



15908 - Probing the inner accretion disk in NGC3147

Cycle: 27, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Prof. Stefano Bianchi (PI) (ESA Member) (Contact)	Universita' degli Studi Roma Tre	bianchi@fis.uniroma3.it
Prof. Robert Antonucci (CoI) (AdminUSPI)	University of California - Santa Barbara	skiantonucci0@gmail.com
Dr. Alessandro Capetti (CoI) (ESA Member)	Osservatorio Astronomico di Torino	alessandro.capetti@inaf.it
Dr. Marco Chiaberge (CoI) (ESA Member)	Space Telescope Science Institute - ESA	marcoc@stsci.edu
Dr. Ari Laor (CoI)	Technion-Israel Institute of Technology	laor@physics.technion.ac.il

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) NGC-3147 CCDFLAT	STIS/CCD STIS/FUV-MAMA	4	04-Oct-2019 12:00:24.0	yes

4 Total Orbits Used

ABSTRACT

NGC 3147 has been considered the best case of a true type 2 AGN: an unobscured AGN, based on the unabsorbed compact X-ray continuum, which lacks a broad line region (BLR). However, the very low luminosity of NGC 3147 implies a compact BLR, which produces very broad lines, hard to detect against the background host galaxy. Narrow (0.1"x0.1") slit HST spectroscopy allowed excluding the host galaxy light, and revealed a remarkably strong and extremely broad H α line. The line profile shows a very steep blue wing and an extended red wing, the signature of a mildly relativistic thin accretion disk line profile. The line profile is well fit with a nearly face on thin disk ($i=23$ degrees), with an inner radius at 77 gravitational radii, as expected from the $R-L^{1/2}$ relation. This result critically questions the very existence of true type 2 AGN, and is likely to

change our current view of the accretion flow at low accretion rates. Here we propose to get the first C IV emission line profile of NGC 3147. Reverberation mapping campaigns indicate that the C IV line is produced in a region which is about half the size of the Balmer line emitting region. This means that the C IV line in NGC 3147 can potentially probe the accretion disk well below 50 gravitational radii, a region currently probed only with X-ray line spectroscopy. Optical detections of relativistic line profiles may provide a new and powerful tool for precision measurements of the innermost accretion disk structure and the BH properties, as the optical photons detection rate is $>10^5$ higher than in the X-rays.

OBSERVING DESCRIPTION

We observe the target using STIS/CCD for 4 orbits with the G750L and the G750M gratings, and the FUV/MAMA with G140L. The observations are aimed at characterizing the expected very broad profile of the C iv line, and getting a higher spectral resolution view of the H α emission disk line profile previously detected by STIS G750L. In ground based spectra, the emission of these lines is heavily contaminated by the host galaxy stellar emission. We will use the 52x0.1" slit in order to reduce such a contamination by a factor of ~ 10 with respect to ground based observations. This choice proved extremely effective with the past STIS G750L observation (GO 15225), which revealed for the first time an extremely broad H α in this source.

The pointing strategy is the same as in our previous program 15225. We will aim at the host galaxy photocenter. A target acquisition image will be taken to allow recentering on the brightest region, which we know coincides with the AGN, as shown by the previous STIS G750L observation. As recommended in the STIS handbook, we will use the F28X50LP lter for the acquisition image and an exposure time of 60s, as in our previous program that observed the very same target.

We performed accurate S/N simulations using the STIS ETC:

G750M: the most efficient choice is to use the 6295-6867A band, which covers most of the observed disk line H α profile and all the bright NLR lines. Using the observed average flux density of the broad H α (0.2×10^{-15} erg cm 2 s $^{-1}$ A $^{-1}$), the ETC returns a S/N ~ 12 per resolution element in 2000 s, which will be accommodated in the first orbit, after the acquisition image.

G750L: a very short repetition of the low resolution H α profile is important, since the restricted band of G750M does not allow for a proper determination of the continuum level. It will also be used for a direct comparison of the disk line profile measured in the earlier observation. An exposure of 800s will be accommodated at the beginning of orbit 2.

G140L: the C iv line is expected to have about the same flux of the H α line, as derived from the SDSS QSO template (Vanden Berk et al., 2001), while the continuum is higher by a factor of 5. The E(B-V) of NGC 3147 is fairly low, being 0.02 mag. Adopting a flux density of $5 \times 10^{-15} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$ (5 times the observed continuum level around H α), the ETC returns a S/N of 12 per resolution element on the continuum, for an exposure time of 8500 s. The required exposure will be split in three orbits (2100s in orbit 2, and 3200 s in orbit 3 and 4).

We use the 52x01E1 aperture to mitigate CTE losses, as suggested by the IHB. For the MAMA observations, we will use the D1 aperture, as recommended in the IHB.

We use two CR-SPLIT images at each slit position to eliminate cosmic rays in the CCD exposures.

We also include simultaneous flat fields to perform de-fringing at long wavelengths, as recommended by the IHB in Sect. 7.2.6. These flats are taken during occultation, immediately after the last on-target exposure in orbits 1 and 2.

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Fri Oct 04 16:00:25 GMT 2019

Visit		Proposal 15908, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD, STIS/FUV-MAMA Special Requirements: (none)								
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	NGC-3147	RA: 10 16 53.6509 (154.2235454d) Dec: +73 24 2.70 (73.40075d) Equinox: J2000		V=11.43	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i> <i>The magnitude is the magnitude of the entire galaxy, not the nucleus. Expected nuclear fluxes are given in the Phase I proposal and in the description of the Observations</i> Category=GALAXY Description=[SEYFERT]										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) NGC-3147	STIS/CCD, ACQ, F28X50LP	MIRROR				60 Secs (60 Secs)	
									[==>]	[1]
	2		(1) NGC-3147	STIS/CCD, ACCUM, 52X0.1E1	G750M 6581 A				2335 Secs (2335 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	3	FLATS	CCDFLAT	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A				[==>(Copy 1)] [==>(Copy 2)]	[1]
	4		(1) NGC-3147	STIS/CCD, ACCUM, 52X0.1E1	G750L 7751 A				800 Secs (800 Secs)	
								[==>(Split 1)] [==>(Split 2)]	[2]	
5	(STIS.sp.13 70009)	(1) NGC-3147	STIS/FUV-MAMA, TIME-TAG, 52X0.1D1	G140L 1425 A		BUFFER-TIME=10 00		1988 Secs (1988 Secs)		
								[==>]	[2]	
6	(STIS.sp.13 70010)	(1) NGC-3147	STIS/FUV-MAMA, TIME-TAG, 52X0.1D1	G140L 1425 A		BUFFER-TIME=15 97		3195 Secs (3195 Secs)		
								[==>]	[3]	
7	(STIS.sp.13 70010)	(1) NGC-3147	STIS/FUV-MAMA, TIME-TAG, 52X0.1D1	G140L 1425 A		BUFFER-TIME=15 97		3195 Secs (3195 Secs)		
								[==>]	[4]	



