



12919 - Physics of Black Hole Transients from Simultaneous X-Ray and UV

Observations

Cycle: 20, 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	(1) SWIFTJ1753.5-0127	COS/FUV COS/NUV	2	10-Jul-2012 23:10:19.0	yes
02	(2) BHTRANSIENT	COS/FUV COS/NUV	2	10-Jul-2012 23:10:29.0	yes

4 Total Orbits Used

ABSTRACT

Fundamental questions concerning processes in the vicinity of black holes (BH) remain open. The accretion flow geometry, the role of the jet and the source of optical radiation are among most disputed. In recent years, simultaneous infrared/optical/ultraviolet--X-ray observations revealed their large

potential in addressing these problems. By joining two powerful astrophysical techniques: (a) high-resolution X-ray spectroscopy and timing (which only XMM-Newton can provide) and (b) high time-resolution UV photometry (available only at HST), we will answer a number of fundamental questions of BH physics. We will constrain the accretion flow geometry, measure the inner disc radius, identify the source of seed photons for Comptonization, and locate the zone of the UV emission.

OBSERVING DESCRIPTION

We will observe two accreting black holes, SWIFT J1753.5-0127 and a new black hole transient. The HST observing time is two orbits per target. The FUV observations should be performed strictly simultaneously with the X-ray observation by XMM-Newton within the allocated 20 ks (per target). The science aim is to check their connection and to constrain the physics of the accretion and the source of radiation from the UV to X-rays.

We will use HST/COS/FUV/G140L in the TIME-TAG mode to observe time variability in the FUV continuum together with X-ray variations as observed by XMM-Newton (in EPIC-PN timing mode). Spectral information will be used to estimate the absorption towards the sources as well as to measure the spectral shape and to distinguish between various emission candidates (accretion disk, synchrotron).

Target 1: The scheduled observation of SWIFT J1753.5-0127 can be performed either before 12-Oct-2012 or during the periods 8-Mar-2013 to 18-Mar-2013 or 5-Apr-2013 to 8-Apr-2013 when the object is visible by both HST and XMM-Newton. The object with V magnitude of 16.5 ± 0.5 has been very stable during the past five years. It has a power-law spectrum of $F_{\lambda} \propto \lambda^{-1.4}$ and extinction $E(B-V)=0.3$. The estimated count rate in G140L is approximately 200 cts/s. The UV flux will be also checked a week before scheduled observation using Swift/UVOT.

Target 2 is a new black hole X-ray transient. We will perform a non-disruptive ToO. The observations by HST and XMM-Newton are triggered on a black hole transient, when it undergoes an outburst. The outbursts follow a typical pattern of a decay with an e-folding time of 0.5-1 month.

At the peak of the outburst, a transient will most likely be too bright for XMM-Newton (upper limit =1000 cts/s) and therefore the observations should be performed a few weeks after the outburst peak. Using the MAXI and Swift/UVOT data, we can predict, when the count rates drop below the upper limits and trigger the ToO two weeks in advance.

The main trigger condition is the sufficiently low X-ray count rate, in order not to exceed the maximum allowed XMM-Newton count rate (1000

cts/s), together with the sufficiently low UV count rate, allowed by the HST/COS, below 15,000 cts/s. For a typical BH transient with a sufficiently low extinction the expected HST/COS/FUV/G140L count rate is between 200 and 2000 cts/s, which is safe for the instrument and allows us to achieve our science goals. Observations are possible after the predicted date, whenever possible for both telescopes. However, the observations should take place before the object becomes undetectable again (on a timescale of a few months).

