18089 - Uncovering the optical emission in the brightest X-ray Jet

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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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) RGB-J1512+020A	WFC3/IR	1	19-Aug-2025 16:00:15.0	yes
02	(1) RGB-J1512+020A	WFC3/UVIS	1	19-Aug-2025 16:00:15.0	yes
03	(1) RGB-J1512+020A	WFC3/UVIS	1	19-Aug-2025 16:00:16.0	yes

3 Total Orbits Used

ABSTRACT

Despite the fact that jets from actively accreting super-massive black holes were first understood to exist over 40 years ago, we are still in ignorance about many primary aspects of these systems -- including how jets are launched from the black hole itself, to their particle makeup and even the nature of the emission mechanism at high energies. The exquisite spatial resolution of Chandra lead to the discovery that these jets continue to accelerate particles to multi-TeV energies very far from the central black hole, as evidenced by unexpectedly strong X-ray emission on these scales,

which remains poorly understood. While Chandra has discovered over 200 X-ray emitting kpc-scale jets, most lack corresponding HST observations, needed to characterize fully the SED and identify the radiation mechanism(s) operating in jets on larger scales. This proposal requests multi-band (IR, optical, UV) observations of the X-ray brightest jet so far discovered, RGB J1512+020A. Hosted by a powerful quasar, tentative ground-based detection of the brightest component in the jet suggests that the radio, optical, and X-rays each belong to a distinct emission component, a signature which has been reported previously in the very low-power jet in M84. These 'optical anomalies' have major implications for our understanding of both jet physics and the impact of jets on their environment. Until the unknown optical and X-ray emission mechanisms are clearly identified, it is impossible to properly measure or account for the impact of jets on their environment.

OBSERVING DESCRIPTION

This is a proposal for multi-band continuum imaging of the jet of quasar RGB J1512+020A, which hosts the brightest resolved X-ray emitting jet at low redshift. The goal of this program is to provide a very well-measured and spatially resolved SED of the jet as it extends out of the galaxy, as currently the (apparent) multiple spectral components in the radio, optical, and X-ray are not well-understood. We already have multi-band imaging at matching resolution with radio telescopes (e.g. VLA) and ALMA, and this program also included a joint Chandra request. The quasar core is expected to be very bright based on ground-based imaging, so roll constraints have been requested to ensure that PSF spikes do not over-run the fainter jet features which extend 20-30" from the central source. At the redshift of this source it is likely that some host galaxy emission will be visible even with the bright quasar, so the requested observing time reflects that needed to reach a relatively high S/N on the individual jet features.

Visit

Proposal 18089, IR (01), implementation Tue Aug 19 20:00:17 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 330D TO 8 D; ORIENT 67D TO 104 D; ORIENT 156D TO 188 D; ORIENT 241D TO 271 D

