Comments: start HD209458 primary eclipse G206 spectra

- visit is 5 orbits long with primary eclipse viewed on orbit 3

- constraint roll angle held constant

This is a repeat of failed visit 03.

Diagnostics

(Visit 53) Warning (Form): Gyro Mode overrides default value of 2G.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-209458	RA: 22 03 10.8000 (330.7950000d) Dec: +18 53 4.00 (18.88444d) Equinox: J2000	Proper Motion RA: 0.02890s/yr Proper Motion Dec: -0.01837"/yr Epoch of Position: 2000.00	V=7.65 K=6.62	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	Imaging 1	(1) HD-209458	NIC3, MULTIACCUM, NIC3-FIXD	F190N	SAMP-SEQ=SCAMRR; CAMERA-FOCUS=DEFOCUS; NSAMP=5	PHASE 0.0184 TO 0.0378		*[==>]*	***[1]***
2	Imaging 2	(1) HD-209458	NIC3, MULTIACCUM, NIC3-FIXD	F190N	SAMP-SEQ=SCAMRR; CAMERA-FOCUS=DEFOCUS; NSAMP=5			*[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***

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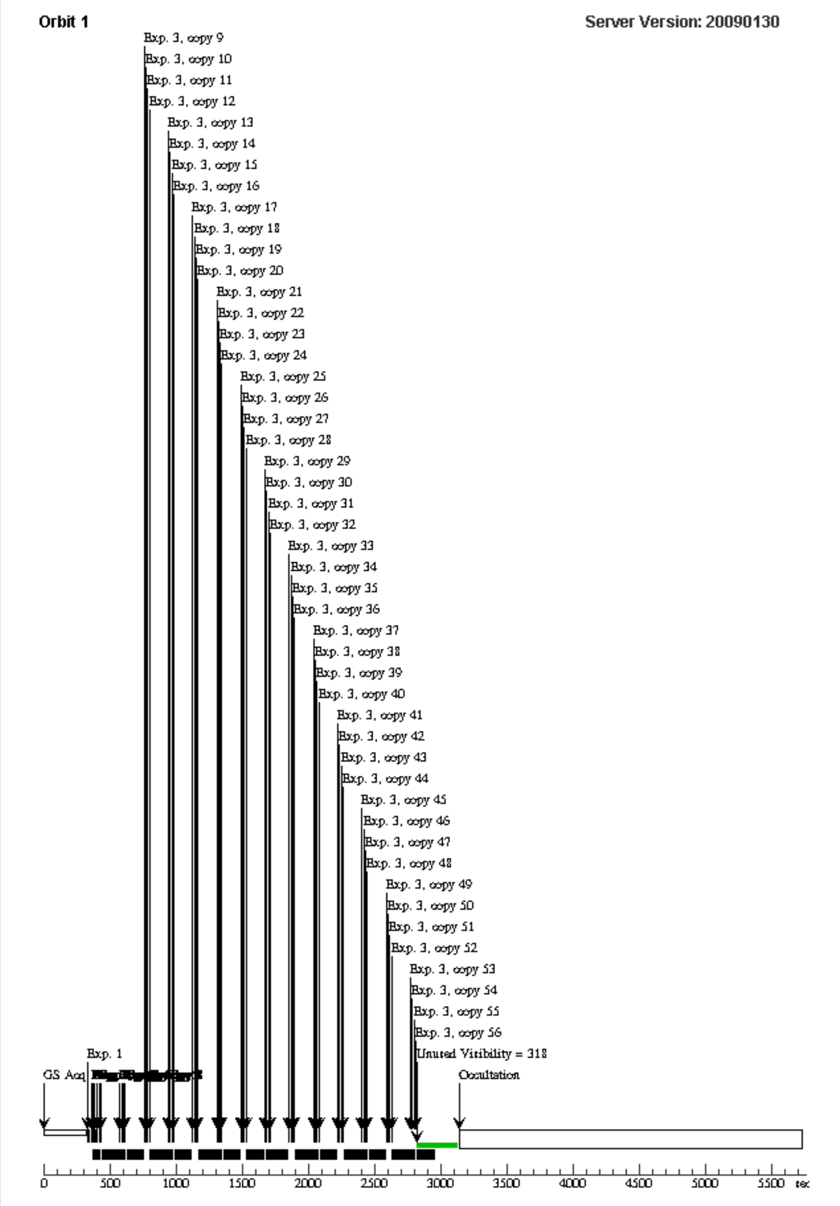
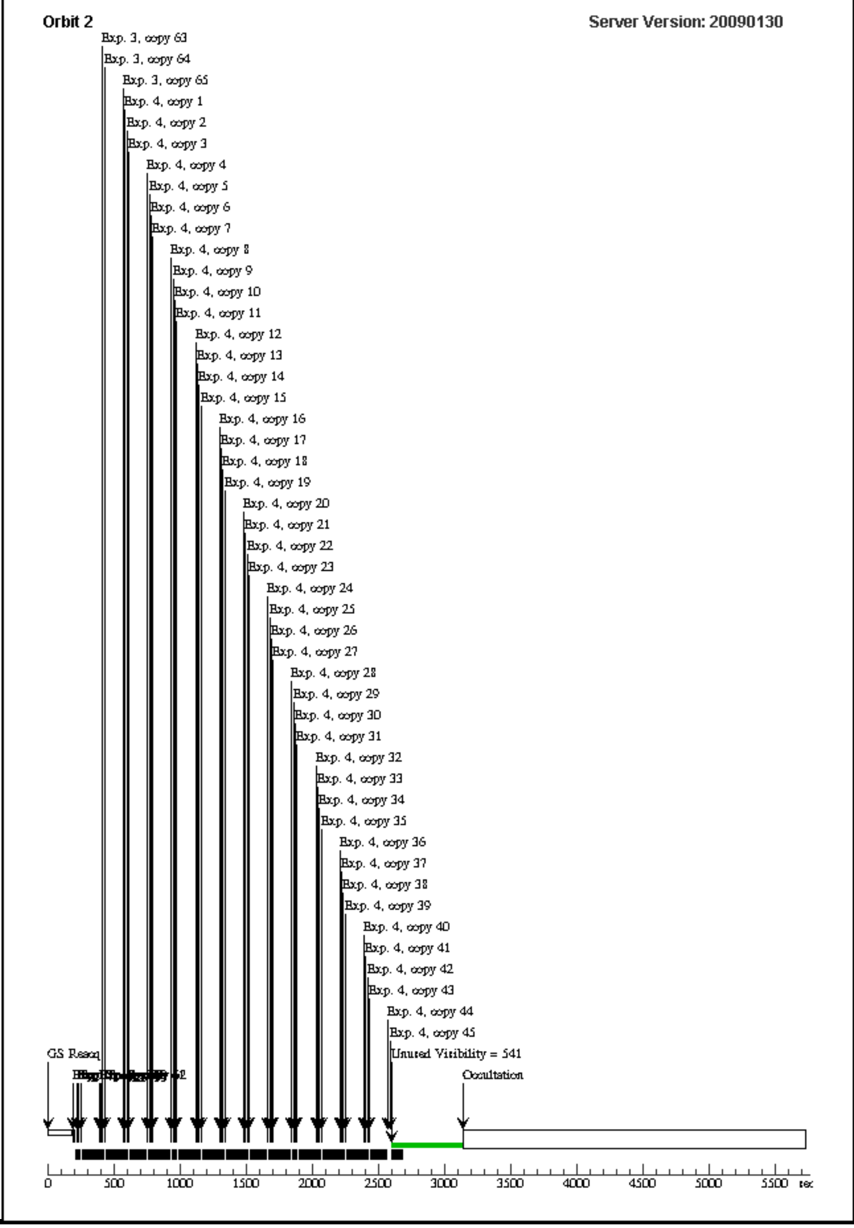
Proposal 11512 - Visit 53 - Molecules in Exoplanet Atmospheres

