X-ray surveys

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INDIA

X-ray surveys

- **All sky survey/monitoring**
- Deep fields of specific portions of the sky

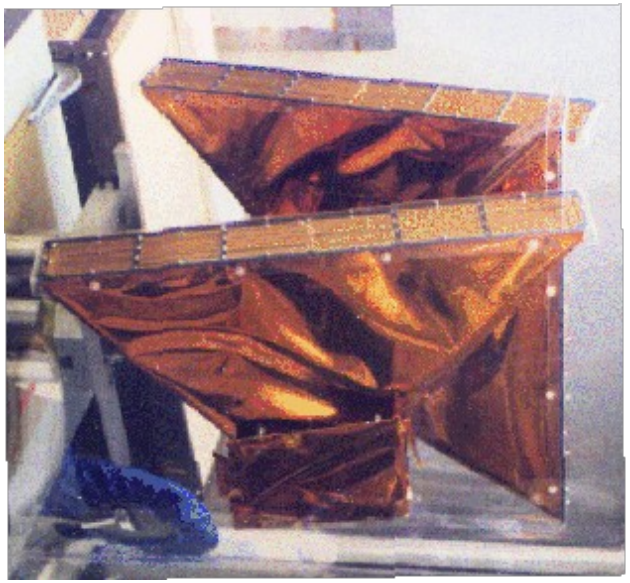
- Present and future programs

X-ray surveys- Scientific Objectives

- To detect and locate new transients
  - New target; its classification and properties
  - Cause of Outburst
- To monitor the sky for transient behaviour in known sources
  - Spectral State variations
  - Detection of variabilities
- Long term monitoring of known sources
  - Orbital, super-orbital periods, precession periods, recurrence timescales

All Sky Monitor (ASM) on RXTE

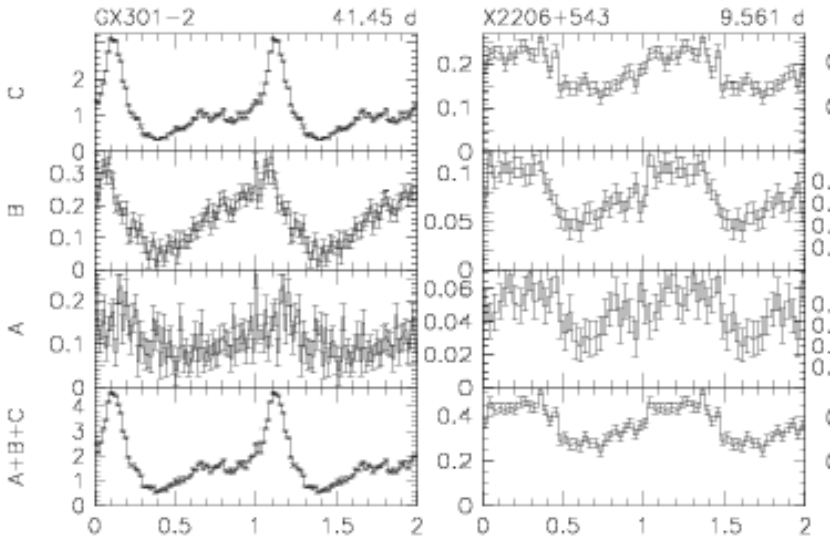
- One of the most successful all sky monitoring in x-rays
- Rotating boom having three detectors
- Scans a large portion of the sky in a rotation of 90 minutes
- Each dwell is of 90seconds; 1 day averages provided
- Light curve in 3 bands- 1.5-3.0 keV, 3-5 keV and 5-12 keV and total 1.5 to 12 keV

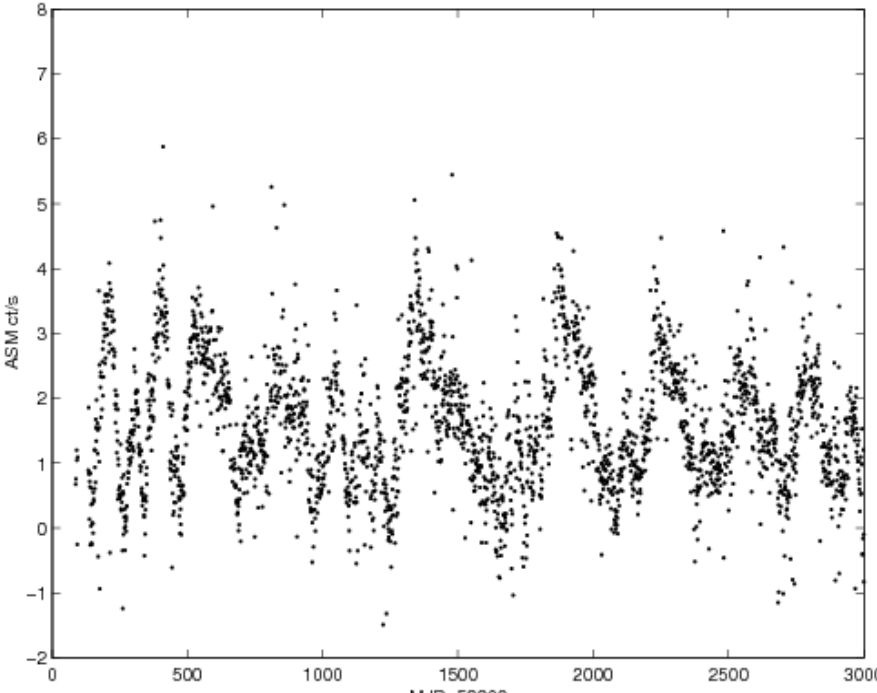


ASM results

- Apart from discovering new transients (RXTE ~ new transients both PCA slew and ASM), ASM for the first time recorded continuous light curves for

