AstroSat Proposal Preparation

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Proposal/Observing Cycles

ISRO has periodically released announcements of opportunity (AO) calls, soliciting proposals from national and international Astronomy community to observe using AstroSat instruments.

AO-12 (Announcement of Opportunity)
cycle : 01 October 2022 - 30 September 2023

last date for submission of proposals: 10th March, 2022, 3:30pm (IST)

Current allocation of Observing Time on AstroSat

For Indian observer ~55% and for International Observers ~20%

Astrosat Proposals:

<u>Scientific Justification</u>: (4-page limit)

- Describe scientific background, target of interest & motivation for the proposed observation.
- Scientific objectives, selection of targets, & demonstrating scientific feasibility with estimates of signal-to noise, flux/count rate expected.
- Justification of requested observing time : spectral and / or temporal simulations.

Report on previous successful AstroSat proposals by PI if any.

Astrosat Proposals:

Technical Justification: (2-page)

- Target visibility: AVIS output tool.
- Details of bright UV sources in the field of UVIT and near the field as per the list of mandatory safety checks.
- Selection of filters, S/N for the requested exposure (after accounting for source counts, background, nearby source).
- Details of time constraint: Coordinated observations with other observatories, etc. Monitoring duration and frequency, Trigger criteria of AToO.

Proposal Types

(a) <u>Regular pointing</u> (with or without any time constraints)**:**

- Simplest type of proposal is without any time constraint.
- Proposals for one or more targets requesting one pointing per target.
- Time Constraint proposals needs stronger science justification then a regular without time constraint proposals
- For each target in a proposal with time constraint, only one observation will be made. Multiple time constraints may be given only for the ease of scheduling.
- If multiple observations are required, then write monitoring proposal or seperate proposal.

Proposal Types

(b) <u>Monitoring proposals</u> : Proposers can request monitoring observations with a minimum interval of 3 days between two consecutive observations.

- Multiple observations of a single target with specified intervals between successive observations.
- All observations are identical i.e., exposure time and instrument configuration do not change from one observation to another observation.
- Successive observations need not equally spaced. It depends upon scientific goals.
- Constraints on the mission operation-- Strong justification needed.
- Recommended to propose only one target in one Monitoring Proposal.

Two additional inputs required:

Number of observations

Interval between successive observations (in days)

Proposal Types

(c) <u>Anticipated ToO proposals</u>:

- Interesting astronomical event is foreseen but the exact timing of the event is unknown.
- Estimate of triggering probability and trigger duration, and provide relevant justification.
- Anticipated ToO proposals cannot request for follow-up observations in the same proposal.
- Strong scientific justification needed becouse it can be interfer in other observation schedule.

Three additional inputs required:

1. Triggering criteria (e. g, the source flux crosses certain threshold or a black X-ray binary makes a transition to a particular state, etc.)
2. Estimated probability of occurrence (between 0 and 1)
3. Expected duration of the event (in hours)

Proposal Types

(d) AstroSat long term key proposals (limit to 6 pages):

- ALTKP target specific science problems demanding long term observations.
- Address key scince that cannot be achieved with the currently available data. Prefrence shall be given to proposals which will have wider interest in Astronomical community
- Preference will be given to proposals utilizing simulataneous multi-wavelength observation capability of AstroSat. Use of multiple payload will be encouraged.

Additional inputs required:

1. Strong justification needed
2. The scientific merits by giving examples of previous similar survey to other observatories and how the proposed programme improve upon them.
3. A proven expertise in Analysing AstroSat data and listing of the earlier accepted proposal and publication based on them.
4. PDFs and Young researcher are encouraged to lead the project.

Observing efficiencies for different payloads:

OBSERVATION TIME / OBSERVING EFFICIENCY = STARE TIME

STARE TIME >> OBSERVATION TIME

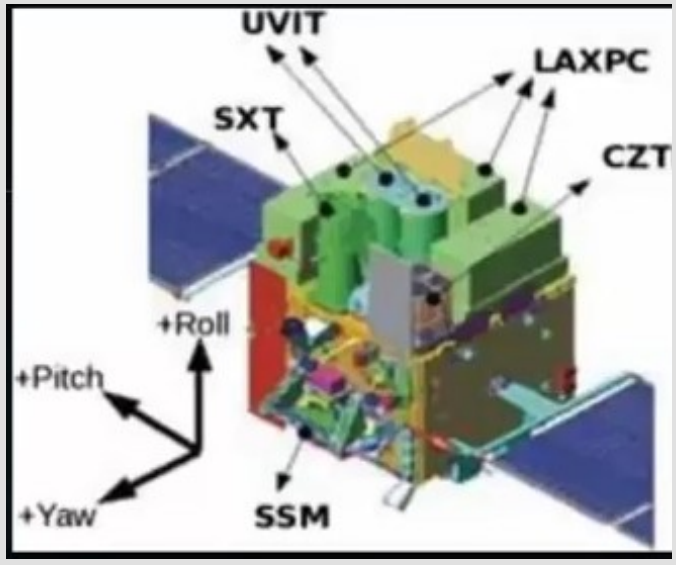
payload	observing efficiency
UVIT[1]	15% (for field sizes 250x250 or larger) < 15% (for smaller fields, see table below)
SXT	25%
LAXPC	45%
CZTI	45%

