14360 - AGN Termination Shocks: Feedback In Action

Cycle: 23, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) MRK-34 CCDFLAT	STIS/CCD	1	12-Jan-2016 21:04:42.0	yes
02	(2) MRK-78 CCDFLAT	STIS/CCD	1	12-Jan-2016 21:04:45.0	yes

2 Total Orbits Used

ABSTRACT

We propose ACIS-S observations to study the termination shocks of the bi-conical outflows in two nearby AGNs, MRK34 and MRK78 studied with HST/STIS. These AGNs are the two with the largest kinetic luminosity, ~10(41) erg/s, being deposited in the host galaxies ISM by fast outflows at distances, ~1kpc ~1 arcsec, from the nucleus resolvable with Chandra/ACIS. This data will test the termination shock hypothesis, distinguish shocked

from photo-ionized gas, and provide ionization, density and temperature diagnostics. We also request 1 orbit of HST/STIS time along the bi-cone major axis for each AGN in order to compare the physical conditions of X-ray and optical plasma in the termination shock region.

OBSERVING DESCRIPTION

We request 2 orbits of HST STIS long slit optical spectra of MRK34 and MRK78 to map the kinematics and physical conditions along the optical NLR bi-cone axis to compare the physical conditions of X-ray and optical plasma in the termination shock region. These spectra will complement the awarded Chandra data and strengthen the previous STIS data set in two ways:

(1) Determine the radial mass distribution of ionized NLR gas and calculate its contribution to the mass outflow rates and kinetic luminosities of the AGN outflows: By combining spatial and kinematic profiles for different emission-lines and the ionization state of the gas via photo-ionization modeling, we will obtain tight constraints on mass outflow rates and kinematic luminosities as a function of radius for these targets, similar to our previous work for NGC 4151 in Crenshaw et al. (2015). With these functions in hand, we can directly compare the location of the X-ray shocks (discussed below) with the radii that experience the greatest KE loss.

(2) Determine the radial position of any discovered shocks: the higher angular resolution of STIS, we will be able to pinpoint the shock locations in relation to our M_dot and LKE measurements. Using line ratios of N[II] 5755, 6548, and 6583, we can calculate the temperature of the gas along the slit and determine location at which temperatures higher than expected from photoionization exist (i.e. where shocks exist). Emission-line fluxes will be corrected for reddening via values of AV estimated from the H-alpha / H-beta ratio.

Instrumental set-up: To cover the key emission lines we will use the G430L and G750L gratings and the 52"x0.2" slit, positioned along the major axis of the NLR, which was not known at the time of the initial STIS observations by Fischer et al. (2011, 2013). A single slit position, thus optimized, is sufficient to detect the outflow signature of the NLR, determine the KE of the gas as a function of radius, and constrain the location of the shocked gas, at the highest possible angular resolution (0.1").

Observing details: We will obtain three subexposures at slightly different positions along the slit to facilitate the removal of cosmic rays and hot pixels on the CCD images. We will obtain these exposures near the top of the chip (the E1 position) to minimize CTE loss. Based on the previous STIS long-slit spectra of MRK34 and MRK78, exposure times of 900 s for each grating will yield emission-line fluxes with uncertainties of 15 - 20% for the strong diagnostic lines. This is sufficient for detailed temperature diagnostics and photo-ionization modeling (Kraemer et al. 2000, 2009).

Based on our previous experience with HST STIS observations, each slit position will require one orbit, and we therefore ask for a total of 2 orbits.