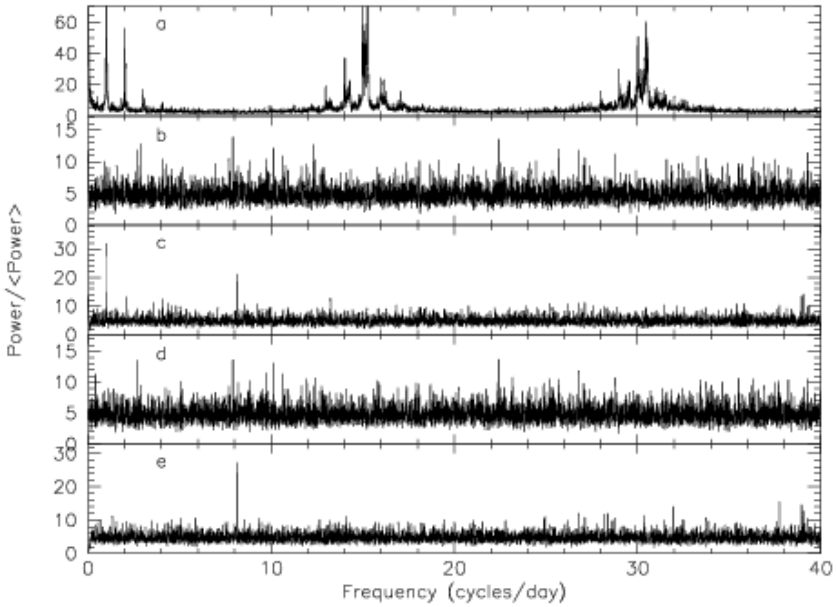
- Wen et al (2006) used ASM data of 8.5 years and provided light curves in the 4 energy bands for several of these sources, and determined long term periods in many of them for the first time; Light curve indicating a period of ~100 days is found in LMC X-3

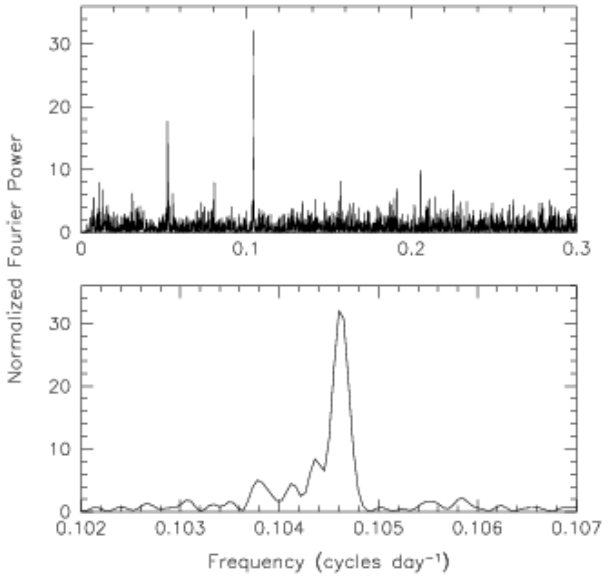




ASM results

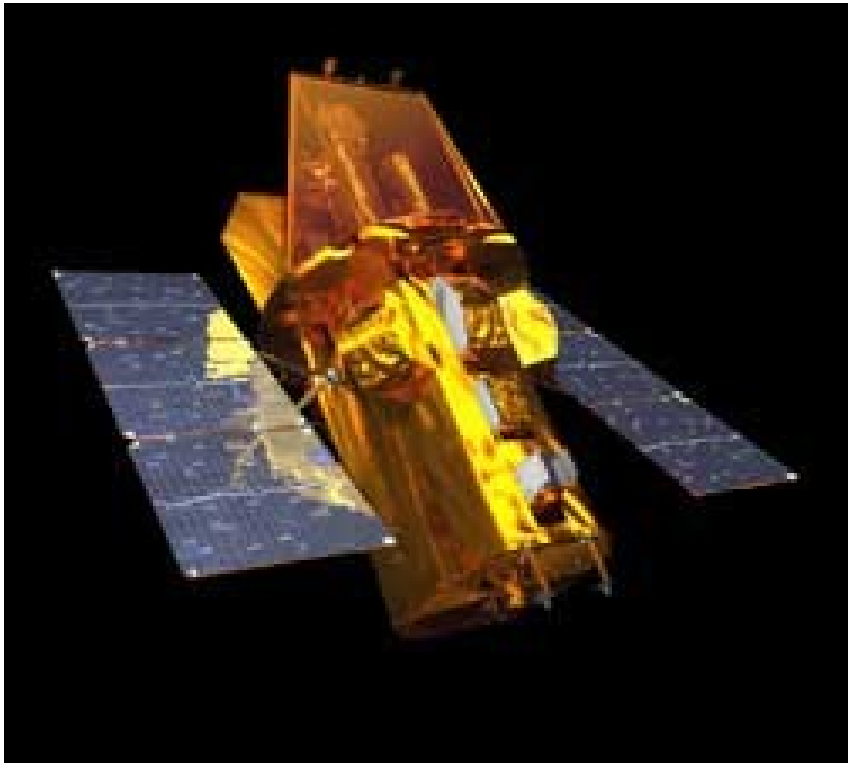
- Levine et al. (2010) used 14 year data set on 571 detected sources
- Improved the search techniques and have found further results from the 14 year data set.
- Search is more sensitive; e.g. 4U2206 -+543; earlier data set indicated only 9.6d period; now 19.11 day period also observed.
- Orbital periods in most LMXBs and HMXBs (not in quiescence) found; 4U1636-536, LMC X-1





Swift BAT (Burst Alert telescope)

- Meant to detect Gamma ray bursts >20keV; CZT detectors; over 500 bursts detected
- Very agile- can point to the GRB location and view it along with XRT and UVOT'