fuv/nuv field size	frame rate	maximum exposure time per orbits (subjected to 15% observing efficiency)
100x100	640/sec	200 sec
150x150	300/sec	454 sec
200x200	180/sec	769 sec
250x250	115/sec	1162 sec
300x300	82/sec	1470 sec
400x400	61/sec	2500 sec
full field	29/sec	3571 sec

SXT observing time of 10ks will result in a total stare time of 40ks, and the observing time of 6ks for UVIT (full field), and 18ks for LAXPC and CZTI.

Relative Angle:

Payload	Angle between Payload Boresight and Body Roll (deg)
UVIT	0.0419
SXT	0.0512
LAXPC 10	0.1605
LAXPC 20	0.1844
LAXPC 30	0.1486
LAXPC-MEAN	0.1514
CZTI	0.0041



These offsets are of the order of a few arcmins. Therefore, the proposers should use the PC mode when SXT is not the primary instrument. This is because, the source may be out of the SXT FoV for the FW mode in this case. However, one may need to use the SXT FW mode for some science goals in order to reduce pile- up and/or to have better time resolution. In such a case, proposers should make SXT the primary instrument, even if SXT does not serve the primary science.

Avis Online Interface

http://astrosat-ssc.iucaa.in:8080/AstroVisCal/

ASTROSAT VISIBILITY CALCULATOR

Settings

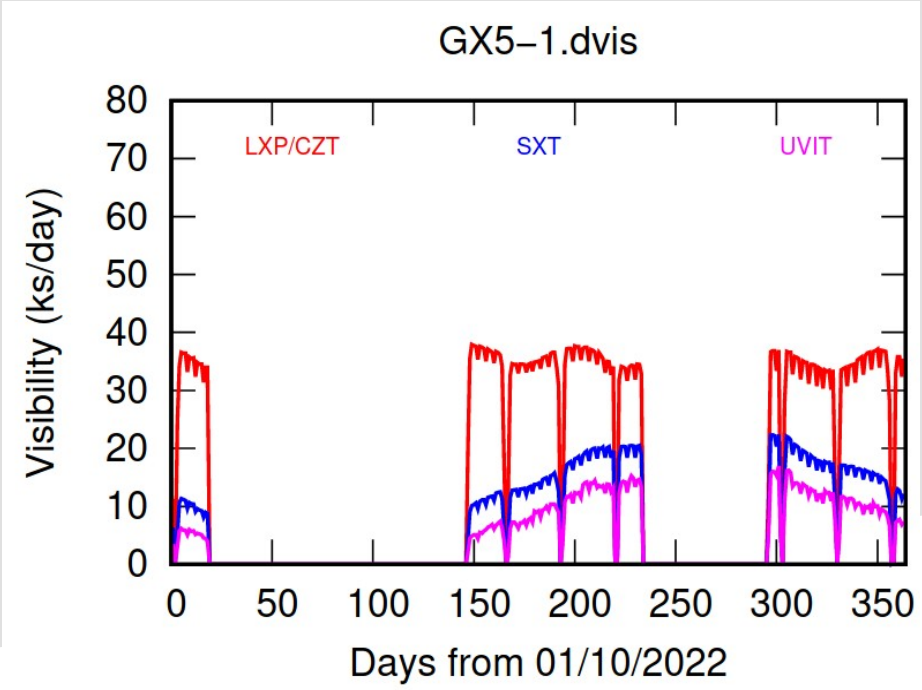
TARGET NAME	RA [J2000]	DEC [J2000]
GX 5-1	18 01 09.73	-25 04 44.1

