



13365 - Probing the nature of small-scale structure towards rho Oph stars: A new avenue in diffuse interstellar band research

Cycle: 21, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

INVESTIGATORS

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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) HD147933 (2) HD147934	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	5	30-Jan-2016 21:00:42.0	yes
02	(3) HD147888	STIS/CCD STIS/FUV-MAMA	3	30-Jan-2016 21:00:44.0	yes

8 Total Orbits Used

ABSTRACT

The first evidence for variations in diffuse interstellar band (DIB) strengths over distance scales as small as a few hundred AU was presented by Cordiner et al. (2013), who measured differences of 5% - 9% in the equivalent widths of several DIBs between the close binary stars rho Oph A and B (separated by c. 344 AU). Larger differences were observed between AB and rho Oph D (separation 19,000 AU), indicative of substantial small-scale variations in the abundances of the large molecules believed to cause the DIBs. This finding offers an unprecedented opportunity to examine the factors that control diffuse band strengths in the relatively small and controlled environment of rho Oph, in order to help resolve the 92-year-old mystery of the identities of the carriers. A secondary objective is to measure the properties of the gas responsible for small-scale structure towards rho Oph, and ascertain the cause of previously-observed atomic and molecular absorption line strength variations. This will provide important information on the nature of diffuse molecular gas in a star-forming region, of relevance to theories regarding molecular cloud formation. We propose to achieve these goals through very high-sensitivity measurements of the ionisation state, temperature, density and depletion of the interstellar gases in the sightlines towards rho Oph A, B and D through high-signal-to-noise, high-resolution observations of atoms, ions and molecules at wavelengths 117-240 nm. Primary diagnostics include the relatively-unsaturated absorption lines of C I, Fe I, Fe II and C2.

OBSERVING DESCRIPTION

We require use of the high-resolution MAMA UV echelle, and aim to obtain the highest S/N possible for C₂ and Fe lines (while keeping the observing time request reasonable), in order to detect small differences in line strengths between our targets. We thus propose to obtain a continuum S/N of 130 in the spectral range 2124-2401 Å using the E230H echelle setting with the NUV-MAMA detector. The 0.2" slit will be employed to maximise throughput and provide sufficient resolution for our science goals in this spectral region. Using the online STIS ETC with flux-calibrated user-supplied spectra of each star obtained from the IUE archive, the desired S/N can be obtained in approximately 3000 s for rho Oph B and 5000 s for rho Oph A.

To obtain the required C_I fine structure spectra at 1190-1330 Å, as well as (relatively unsaturated) lines of O_I, P_{II}, Kr_I, Ge_{II}, Mg_{II}, Mn_{II} and Ni_{II}, we propose to employ the E140H echelle setting in the FUV. Use of the 0.03" slit is required for observation of rho Oph A and B which, according to the ETC, have total detector count rates of 104,000 s⁻¹ and 143,000 s⁻¹, respectively, in the range 1170-1372 Å. In order to discern differences in spectral line profiles at the level of a few percent, we also require reobservation of rho Oph D in the FUV using the 0.03" slit. Required exposure times to reach the required S/N of ~100 at 1270 Å are 2000 s for A, 1500 s for B and 8000 s for D. To achieve highest possible resolution, we request use of the 'repeller wire off setting' of the FUV MAMA.

To keep within the 2" limit for small-angle maneuvers, we propose to observe A & B in one visit and D in a separate visit. The STIS CCD will be used for target acquisition; counts from our (bright) targets will be restricted by use of the O_{II} filter. Two 6-minute pickup maneuvers will be required to center the stars in the 0.03" slit at the start of FUV observations. The telescope pointing accuracy is 0.003" for a 3" small-angle maneuver (SAM), so an additional pickup is not required after the 3.1" SAM from B to A. No pickup is required for the 0.2" slit.