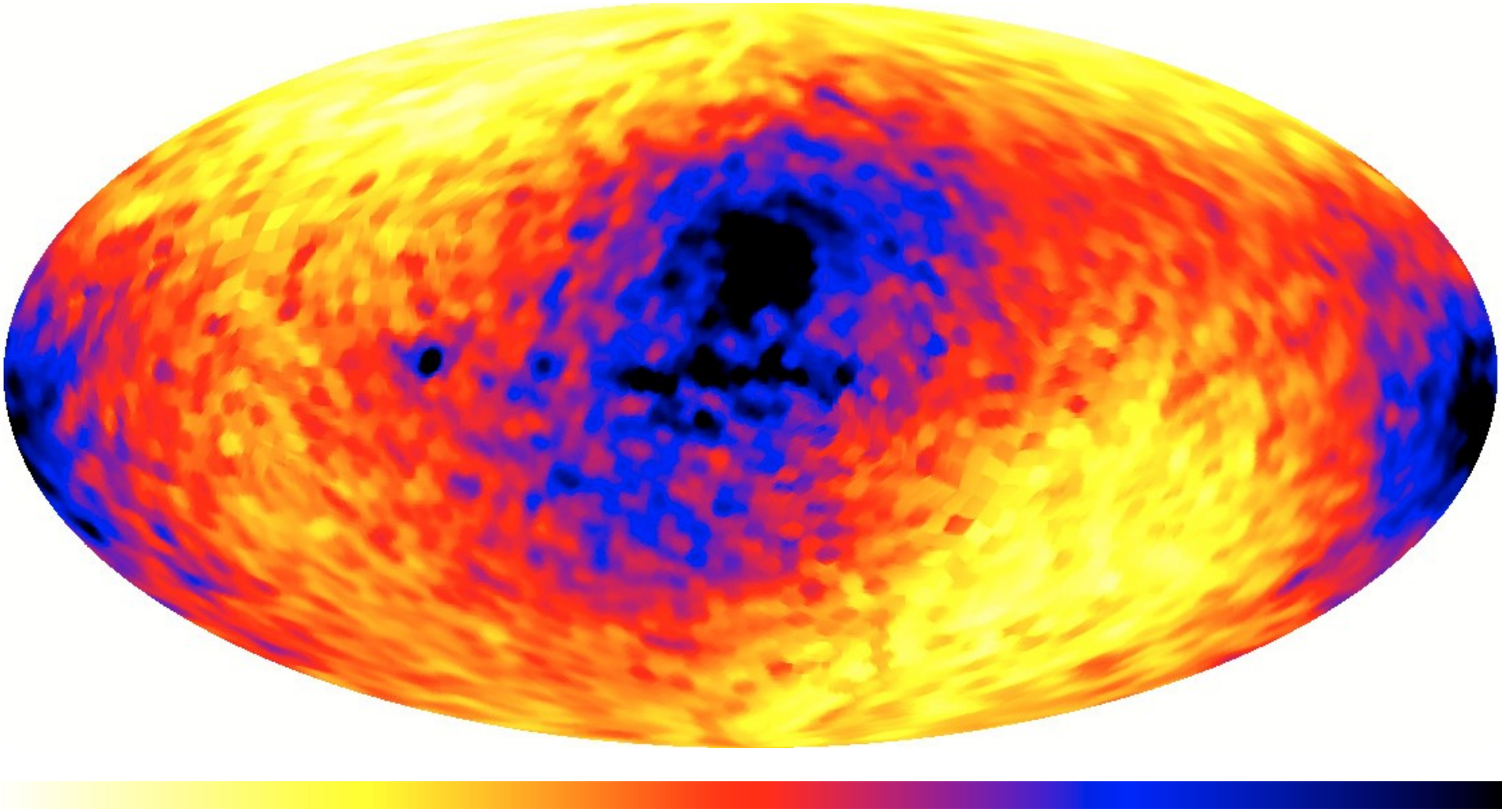


Swift BAT (Burst Alert telescope) survey

- 2nd catalog;54 months Dec 04 to May 09)
- 1256 hard x-ray sources sky maps in 15-30, 15-70, 15-159 keV ; 50% sky surveyed down to 9*10-12 erg/sqcm/s)0.43mCrab)

Type	No.	%
Galactic (total)	250	(19.5)
Extragalactic (total)	735	(57.1)
Unclassified sources	124	(9.6)
Unassociated sources	177	(13.8

Cusumano et al 2010;