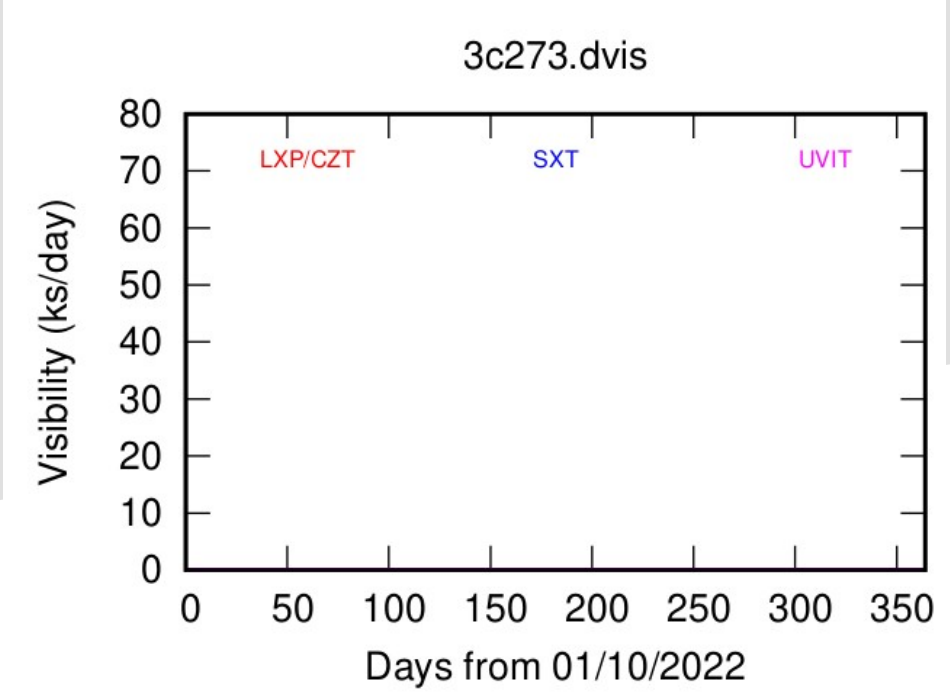
START TIME : 01-10-2022 00:00:00

END TIME : 30-09-2023 11:59:59

Generate | Reset | AO-12 period

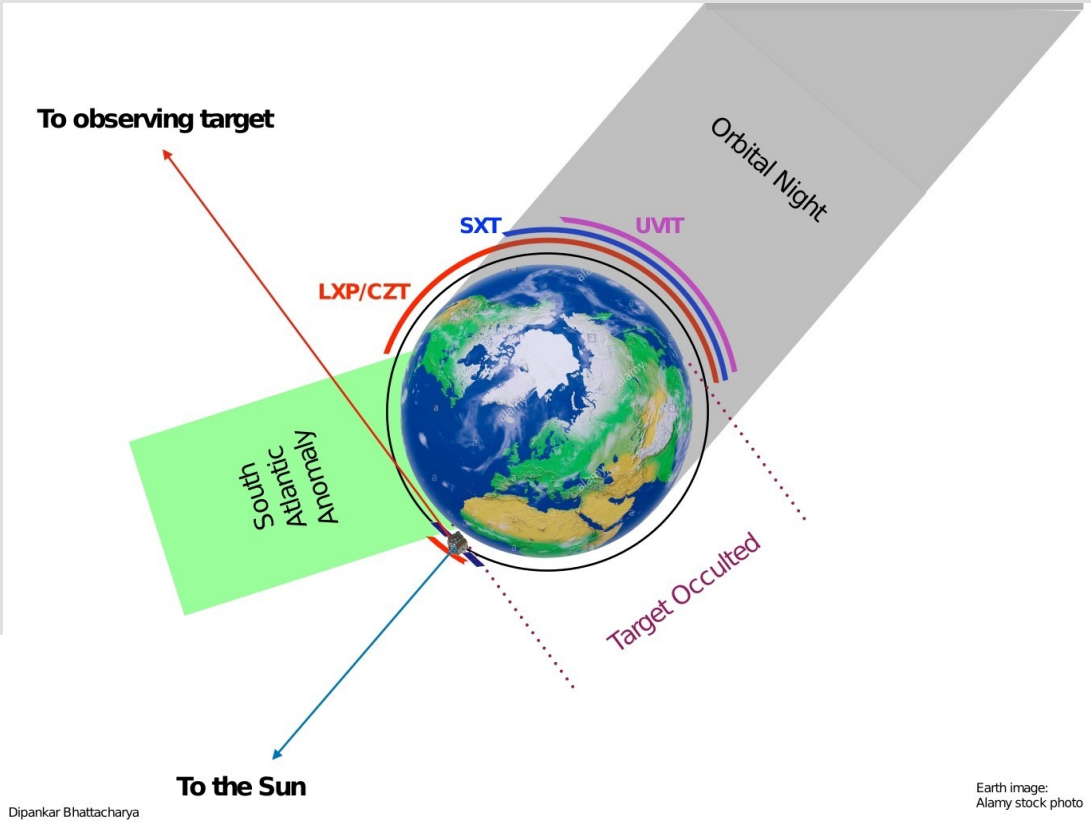
AVIS Source Visibility





If your science case requires time constraints, ensure that the time constraints are covered by the visibility windows.