Orbit Structure



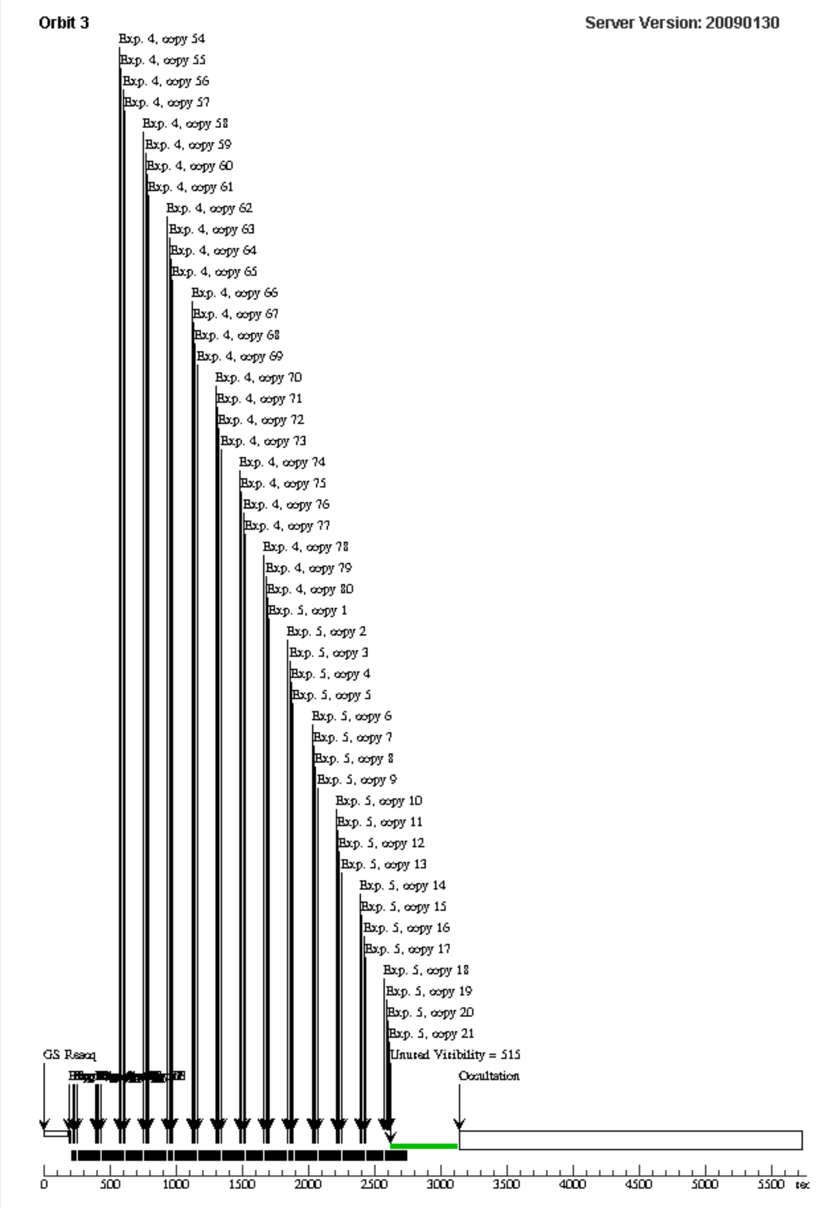
Proposal 11512 - Visit 53 - Molecules in Exoplanet Atmospheres