Visit

Proposal 14360, Mrk-34 (01), implementation Wed Jan 13 02:04:46 GMT 2016

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT +8D TO +18 D; ORIENT +188D TO +198 D

Diagnostics

(Mrk-34 (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE
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Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(2), (3)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=3	Angle Between Sides=		
	Point Spacing=0.25	Center Pattern=false		
	Line Spacing=			

Fixed Targets

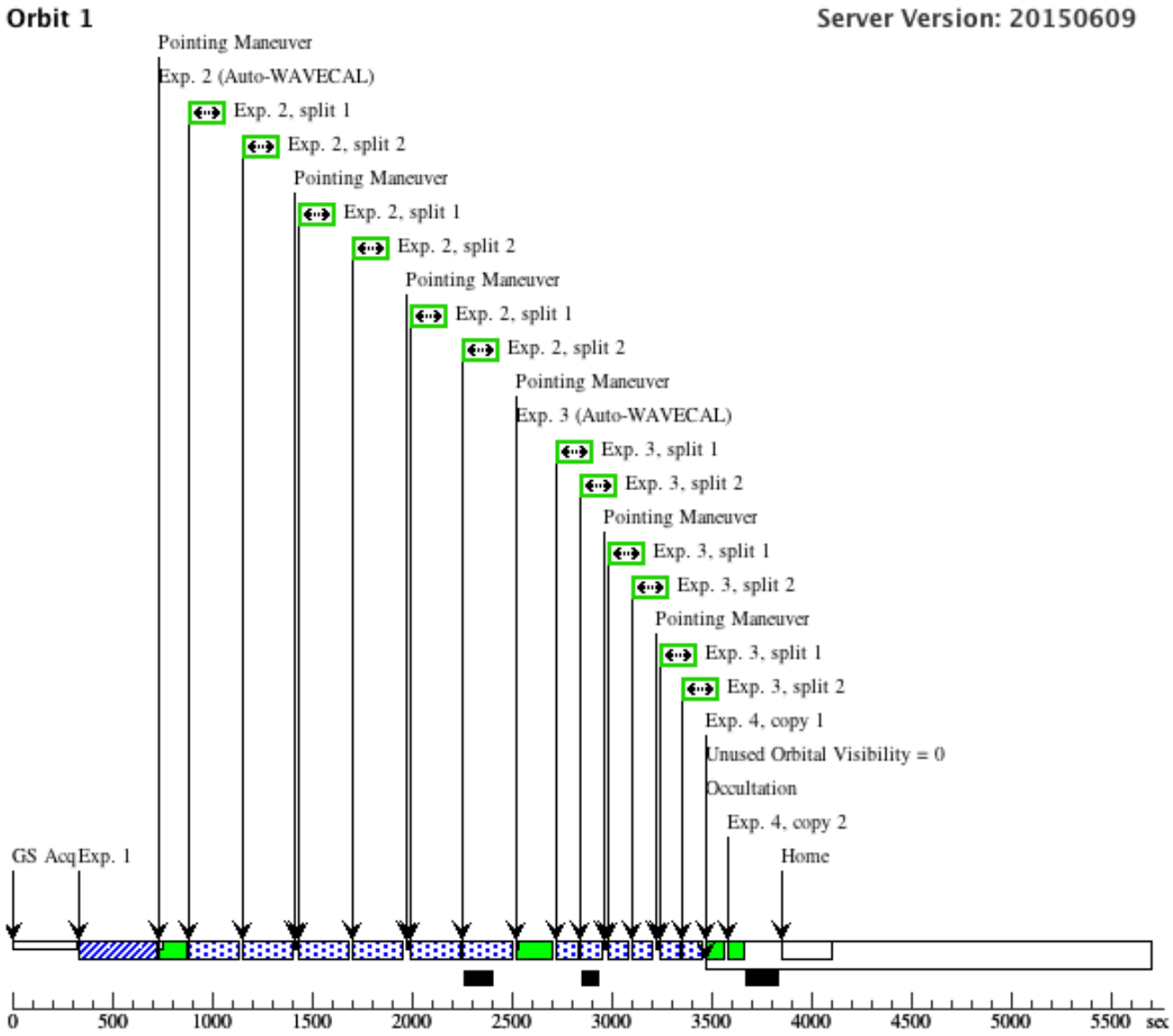
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	MRK-34	RA: 10 34 8.5920 (158.5358000d)	Proper Motion RA: 0.0	V=14.65	Reference Frame: SIMBAD
		Dec: +60 01 52.01 (60.03111d)	Proper Motion Dec: 0.0		
		Equinox: J2000	Parallax: 0.0"		
			Redshift: 0.0505		

