



12260 - Probing Intermediate Ionization Gas in the Perseus and Virgo Clusters

Cycle: 18, Proposal Category: GO

(Availability Mode: SUPPORTED)

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	(5) NGC1275-NUCLEUS	COS/FUV COS/NUV	3	27-Jun-2011 21:18:02.0	yes
02	(2) M87-NUCLEUS (6) OFFSET-FROM-M87-NUCLEUS	COS/FUV COS/NUV	3	27-Jun-2011 21:18:08.0	yes

6 Total Orbits Used

ABSTRACT

The physics of the evolution of X-ray emitting gas in the cores of clusters is now known to be much more complex than the simple cooling model. In order to understand how the observed molecular/atomic and keV components interact we need to probe the full range of gas phases between these components.

We therefore propose deep ultraviolet spectra of the active nuclei in NGC1275 and M87, the central galaxies in the Perseus and Virgo clusters. Discovery of absorption lines from highly ionized species such as CIV and SiIV will provide a sensitive diagnostic of this crucial intermediate phase of the intracluster medium that is not accessible in any other way.

OBSERVING DESCRIPTION

We propose high resolution spectroscopy of the active nuclei in NCG 1275 and M87 covering the absorption doublets of SiIV 1400, CIV 1550 using COS. HST is required because these lines lie in the ultraviolet part of the spectrum. COS is the instrument selected as it has the best sensitivity for these observations.

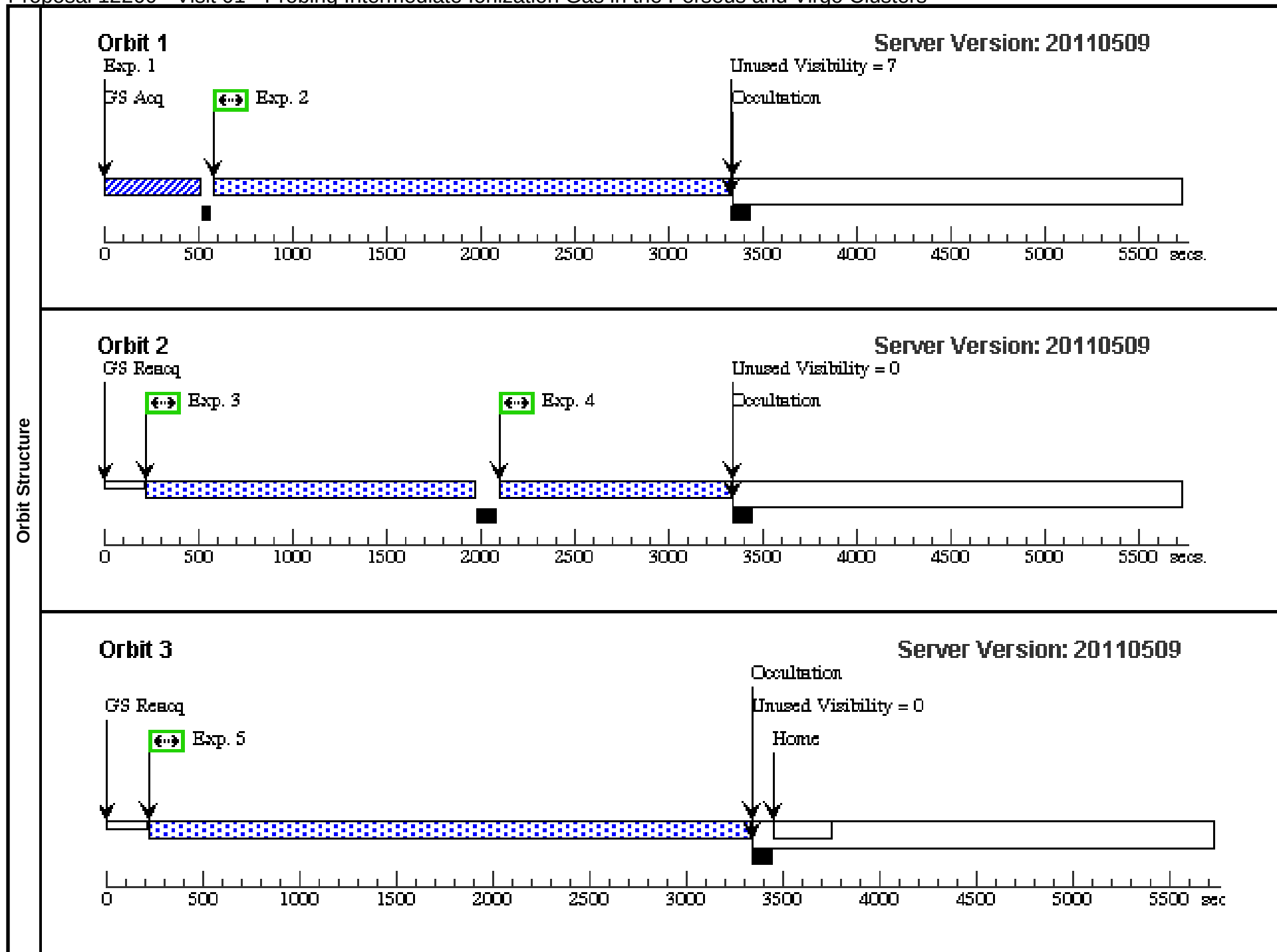
We aim to reach a sensitivity at SiIV and CIV in equivalent width and column density terms that are at least a factor of ten better than our initial work on NGC1275 with FOS (Johnstone et al 1995). That work set a 3sigma equivalent width limit of 300mA on the absorption from the CIV doublet corresponding to a column density of $1.2 \times 10^{14} \text{cm}^2$ in the C3+ ion.