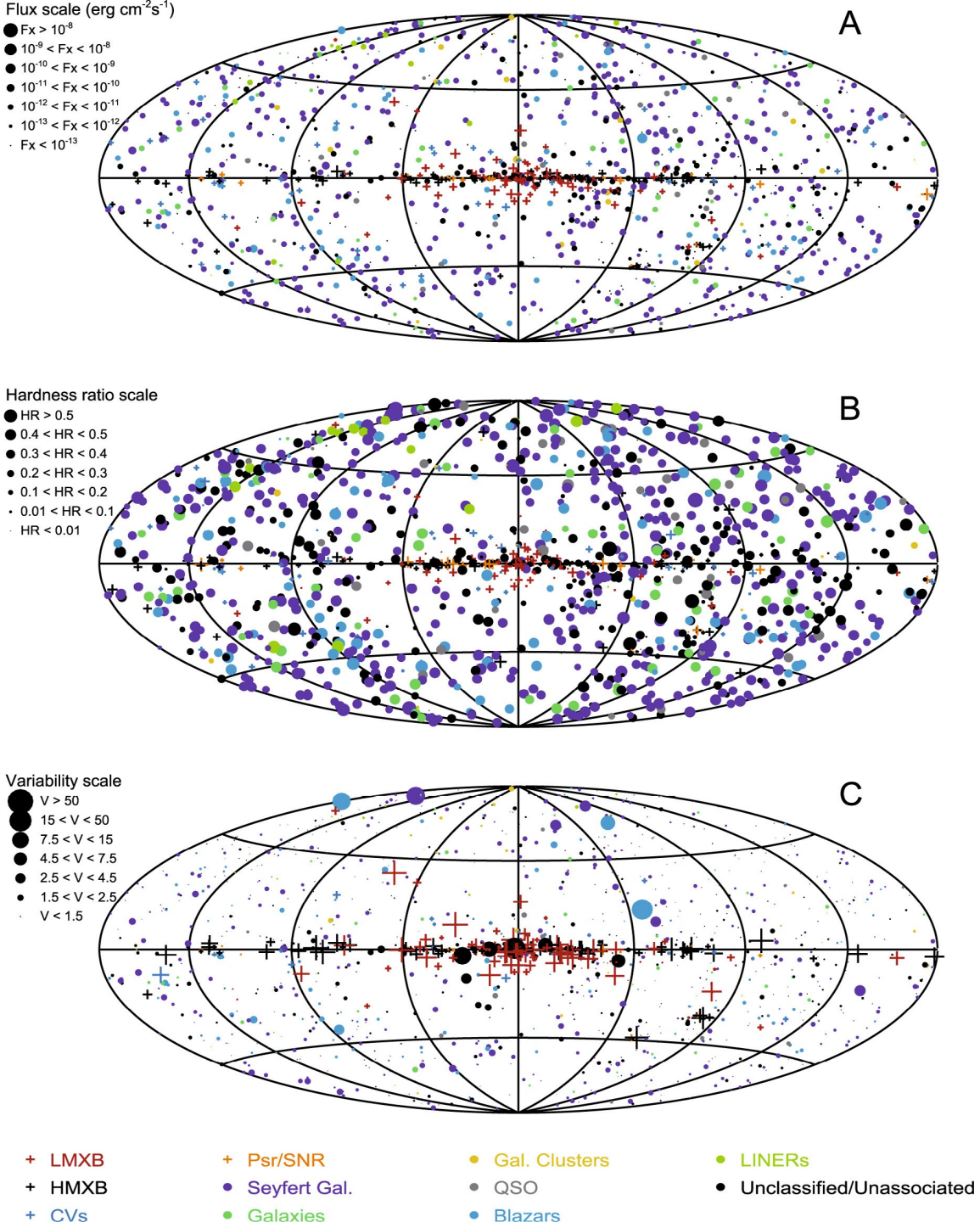
6*10-12

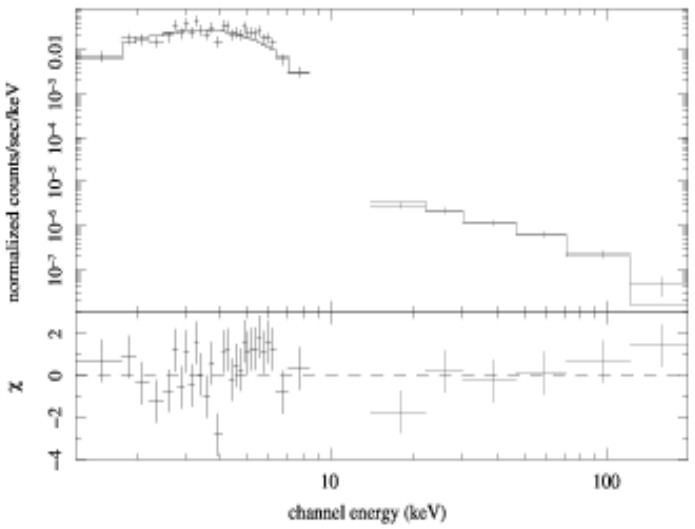
1.4*10-11

Cusumano et al 2010;

- Hardness ratio estimated 35-150 to 15-150 ratio
- Clusters of galaxies softest tail of kT10keV exc CIZAJ0635.0+223
- HR of uncertain sources-- like extragalactic
- Seyfert 2s nearer than Sey1s
- Sey 1s intrinsically more luminous

Cusumano et al 2010;