AstroSat payloads receive different exposures per orbit



SXT and UVIT can observe only during orbital night. For UVIT there is an additional overhead of switching on after the orbital night begins and switching off before orbital night ends. SXT does not undergo such an on-off sequence.

All instruments are switched off during SAA.

LAXPC simulator:

To simulate event file for LAXPC. The simulated event file can the be used to construct simulated energy dependent lightcurves, power spectra, energy and frequency dependent time-lags using the laxpc data analysis software.

Compilation: ***gfortran simul.f libcfitsio.a -o Event_simul***

Input files : input_fak_specfiles and input_simul

Usage : ./Event_simul

Output : simul_level2.event.fits

Light curve simulator: LAXPC (Maxi J1659-152)

Input_fak_specfiles:

1. Spectrum (fake it/real) file:
   Spectra.fak
2. Background spectrum file:
   Backspec.fak
3. Response file :
   lx20v1.0.rsp
4. No. of proportional counters on: 1

Name of output event file:

simul_level2.event.fits

input_simul:

1. Exposure time for simulation in seconds : 5000

2. Frequency of QPO in Hz : 4.6

3. Width of QPO in Hz : 0.25

4. R.M.S of QPO : 0.06

Index of power-law continuum of powerlaw spectrum : 1

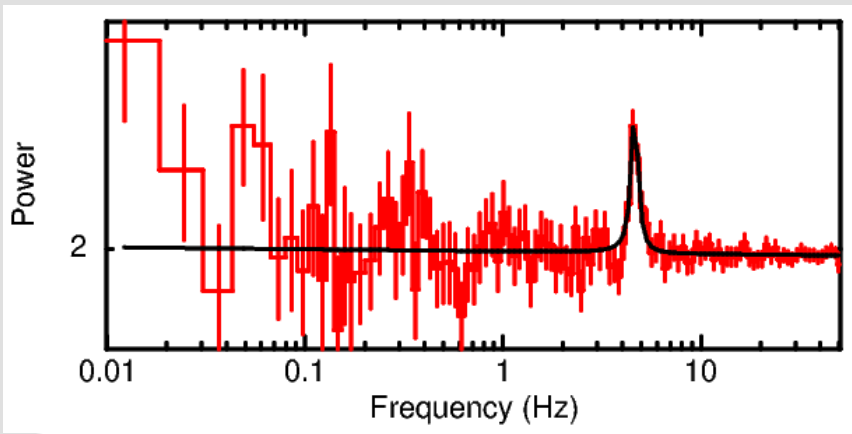
Normalization of power-law continuum : 1e-4

Simulated QPO in 15-25 keV using LAXPC lightcurve

1) laxpc_find_freqlag -l 0.01 -h 50.0 -f 4.6 -p 1 -e eneinput simul_level2.event.fits

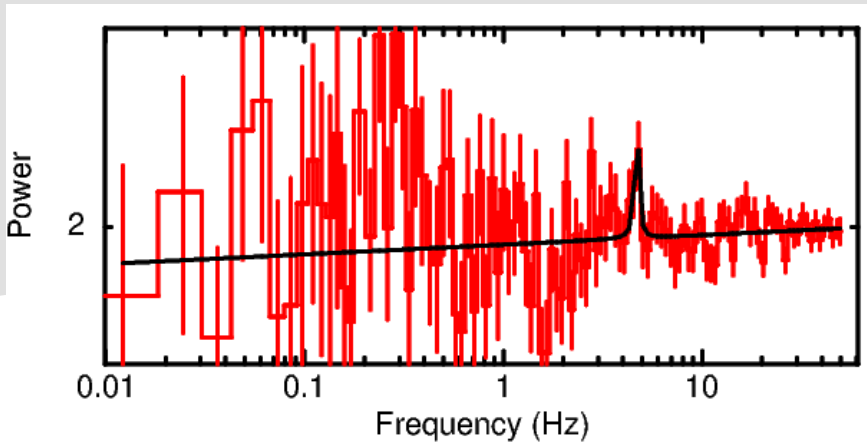
1.1) gnuplot>plot '1Pow_level2.event' u 3:8 w l

2) laxpc_make_lightcurve -p 1 -t 1 -e eneinput simul_level2.event.fits



15000 sec exposure

Frequency = 4.6±0.05 Hz
Width = 0.41±0.19 Hz,
Q-factor = 11.3, 7 sigma



2000 sec exposure

Frequency = 4.6±0.1 Hz, Width =0.18±0.8 Hz ,Unable to constraint
1 sigma error on normalization 0.6

Thank you