We have used the COS ETC to estimate exposure times. With the G160M gating set to a central wavelength of 1600A we can observe the SiIV and CIV lines simultaneously. Assuming a continuum flux density of $10^{15} \text{erg cm}^{-2} \text{s}^{-1} \text{Å}^{-1}$, (appropriate for NGC1275; M87 is about a factor of two brighter; Pogge et al 2000) a flat continuum in F(lambda) and nominal background levels then in a 3 orbit visit (total of 8600 s on source) a signal-to-noise ratio per resolution element of S/N=9.5 and S/N=6.8 is attained at the (redshifted) wavelengths of SiIV and CIV respectively. Using a resolution element of 6 pixels or 73mA this translates to an equivalent width uncertainty of 7.7mA and 10.7mA respectively, or 3sigma upper limits of 23 and 32 mA.

The VPGUESS program (<http://www.eso.org/~jliske/vpguess/>) is then used to convert these equivalent width values to uncertainties in ionic column densities, yielding 3 detection upper limits of $3 \times 10^{12} \text{cm}^2$ and $8 \times 10^{12} \text{cm}^2$ for SiIV and CIV respectively. These column densities are on the linear part of the curve of growth and are therefore not dependent on line width for reasonable values of thermal broadening. Uncertainties for M87 will be a factor of $\sqrt{2}$ tighter.

Proposal 12260 - Visit 01 - Probing Intermediate Ionization Gas in the Perseus and Virgo Clusters