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Acquisition	(1) MRK-34	STIS/CCD, ACQ, F28X50LP	MIRROR				40 Secs (40 Secs)	
								[==>]	***[1]***
2		(1) MRK-34	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2		Pattern 1, Exps 2-2 in Mrk-34 (01) (1)	435 Secs (1311 Secs)	
								[==>218.5 Secs (Pattern 1, Split 1)]	***[1]***
								[==>218.5 Secs (Pattern 1, Split 2)]	
								[==>218.5 Secs (Pattern 2, Split 1)]	
								[==>218.5 Secs (Pattern 2, Split 2)]	
								[==>218.5 Secs (Pattern 3, Split 1)]	
								[==>218.5 Secs (Pattern 3, Split 2)]	
3		(1) MRK-34	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2		Pattern 1, Exps 3-3 in Mrk-34 (01) (1)	143 Secs (431 Secs)	
								[==>72.5 Secs (Pattern 1, Split 1)]	***[1]***
								[==>72.5 Secs (Pattern 1, Split 2)]	
								[==>(Pattern 2, Split 1)]	
								[==>(Pattern 2, Split 2)]	
								[==>(Pattern 3, Split 1)]	
								[==>(Pattern 3, Split 2)]	
4		CCDFLAT	STIS/CCD, ACCUM, 52X0.2	G750L 7751 A				*[==>(Copy 1)]*	***[1]***
								[==>(Copy 2)]	

Orbit Structure



Visit

Proposal 14360, Mrk-78 (02), implementation Wed Jan 13 02:04:46 GMT 2016

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT +105D TO +115 D; ORIENT +285D TO +295 D

Diagnostics

(Mrk-78 (02)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE
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Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(2), (3)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=3	Angle Between Sides=		
	Point Spacing=0.25	Center Pattern=false		
	Line Spacing=			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	MRK-78	RA: 07 42 41.7310 (115.6738792d)	Proper Motion RA: 0.0	V=14.58	Reference Frame: SIMBAD
		Dec: +65 10 37.46 (65.17707d)	Proper Motion Dec: 0.0		
		Equinox: J2000	Parallax: 0.0"		
			Redshift: 0.03715		

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=YES

Proposal 14360 - Mrk-78 (02) - AGN Termination Shocks: Feedback In Action

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Acquisition	(2) MRK-78	STIS/CCD, ACQ, F28X50LP	MIRROR				40 Secs (40 Secs)	
								[==>]	***[1]***
2		(2) MRK-78	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2		Pattern 1, Exps 2-2 in Mrk-78 (02) (1)	452 Secs (1362 Secs)	
								[==>227 Secs (Pattern 1, Split 1)]	***[1]***
								[==>227 Secs (Pattern 1, Split 2)]	
								[==>227 Secs (Pattern 2, Split 1)]	
								[==>227 Secs (Pattern 2, Split 2)]	
								[==>227 Secs (Pattern 3, Split 1)]	
								[==>227 Secs (Pattern 3, Split 2)]	
3		(2) MRK-78	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2		Pattern 1, Exps 3-3 in Mrk-78 (02) (1)	154 Secs (464 Secs)	
								[==>78 Secs (Pattern 1, Split 1)]	***[1]***
								[==>78 Secs (Pattern 1, Split 2)]	
								[==>(Pattern 2, Split 1)]	
								[==>(Pattern 2, Split 2)]	
								[==>(Pattern 3, Split 1)]	
								[==>(Pattern 3, Split 2)]	
4		CCDFLAT	STIS/CCD, ACCUM, 52X0.2	G750L 7751 A				*[==>(Copy 1)]*	***[1]***
								[==>(Copy 2)]	

Orbit Structure