Orbit Structure (continued)

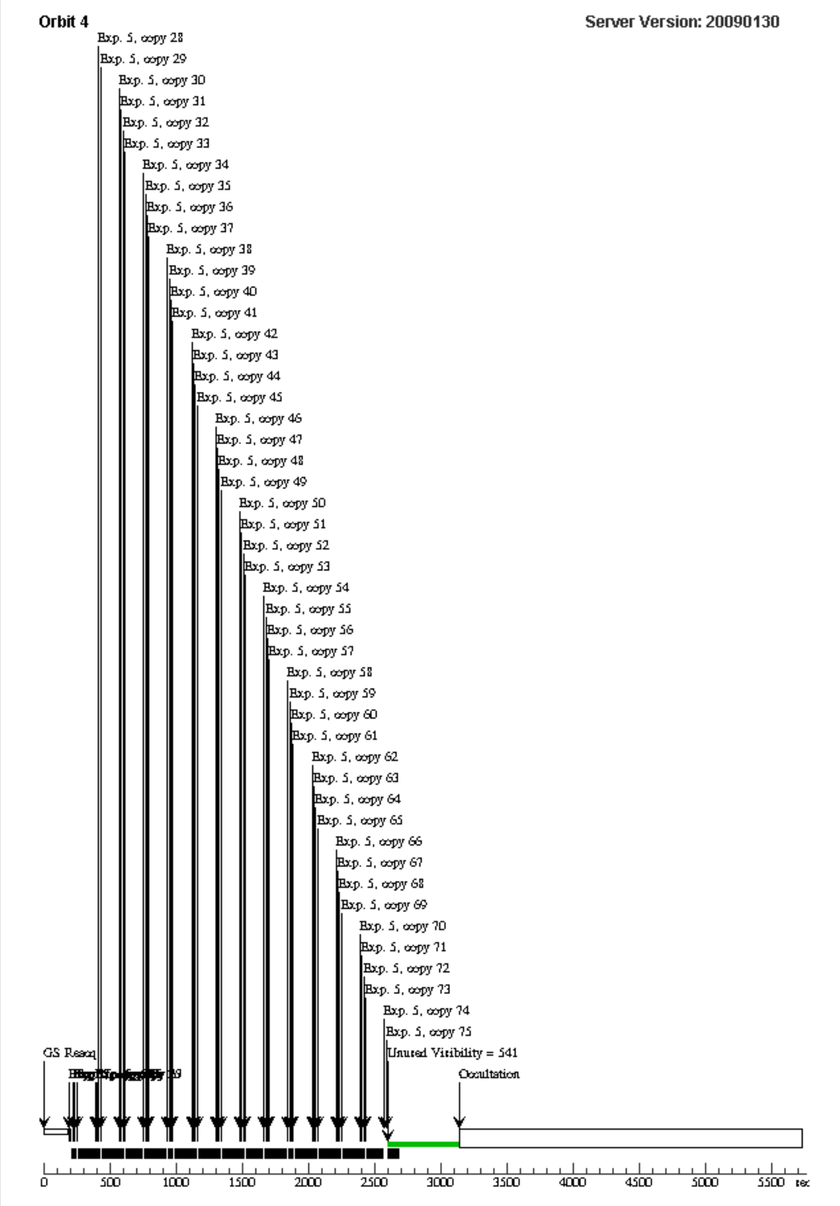


Proposal 11512 - Visit 53 - Molecules in Exoplanet Atmospheres

Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)