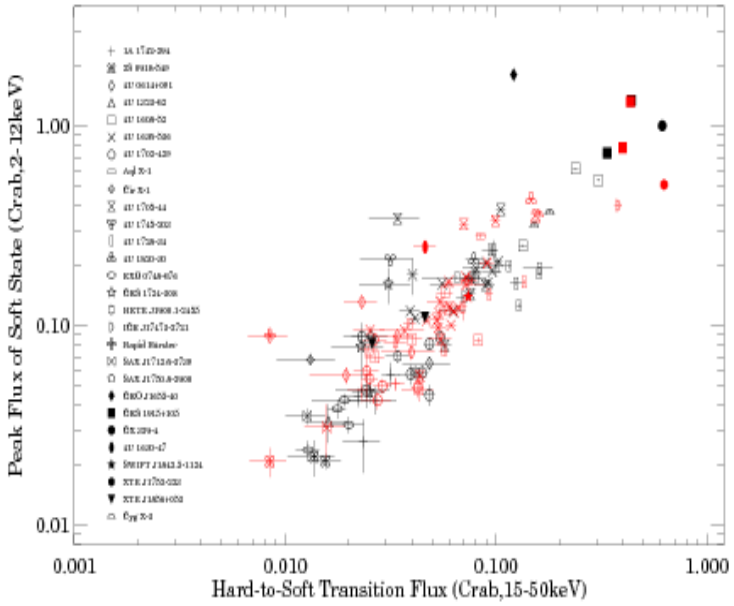


Spectra from Swift on individual sources

Ajello et al 2008,

Combining ASM and BAT data →

Jing Tang et al 2010



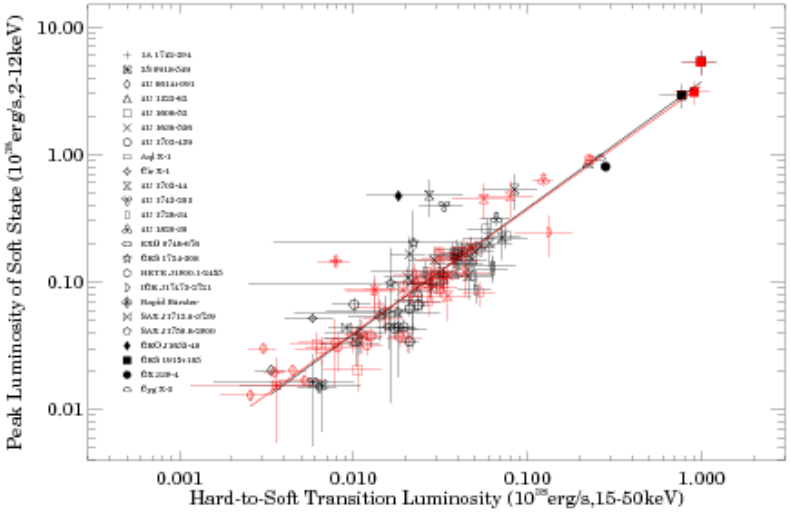
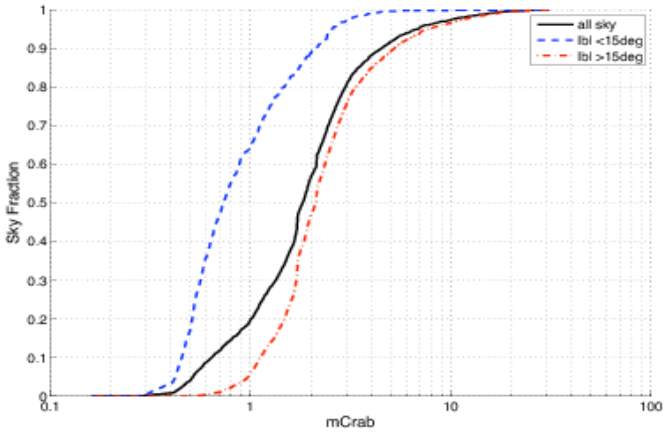
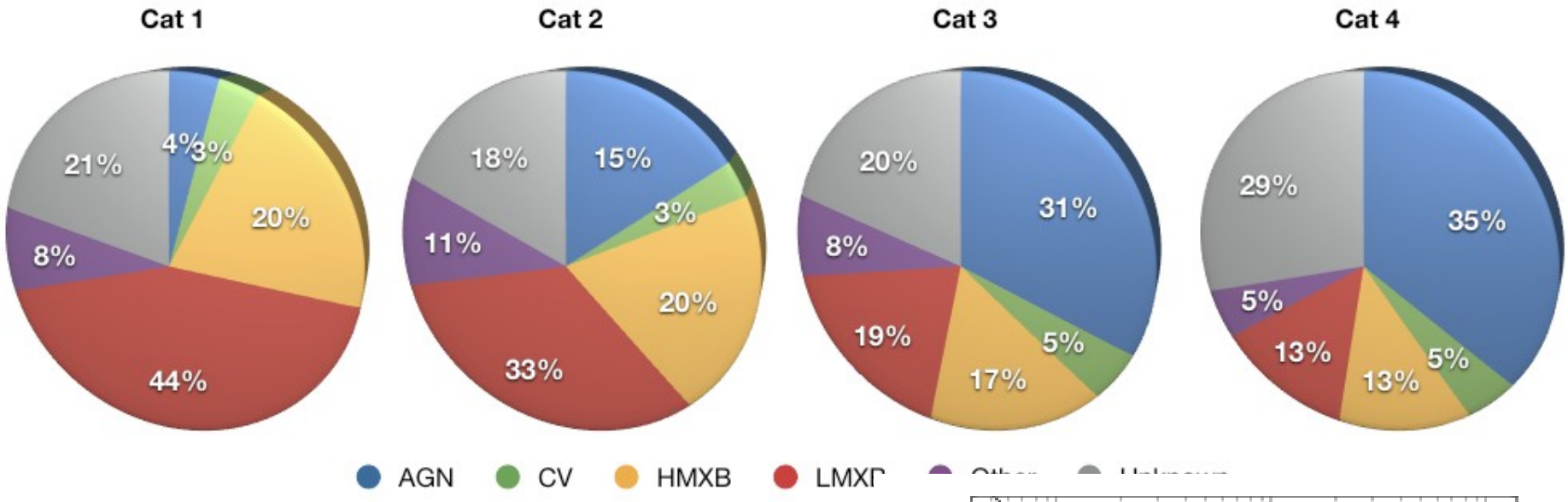


Fig. 5 The transition luminosity(15-50keV,erg s^{-1}) and the peak luminosity of the following soft state(2-12keV,erg s^{-1}). Hollow symbols and solid symbols represent neutron star and black hole binaries, respectively. Black symbols and red symbols represent data from MJD 53413 to MJD 54504 and data from MJD 54504 to MJD 55304, respectively. The black line and the red line represent the fits of data from