Visit	Proposal 12260, Visit 01, scheduling						Tue Jun 28 01:18:11 GMT 2011			
	Diagnostic Status: Warning									
	Scientific Instruments: COS/NUV, COS/FUV									
	Special Requirements: (none)									
Comments: NGC1275										
Diagnostics	(Visit 01) Warning (Form): If the target coordinates are not known to 0.4" (or better) an ACQ/SEARCH should precede the ACQ/IMAGE.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(5)	NGC1275-NUCLEUS	RA: 03 19 48.1600 (49.9506667d) Dec: +41 30 42.11 (41.51170d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr	V=13+/-2 1+/-0.2 e-15 erg/cm/cm/s/A at 1600A, 3.2e-15 erg/cm/cm/s/A at 2300A	Reference Frame: ICRS				
	Comments: Position is from VLBI from Ma et al 1998, AJ 116, 516									
	Flux at 1600 (FOS 0.21x1.23 aperture) from Johnstone + Fabian 1995 MNRAS 273, 625. Flux at 2300A confirmed from small extrapolation of preview data for HST dataset O62O05010 (2000-08-18) STIS 52x0.2. That spectrum is largely in agreement with F320W columns in Table 5 of Zirbel + Baum 1998, ApJ, 114, 177 when only point source component is taken into account.									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	Acquisition for NGC 1275 nucleus	(5) NGC1275-NUCL EUS	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				45 Secs [==>]	[1]
	2	NGC1275 1/4	(5) NGC1275-NUCL EUS	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=2529; FP-POS=1			2529 Secs [==>]	[1]
	3	NGC1275 2/4	(5) NGC1275-NUCL EUS	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=1698; FP-POS=1			1698 Secs [==>]	[2]
	4	NGC1275 3/4	(5) NGC1275-NUCL EUS	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=1172; FP-POS=2			1172 Secs [==>]	[2]
	5	NGC1275 4/4	(5) NGC1275-NUCL EUS	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=3055; FP-POS=2			3055 Secs [==>]	[3]



Proposal 12260 - Visit 02 - Probing Intermediate Ionization Gas in the Perseus and Virgo Clusters

Visit	Proposal 12260, Visit 02, scheduling						Tue Jun 28 01:18:13 GMT 2011			
	Diagnostic Status: Warning									
	Scientific Instruments: COS/NUV, COS/FUV									
	Special Requirements: ORIENT 220D TO 280 D; ORIENT 40D TO 100 D									
Comments: NGC4486										
Diagnostics	(Visit 02) Warning (Form): If the target coordinates are not known to 0.4" (or better) an ACQ/SEARCH should precede the ACQ/IMAGE.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	M87-NUCLEUS Alt Name1: NGC4486	RA: 12 30 49.4230 (187.7059292d) Dec: +12 23 28.04 (12.39112d) Equinox: J2000	Radial Velocity: 1307 km/sec	V=11.4+/-2 2 +/- 0.4 e-15erg/cm^2/s/A at 1600A	Reference Frame: ICRS				
	Comments: Position is from VLBI from Ma et al 1998, AJ 116, 516									
	Flux in the M87 nucleus at ~2700A (ACS/F250W) =0.14mJy (~7e-16 erg/sm/sm/s/A) on 2006 Dec 30 published by Madrid 2009, ApJ 137, 3864 is used for the NUV acquisition exposure time calculation.									
(6)	OFFSET-FROM-M87-NUCLEUS	Offset from M87-NUCLEUS by RA Offset: -0.027 Secs Dec Offset: 0.175 Arcsec		V=35.0	Offset Position (OFFSET-FROM-M87-NUCLEUS) Reference Frame: ICRS					
Comments: Offset to centre COS aperture mid-way betweenM87 nucleus and HST-1. These offsets assume that th acquisition picked up M87 nucleus as the brigher of the two soures. If HST-1 is seen to be brighter than M87 nucleus in the quiescence check observation there offsets need to be changed.										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	Acquisition f or M87 nucl eus	(2) M87-NUCLEUS	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				12 Secs	
									[==>]	[1]
	2	NGC4486 1/4	(6) OFFSET-FROM-M87-NUCLEUS	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=2528; FP-POS=3			2528 Secs	
									[==>]	[1]
	3	NGC4486 2/4	(6) OFFSET-FROM-M87-NUCLEUS	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=1602; FP-POS=3			1602 Secs	
									[==>]	[2]
4	NGC4486 3/4	(6) OFFSET-FROM-M87-NUCLEUS	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=1172; FP-POS=4			1172 Secs		
								[==>]	[2]	
5	NGC4486 4/4	(6) OFFSET-FROM-M87-NUCLEUS	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=2959; FP-POS=4			2959 Secs		
								[==>]	[3]	