REAL TIME JUSTIFICATION

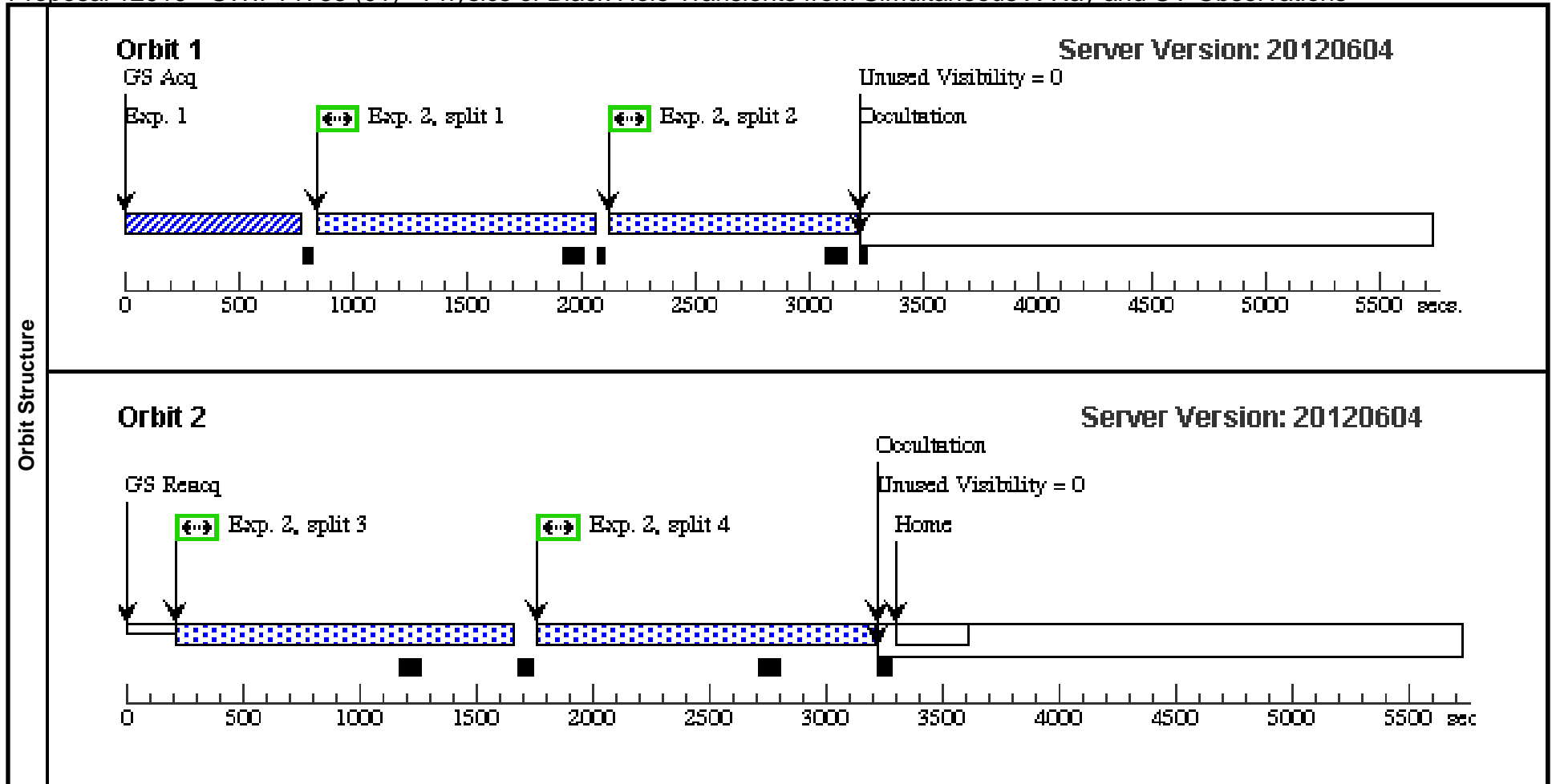
We need a minimum of 3000 sec (per target) of simultaneous exposure with the XMM-Newton. We were awarded 20 000 sec of the XMM-Newton time per target, so the observations should be scheduled any time within that period.