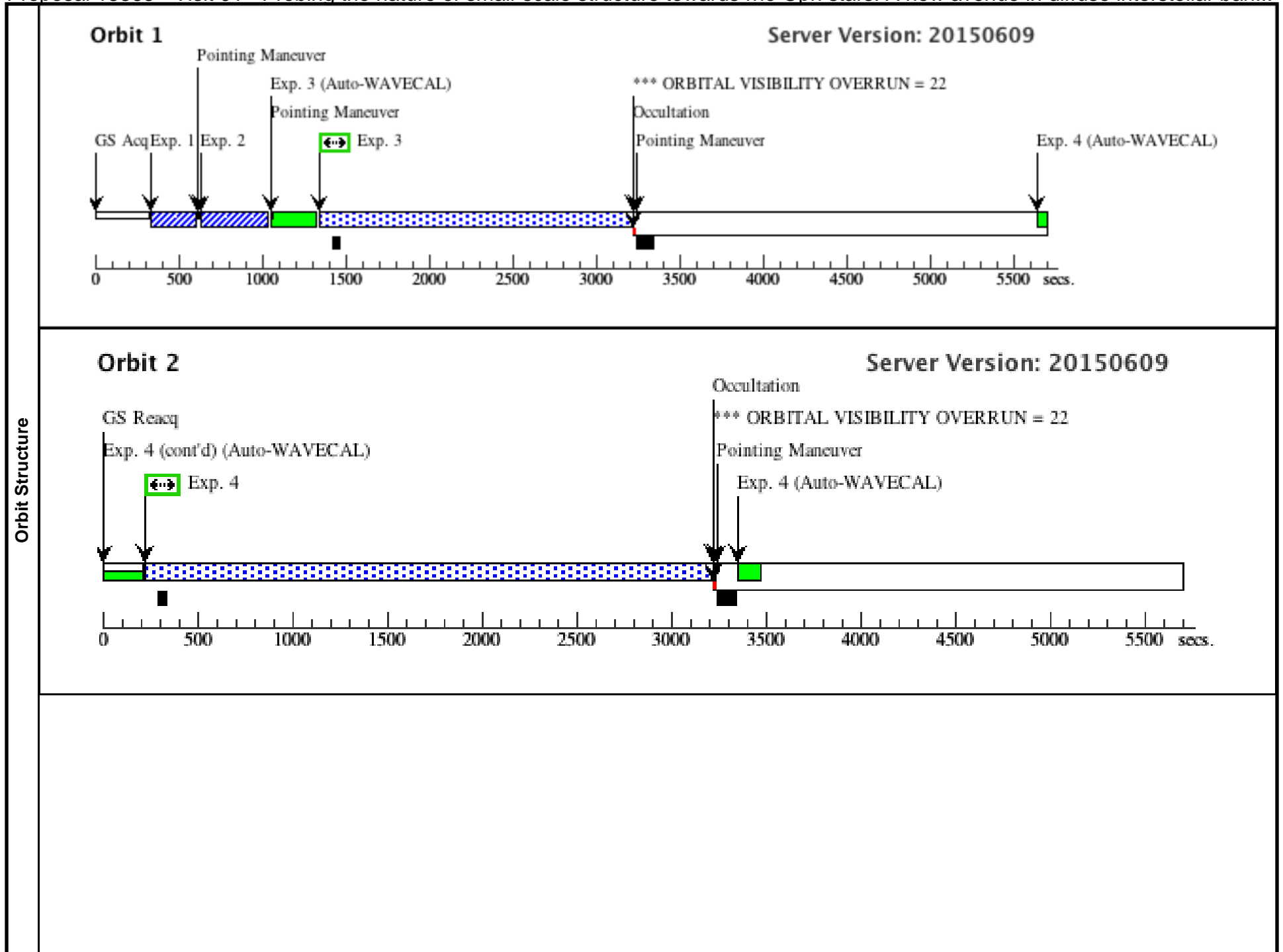
Proposal 13365 - Visit 01 - Probing the nature of small-scale structure towards rho Oph stars: A new avenue in diffuse interstellar ban...