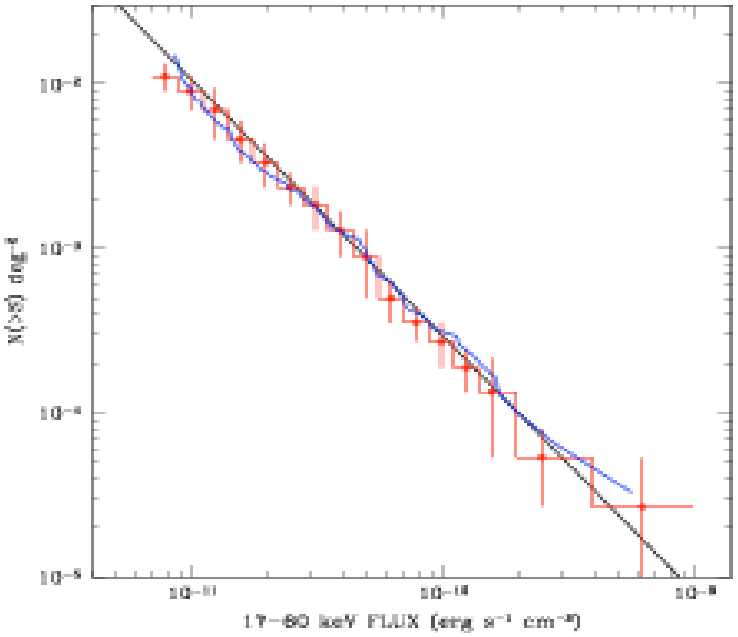
Integral IBIS (Imager on-Board Integral Satellite)

- Coded mask camera with CdTe detectors
- Survey in the 17-160keV
- 30 x 30 deg; source location ~1' at 5 sigma
- Bird et al 2010
- Krivonos et al 2010





- 723 sources detected >4.8 03-April 08)
- GP is better surveyed dow
- Variability of source chec
- Many AGNs/unknown sources in GP



MAXI – Monitor of All sky X-ray Images

To monitor the sky for x-ray transients

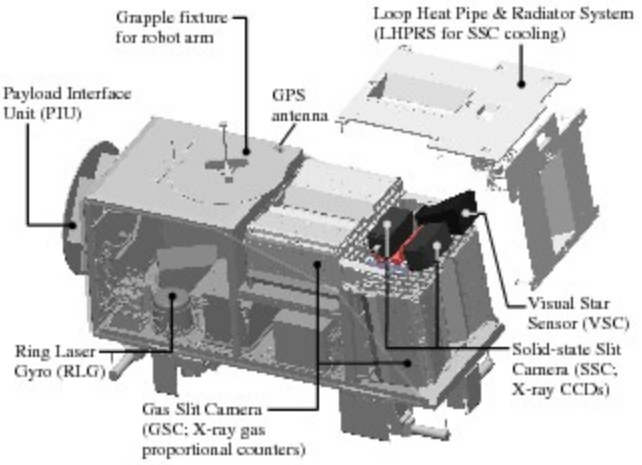
12 gas filled proportional counters
2-20 keV; 3 deg X160deg (PS- 6

32 x-ray CCDs; 0.5-12 keV

X-ray images-- 20mCrab in 90 min.

