15987 - Searching for NUV pulses of SAX J1808.4-3658 during its 2019 outburst

Cycle: 26, Proposal Category: GO/DD

(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) SAX-J1808.4-3658	STIS/CCD STIS/NUV-MAMA	1	17-Aug-2019 16:00:14.0	yes

1 Total Orbits Used

ABSTRACT

The accreting millisecond X-ray pulsar (AMXP) SAX J1808.4-3658 has revealed an abrupt increase in intensity beginning August 5, likely indicating the onset of a new transient outburst. The optical brightening reached V~16.6 mag in few days. X-ray pulsations at the neutron star (NS) spin period have been detected on 7 August with NICER, we thus want to explore the presence of pulsations in the Near-UV band with HST. We

require to observe SAX J1808.4-3658 with HST STIS/NUV-MAMA instrument combination in order: (i) to investigate the presence or absence of the Near-UV pulses during the ongoing outburst; (ii) to compare the NUV and X-ray pulse profiles and their fractional amplitude. These observations can only be carried out using instruments with a high temporal resolution (<1ms), necessary to resolve pulsations at 2.5 ms in NUV band. This represents the first timing analysis of an AMXP in the NUV band during outburst. The discovery of UV pulsation in this class of objects would constitute a crucial step toward a better understanding of the evolution of binary millisecond pulsars.

OBSERVING DESCRIPTION

We ask to observe SAX J1808.4-3658 with HST during its 2019 outburst. This visit will consist in one HST orbit (~2250 s) during which we will carry out time-resolved NUV TIME-TAG spectroscopy with the STIS/NUV-MAMA/G230L instrument/grating combination. We will use the 2376 \AA setting for this observation to achieve continuous wavelength coverage between 1570 \AA and 3180 \AA, with the 52X0.2 slit. The TIME-TAG mode of STIS will provide a maximum time resolution of 125 μs, fast enough to resolve pulsations at 2.5 ms (NS pulse period) in the Near-UV band. We will use precise and updated ephemeris of the 2019 outburst measured by the timing analysis of X-ray NICER data to investigate the presence of the pulses in NUV band.

Swift/UVOT monitoring observations (acquired in the current outburst) show that the system is nowhere near bright enough to threaten detector damage, then there are no safety concerns for the STIS detectors.

Visit

Proposal 15987, Visit 01, implementation Sat Aug 17 20:00:14 GMT 2019

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SAX-J1808.4-3658	RA: 18 08 27.5400 (272.1147500d) Dec: -36 58 44.30 (-36.97897d) Equinox: J2000		V=16.8	Reference Frame: ICRS

Comments: The reference magnitude in V band is the minimum reached during the outburst. Observations of SAX J1808.4-3658 at the end of the outburst will likely detect a lower brightness.
Category=STAR
Description=[BINARY PULSAR, LMXB, NEUTRON STAR, PULSAR, X-RAY TRANSIENT]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SAX-J1808.4-3658	STIS/CCD, ACQ, 50CCD	MIRROR				5 Secs (5 Secs) *[==>]*	 ***[1]***
2	(STIS.sp.1375353)	(1) SAX-J1808.4-3658	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=75 5			2240 Secs (2240 Secs) *[==>]*	 ***[1]***

Comments: For our SNR estimate we started from the conservative assumption that the source may have faded at the time of the HST observation.

Orbit Structure