Sun Jan 31 02:00:46 GMT 2016

Visit	Proposal 13365, Visit 01, completed Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA Special Requirements: ORIENT 68D TO 158 D; ORIENT 248D TO 338 D																																															
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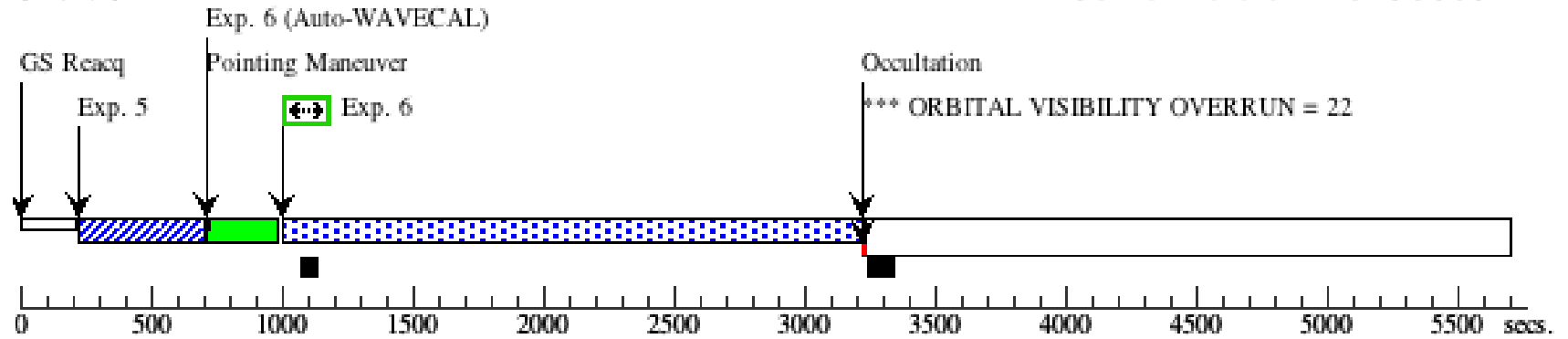
Proposal 13365 - Visit 01 - Probing the nature of small-scale structure towards rho Oph stars: A new avenue in diffuse interstellar ban...

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
Exposures	1	ACQ rho Op h A (STIS.im.60 8256)	(1) HD147933 STIS/CCD, ACQ, F28X50OIII	MIRROR				0.1 Secs (0.1 Secs) [==>]	[1]	
	<i>Comments: 3x3 pixel box 18,036 or S/N ~130</i>									
	2	ACQ Peak r ho Oph A (STIS.sp.60 8254)	(1) HD147933 STIS/CCD, ACQ/PEAK, 31X0.05NDA	G430M 4451 A				1 Secs (1 Secs) [==>]	[1]	
	<i>Comments: ETC is for 1 second integration with 52x0.05 This ACQPEAK is with 31x0.05NDA with 0.4 times the predicted count rate. 8827*0.4 = 3530 per 7 pixel high sample or S/N~59</i>									
	3	rho Oph A F UV 1 (STIS.sp.61 5399)	(1) HD147933 STIS/FUV-MAMA, ACCUM, 31X0.05NDA	E140H 1271 A				1818 Secs (1818 Secs) [==>]	[1]	
	<i>Comments: ETC run uses a scaled IUE large aperture spectrum (that includes flux from both HD147933 and HD147934). Scaling factor of 0.65 accounts for the contribution of HD147933, and factor 0.4 accounts for the difference in throughput between the requested 31x0.05NDA slit and the 52x0.05 slit available in the ETC.</i>									
	4	rho Oph A NUV 1 (STIS.sp.61 5400)	(1) HD147933 STIS/NUV-MAMA, ACCUM, 31X0.05NDA	E230H 2263 A				2941 Secs (2941 Secs) [==>]	[2]	
	<i>Comments: ETC run uses a scaled IUE large aperture spectrum (that includes flux from both HD147933 and HD147934). Scaling factor of 0.65 accounts for the contribution of HD147933, and factor 0.4 accounts for the difference in throughput between the requested 31x0.05NDA slit and the 52x0.05 slit available in the ETC.</i>									
5	ACQ Peak r ho Oph B (STIS.ta.608 262)	(2) HD147934 STIS/CCD, ACQ/PEAK, 31X0.05NDA	G430M 4451 A				1 Secs (1 Secs) [==>]	[3]		
<i>Comments: Count rate for 52x0.05 aperture is 7685 counts/2.5 (31x0.05NDB = ND0.4 or 1/2.5) =3074 counts per 7 pixel res element</i>										
6	rho Oph B N UV 1 (STIS.sp.61 5402)	(2) HD147934 STIS/NUV-MAMA, ACCUM, 31X0.05NDA	E230H 2263 A				2162 Secs (2162 Secs) [==>]	[3]		
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7	rho Oph B N UV 2 (STIS.sp.61 5403)	(2) HD147934 STIS/NUV-MAMA, ACCUM, 31X0.05NDA	E230H 2263 A				2941 Secs (2992 Secs) [==>2992.0 Secs]	[4]		
<i>Comments: ETC run uses a scaled IUE large aperture spectrum (that includes flux from both HD147933 and HD147934). Scaling factor of 0.35 accounts for the contribution of HD147934, and factor 0.4 accounts for the difference in throughput between the requested 31x0.05NDA slit and the 52x0.05 slit available in the ETC.</i>										
8	rho Oph B F UV 1 (STIS.sp.61 5404)	(2) HD147934 STIS/FUV-MAMA, ACCUM, 31X0.05NDA	E140H 1271 A				2941 Secs (2941 Secs) [==>]	[5]		
<i>Comments: ETC run uses a scaled IUE large aperture spectrum (that includes flux from both HD147933 and HD147934). Scaling factor of 0.35 accounts for the contribution of HD147934, and factor 0.4 accounts for the difference in throughput between the requested 31x0.05NDA slit and the 52x0.05 slit available in the ETC.</i>										