Fixed Targets

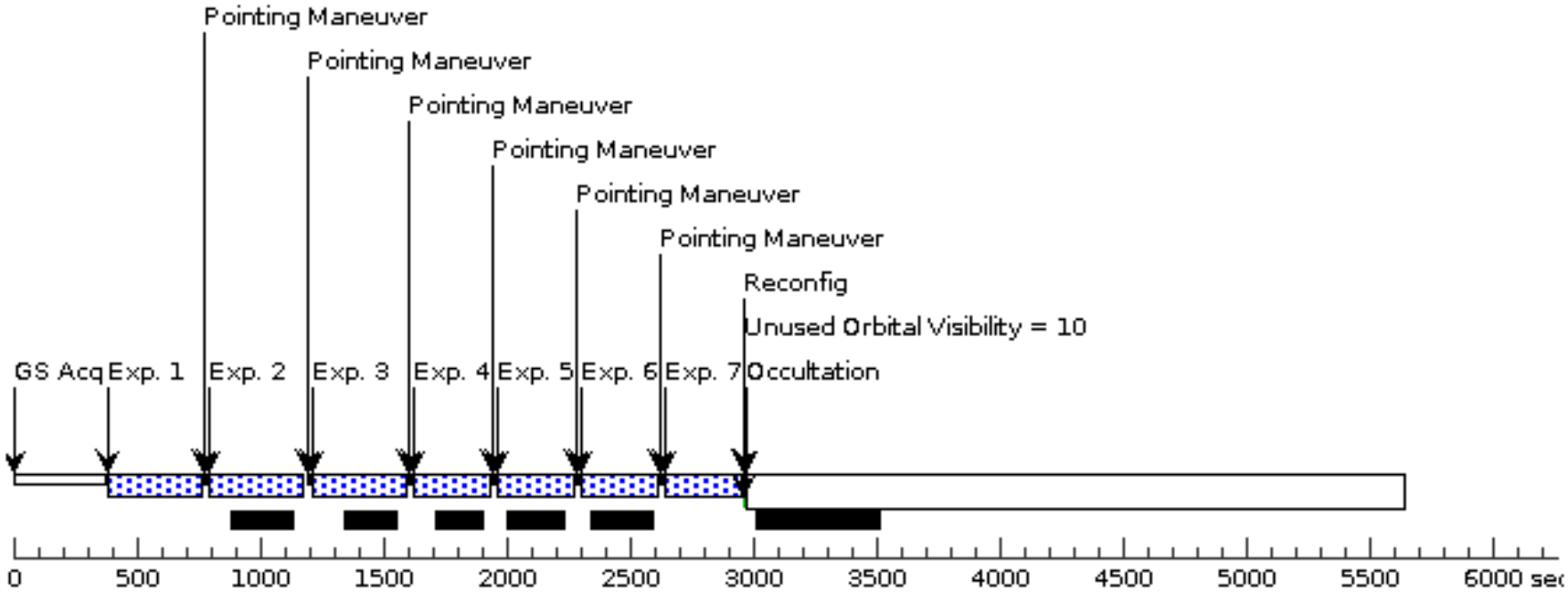
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	RGB-J1512+020A	RA: 15 12 15.7418 (228.0655908d) Dec: +02 03 16.98 (2.05472d) Equinox: J2000	Proper Motion RA: 0 sec of time/yr Proper Motion Dec: 0 arcsec/yr Epoch of Position: 2015.5	V=18.31	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[JET, QUASAR]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F105W	(1) RGB-J1512+020A	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=8; SAMP-SEQ=SPARS50	POS TARG 0,0		352.935448 Secs (352.935 Secs) *[==>]*	*[1]*
2	F105W	(1) RGB-J1512+020A	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=8; SAMP-SEQ=SPARS50	POS TARG 0.0858,1.083		352.935448 Secs (352.935 Secs) *[==>]*	*[1]*
3	F105W	(1) RGB-J1512+020A	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=8; SAMP-SEQ=SPARS50	POS TARG 0.497,2.647		352.935448 Secs (352.935 Secs) *[==>]*	*[1]*
4	F160W	(1) RGB-J1512+020A	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPARS25	POS TARG 1,1		277.937956 Secs (277.938 Secs) *[==>]*	*[1]*
5	F160W	(1) RGB-J1512+020A	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPARS25	POS TARG 1.704,2.051		277.937956 Secs (277.938 Secs) *[==>]*	*[1]*
6	F160W	(1) RGB-J1512+020A	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPARS25	POS TARG 2.409,2.101		277.937956 Secs (277.938 Secs) *[==>]*	*[1]*
7	F160W	(1) RGB-J1512+020A	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPARS25	POS TARG 3.352,2.630		277.937956 Secs (277.938 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 18089, Optical (02), implementation Tue Aug 19 20:00:17 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 335D TO 0 D; ORIENT 58D TO 90 D; ORIENT 155D TO 175 D; ORIENT 240D TO 265 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(2)
(4)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