Our scientific goal is to investigate radiation mechanisms of the black hole X-ray transients. In order to achieve it, we are looking for a connection between the UV and the X-ray light-curves by calculating their cross-correlation function. Any features it will show would provide us with the unique information about the processes operating in the vicinity of the compact object. The significance levels of these features depend on the square root of the duration of simultaneous exposure. Our calculations show that for typical X-ray and FUV count rates of 100 cts/s and 1000 cts/s in order to detect the anticipated features at 5 sigma level, the minimum duration is 3000 sec. Any duration, which is longer than this time would result in a considerable improvement of the significance. As the count rates are difficult to estimate in advance of observations, we require two full HST orbits to achieve the science goals.

Proposal 12919 - SWIFT1753 (01) - Physics of Black Hole Transients from Simultaneous X-Ray and UV Observations

Wed Jul 11 03:10:37 GMT 2012

Visit	Proposal 12919, SWIFT1753 (01) Diagnostic Status: Warning Scientific Instruments: COS/NUV, COS/FUV Special Requirements: BETWEEN 31-AUG-2012 AND 12-OCT-2012; BETWEEN 27-FEB-2013 AND 04-MAR-2013; BETWEEN 08-MAR-2013 AND 31-MAR-2013; BETWEEN 04-APR-2013 AND 08-APR-2013									
	(SWIFT1753 (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		
	(1)	SWIFTJ1753.5-0127 Alt Name1: PBCJ1753.4-0126	RA: 17 53 28.2900 (268.3678750d) Dec: -01 27 6.20 (-1.45172d) Equinox: J2000				V=16.5+/-1	Reference Frame: ICRS		
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	TA1 (COS.ta.415 250)	(1) SWIFTJ1753.5-0127	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				171.2 Secs [==>]	[1]
	2	Science1 (COS.sp.415 251)	(1) SWIFTJ1753.5-0127	COS/FUV, TIME-TAG, PSA	G140L 1280 A	EXTENDED=NO; FP-POS=ALL; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=92 0			700 Secs [==>1040.0 Secs (Split 1)] [==>1041.0 Secs (Split 2)] [==>1400.0 Secs (Split 3)] [==>1400.0 Secs (Split 4)]	[1] [2]
	<i>Comments: We require the science time of minimum 3000 s to be within the XMM-Newton exposure time (where we have 20 ksec).</i>									



Proposal 12919 - BHtransient (02) - Physics of Black Hole Transients from Simultaneous X-Ray and UV Observations

Wed Jul 11 03:10:39 GMT 2012

Visit	Proposal 12919, BHtransient (02) Diagnostic Status: No Diagnostics Scientific Instruments: COS/NUV, COS/FUV Special Requirements: ON HOLD <i>On Hold Comments: The observation is a simultaneous (soft trigger) ToO with the XMM-Newton.</i> <i>Trigger condition for HST is the count rate (in the entire detector) below the upper limit of 15000 cts/s and above the lower limit of 1000 cts/s.</i> <i>And for XMM-Newton the criteria are the X-ray count rate below 1000 cts/s and above 100 cts/sec.</i>									
Generic Targets	#	Name	Criteria	Description						
	(2)	BHTRANSIENT	Count rate is below 15000 cts/sec and above 1000 cts/sec	LMXB X-RAY TRANSIENT						
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time[Actual Dur.]	Orbit
	1	TA1 (COS.ta.416 314)	(2) BHTRANSIENT	COS/NUV, ACQ/SEARCH, PSA	MIRRORB	CENTER=FLUX-W T-FLR; SCAN-SIZE=3; STEP-SIZE=1.767			7.7 Secs [==>]	[1]
	2	TA2 (COS.ta.416 314)	(2) BHTRANSIENT	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				7.7 Secs [==>]	[1]
	3	Science1 (COS.sp.416 313)	(2) BHTRANSIENT	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=90 0; EXTENDED=NO; FLASH=YES; FP-POS=ALL; SEGMENT=BOTH			1000 Secs [==>1000.0 Secs (Split 1)] [==>1029.0 Secs (Split 2)] [==>1400.0 Secs (Split 3)] [==>1400.0 Secs (Split 4)]	[1] [2]
	<i>Comments: We require minimum of 3000 s of the science exposure time to be within the XMM-Newton exposure time (where we have 20 ksec).</i>									