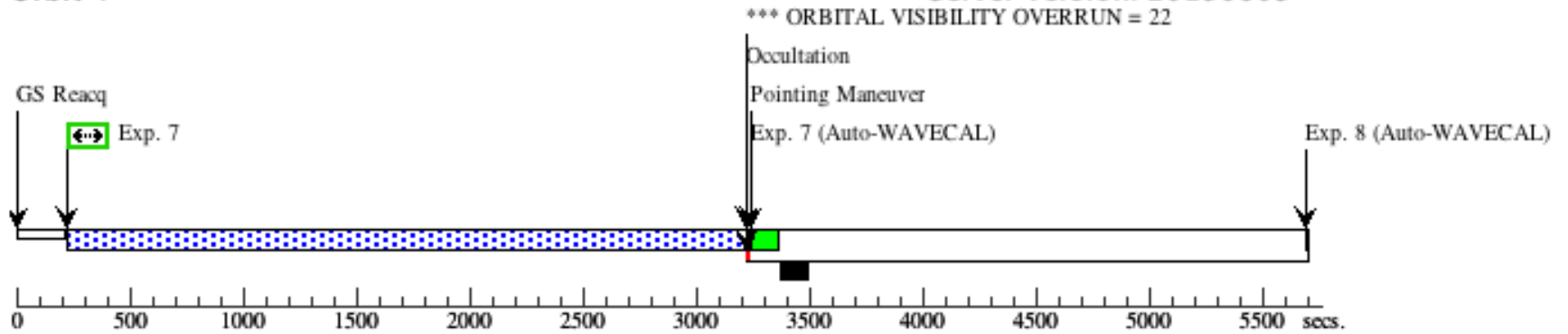
Orbit 3

Server Version: 20150609



Orbit 4

Server Version: 20150609



Proposal 13365 - Visit 02 - Probing the nature of small-scale structure towards rho Oph stars: A new avenue in diffuse interstellar ban...

Sun Jan 31 02:00:46 GMT 2016

Visit	Proposal 13365, Visit 02, completed Diagnostic Status: Warning Scientific Instruments: STIS/CCD, STIS/FUV-MAMA Special Requirements: (none)																																																																																																													
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