- 2mCrab in 1 week

4 GSCs turned off



Matsuoka et al 2009

MAXI – XTE J1752-223

XTE J1752-223 discovered in

RXTE PCA slew; oct23, 2009

(MJD

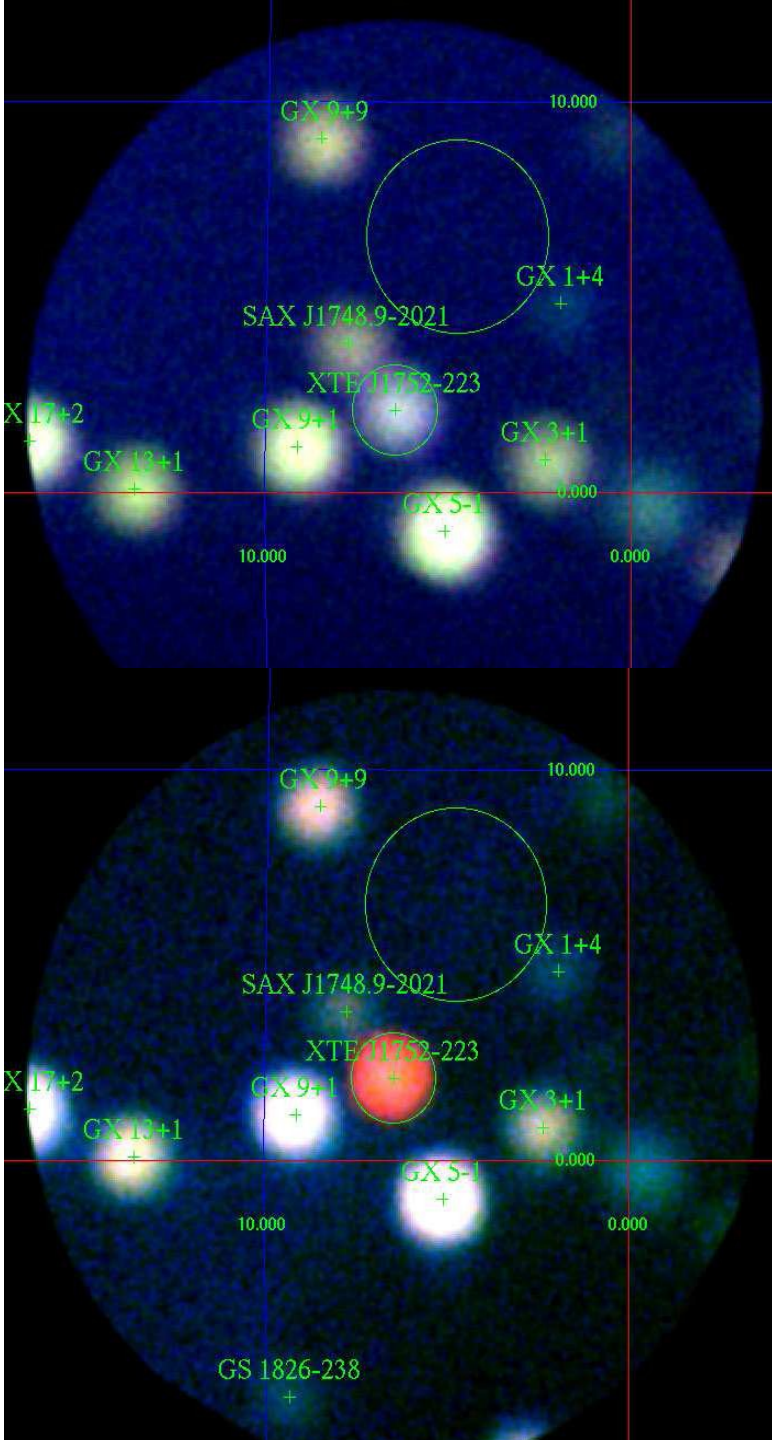
slow rise – 3 months

MAXI studied it from initial

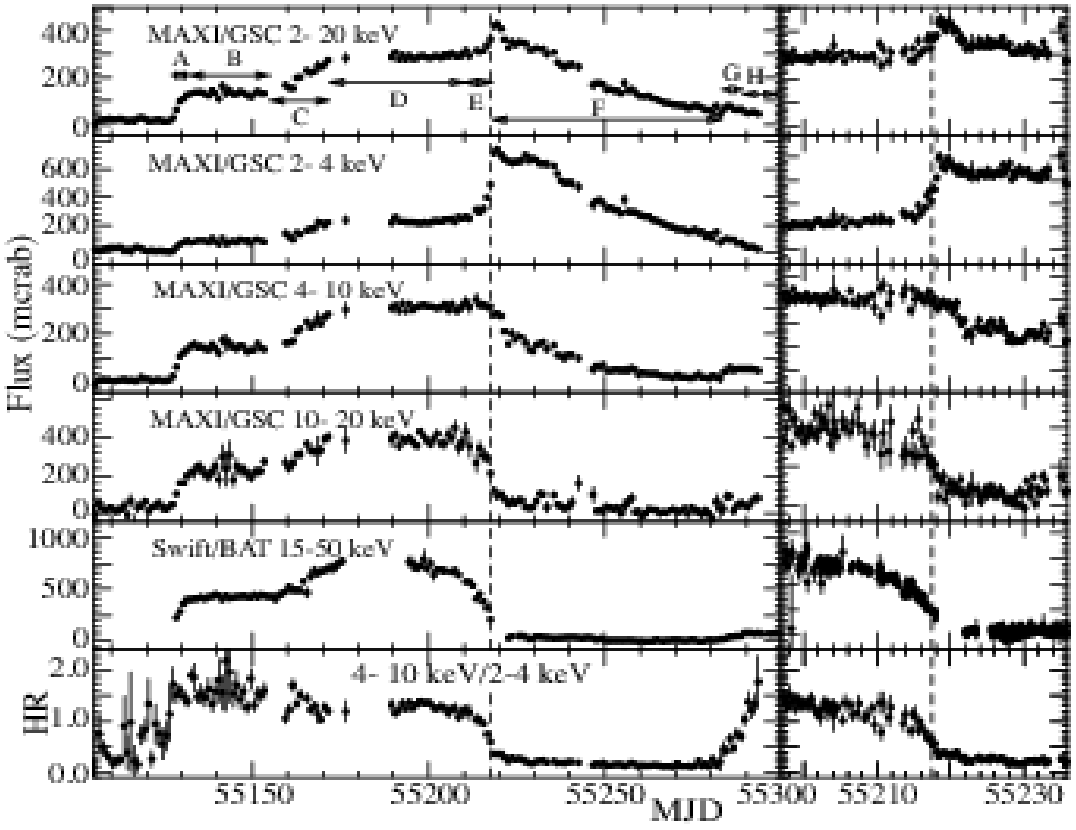
phase~30mCrab Images 2-4

(red), 4-10(blue) and

10-20keV (green)



MAXI 1752 light curve in different bands



Scanning Sky Monitor on ASTROSAT

1-D coded mask position-sensitive detector

Detectors: proportional counters with resistive anodes;

Ratio of signals on either ends of anode gives position.

Energy range 2-10 keV

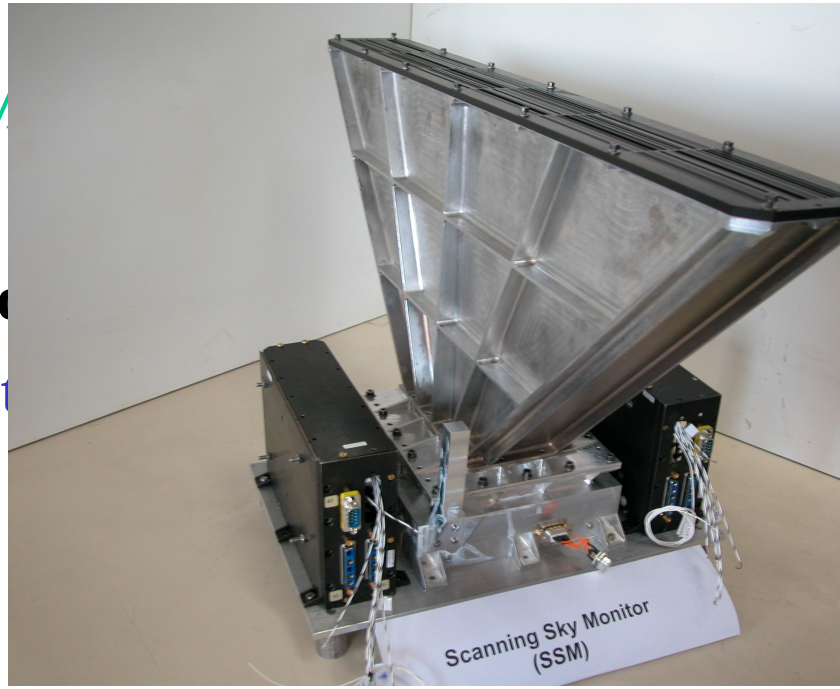
Position resolution ~ 1.5 mm(FWHM)