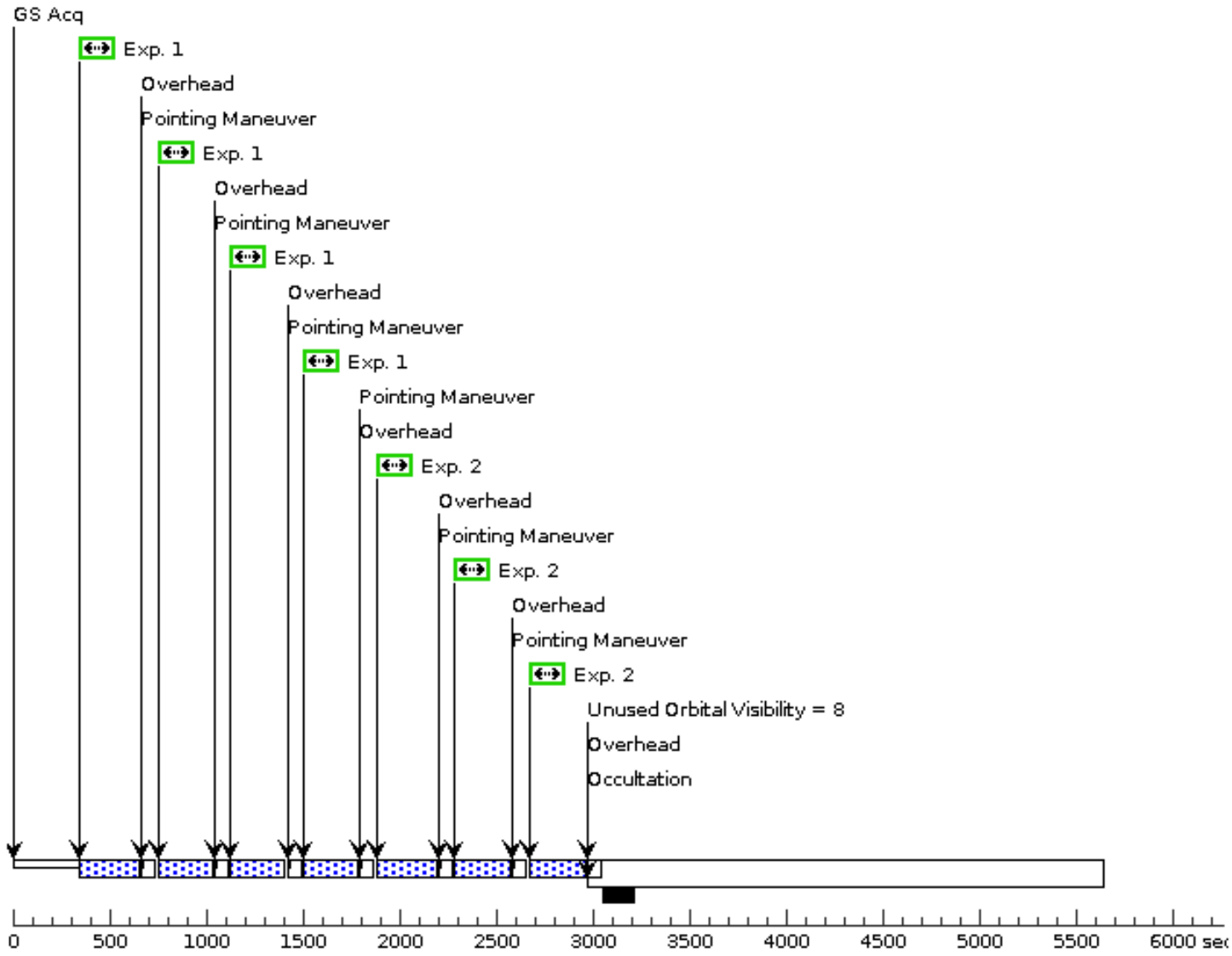
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	RGB-J1512+020A	RA: 15 12 15.7418 (228.0655908d) Dec: +02 03 16.98 (2.05472d) Equinox: J2000	Proper Motion RA: 0 sec of time/yr Proper Motion Dec: 0 arcsec/yr Epoch of Position: 2015.5	V=18.31	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[JET, QUASAR]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) RGB-J1512+020A	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F814W	FLASH=10		Pattern 4, Exps 1-1 in Optical (02) (4)	280 Secs (1120 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) RGB-J1512+020A	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F606W	FLASH=10		Pattern 3, Exps 2-2 in Optical (02) (3)	288 Secs (864 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***

Orbit Structure



Visit

Proposal 18089, UV (03), implementation Tue Aug 19 20:00:17 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 335D TO 0 D; ORIENT 58D TO 90 D; ORIENT 155D TO 175 D; ORIENT 240D TO 265 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(2)
(4)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	RGB-J1512+020A	RA: 15 12 15.7418 (228.0655908d) Dec: +02 03 16.98 (2.05472d) Equinox: J2000	Proper Motion RA: 0 sec of time/yr Proper Motion Dec: 0 arcsec/yr Epoch of Position: 2015.5	V=18.31	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[JET, QUASAR]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) RGB-J1512+020A	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F300X	FLASH=18		Pattern 4, Exps 1-1 in UV (03) (4)	300 Secs (1200 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) RGB-J1512+020A	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F475X	FLASH=10		Pattern 3, Exps 2-2 in UV (03) (3)	260 Secs (780 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***

Orbit Structure