18193 - Probing Super-Eddington Outflows via Accreting Galactic BeXRBs

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) BEXRB-TOO	STIS/CCD STIS/FUV-MAMA	1	01-Oct-2025 16:01:11.0	yes

1 Total Orbits Used

ABSTRACT

Observations of the population of ultra luminous X-ray sources has revealed that at least a subset of this group contains a neutron star primary. Thus, dramatically demonstrating the viability of super-Eddington accretion for this source class. However, the physics of these super-Eddington accretion flows are poorly understood with the sources typically lying at Mpc distances. The population of Galactic Be/X-ray binaries (BeXRBs) are known to have giant outbursts that enter the super-Eddington regime and promise the opportunity to learn much about this mode of accretion. Herein, we propose to obtain simultaneous high resolution X-ray, UV and radio spectroscopy of the next bright Galactic BeXRB to enter a giant outburst when the neutron star will be accreting in the super-Eddington regime.

OBSERVING DESCRIPTION

Studies of giant outbursts of other BeXRBs are highly warranted to determine that winds and jets indeed occur simultaneously in the super-Eddington regime. We note that ULXs are too distant to detect a compact radio jet, so determining the co-existence of winds and jets at highly super-Eddington accretion rates can ONLY be achieved with Galactic BeXRBs, as we aim to target with this proposal. To be able to confirm the presence of both winds and jets in the super-Eddington regime, we therefore proposed for and were granted (quasi-simultaneous) Chandra/HETGS, HST/STIS and JVLA observations of the next giant outburst of a BeXRB.

In a BeXRB accreting a super Eddington luminosities, we expect the UV emission to evolve when the accretion envelope develops and shields the outer disk from the inner X-ray emitting region, e.g., Shakura & Sunyaev (1973). In this regime we might expect the UV emission to be dominated by the re-reprocessing component detected in soft X-rays. The high S/N and spectral resolution of STIS will be key here as the kinematics of the accretion inflow and wind will be encoded in the spectral lines. Obtaining observational evidence for wind outflows in ULXs is highly challenging due to the high absorption and distance to these systems. However, low resolution HST/ACS prism spectroscopy has had some limited success and demonstrated the presence of a complex highly ionized outflow at these accretion rates (e.g. M81 X-1, Bregman et al., 2012).

We are requesting observations with STIS with the MAMA detector and the E140M grating, which will provide wavelength coverage from 1150 - 1800 Ang . The high dispersion provided by this grating will ensure the safety of the MAMA detector as these sources can be very bright (> 0.06 Jy; lambda_c ~ 2200Ang). In the event of a fainter UV counterpart, a lower resolution grating will be utilized.

Accurate flux estimates will be provided by Swift/UVOT observations in support of this program.

GYRO MODE: As our program is a joint ToO w/ Chandra & JVLA, reduced gyro mode observations would reduce our ability to observe a quasi-random outburst from an unknown source (though likely in Galactic plane). Fingers crossed!

Visit

Proposal 18193, Orbit 1 (01) Wed Oct 01 20:01:12 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D

Comments: The acq exptime is a fiducial configuration given the unknown nature of the target at the current time. Given the system will contain a Be-star, we expect it to be bright (V~10).

On Hold Comments: This cycle 28 HST/STIS observation is on hold pending trigger of our CXO TAC awarded joint CXO/HST/JVLA observation

We have an approved program with Swift to monitor a bright out-burst from a Be/X-ray binary, via 40 monitoring observations. The spectra provided by Swift will be used in combination with data from Swift/BAT and MAXI to trigger the proposed Chandra/HST/JVLA observation. We will trigger this program based on an observation of a known BeXRB at a luminosity in excess of 20% Eddington, e.g., see the BeXRB catalogue1 (Raguzova et al. 2005) or the ESO BeXRB monitor2. Based on the typical duration of a large outburst (30 - 90 days), we estimate a required turn around time of ~21 days

Generic Targets

#	Name	Criteria	Description
(1)	BEXRB-TOO	Next type-II BeXRB outburst	ACCRETION DISK JET NEUTRON STAR X-RAY TRANSIENT

Comments: We request a single trigger in cycle 32 to occur quasi-simultaneously with a CXO and VLA observation. We have an approved program with Swift to monitor a bright outburst from a Be/X-ray binary, via 40 monitoring observations. The spectra provided by Swift will be used in combination with data from Swift/BAT and MAXI to trigger the proposed Chandra/HST/JVLA observation.

We will trigger this program based on an observation of a known BeXRB at a luminosity in excess of 50% Eddington, e.g., see the BeXRB catalogue1 (Raguzova et al. 2005) or the ESO BeXRB monitor2 .

Based on the typical duration of a large outburst (30 - 90 days), we estimate a required turn around time of 21 days, i.e., medium in CXO parlance.

The program trigger will come via the CXO office.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Acquisation (ACQ)	(1) BEXRB-TOO	STIS/CCD, ACQ, F25ND3	MIRROR				1 Secs (1 Secs) *[==>]*	 ***[1]***
2	Science exposure I (STIS.sp.1379906)	(1) BEXRB-TOO	STIS/FUV-MAMA, TIME-TAG, 0.2X0.06	E140M 1425 A	BUFFER-TIME=1200			1000 Secs (1000 Secs) *[==>]*	 ***[1]***
3	Science exposure II (STIS.sp.1379906)	(1) BEXRB-TOO	STIS/FUV-MAMA, TIME-TAG, 0.2X0.06	E140M 1425 A	BUFFER-TIME=1200			824 Secs (824 Secs) *[==>]*	 ***[1]***

Orbit Structure