Field of view ~ 11° X 90° min (FWHM

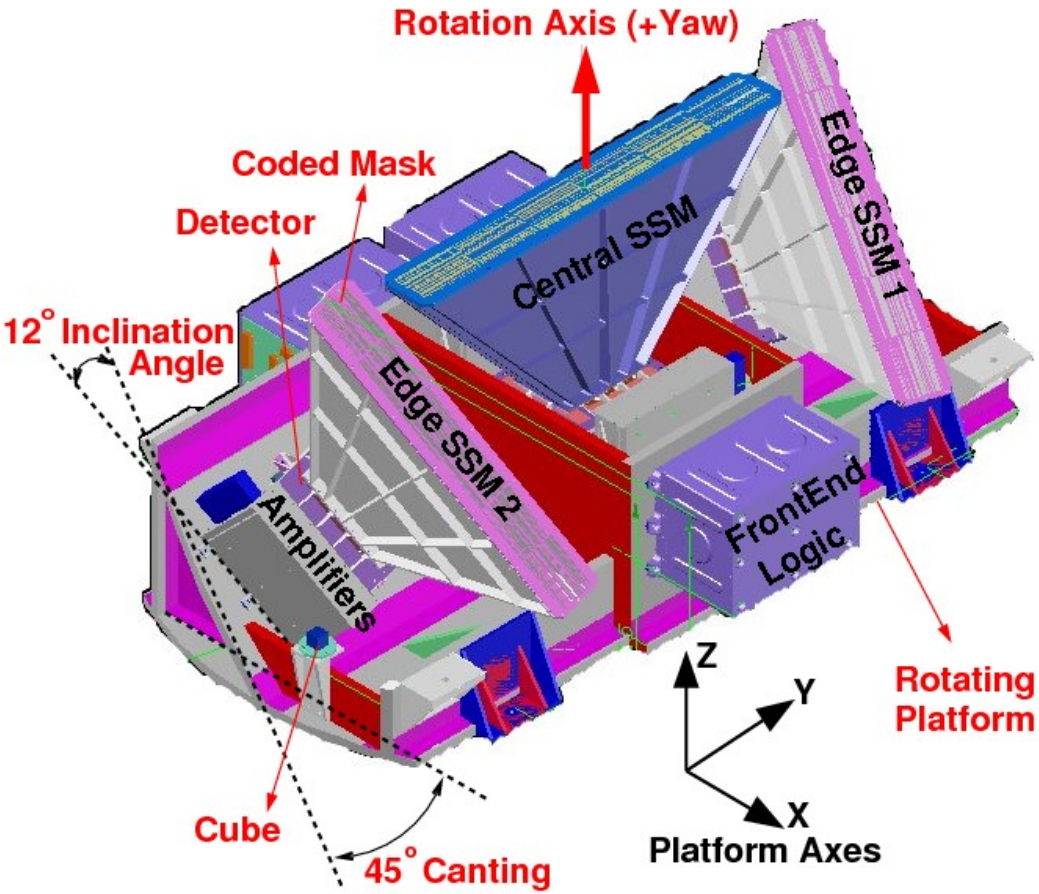
Sensitivity ~24 mCrab (10 min.

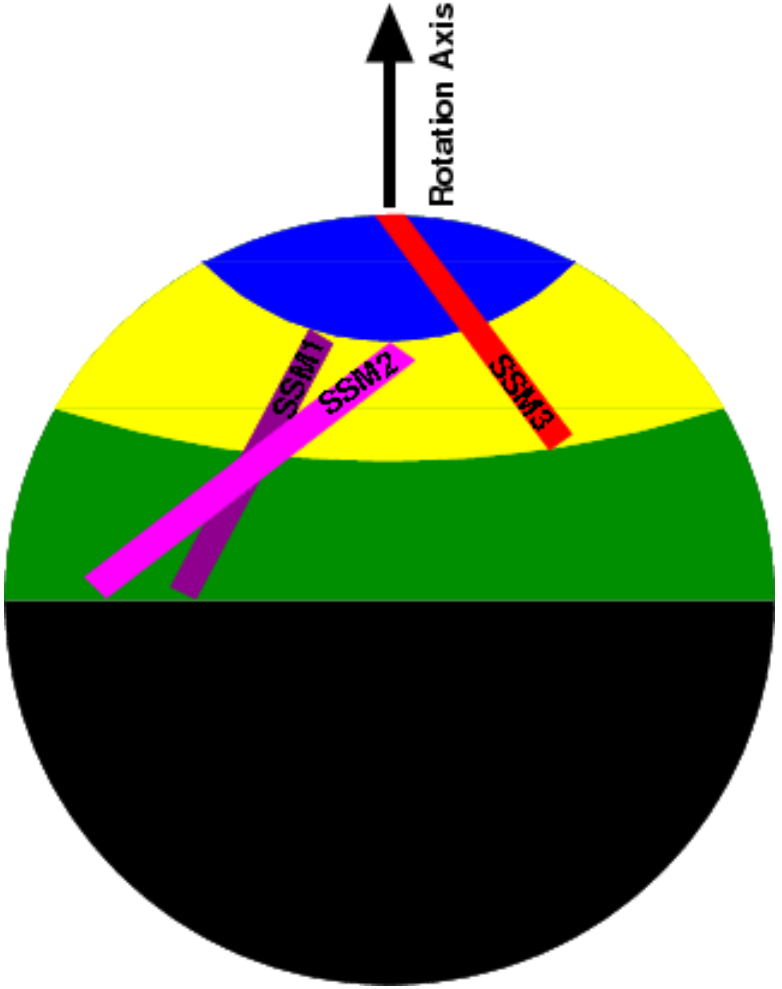
Payload Weight ~ 52 kg (including m

Onboard memory - 400 Mbyte/3count

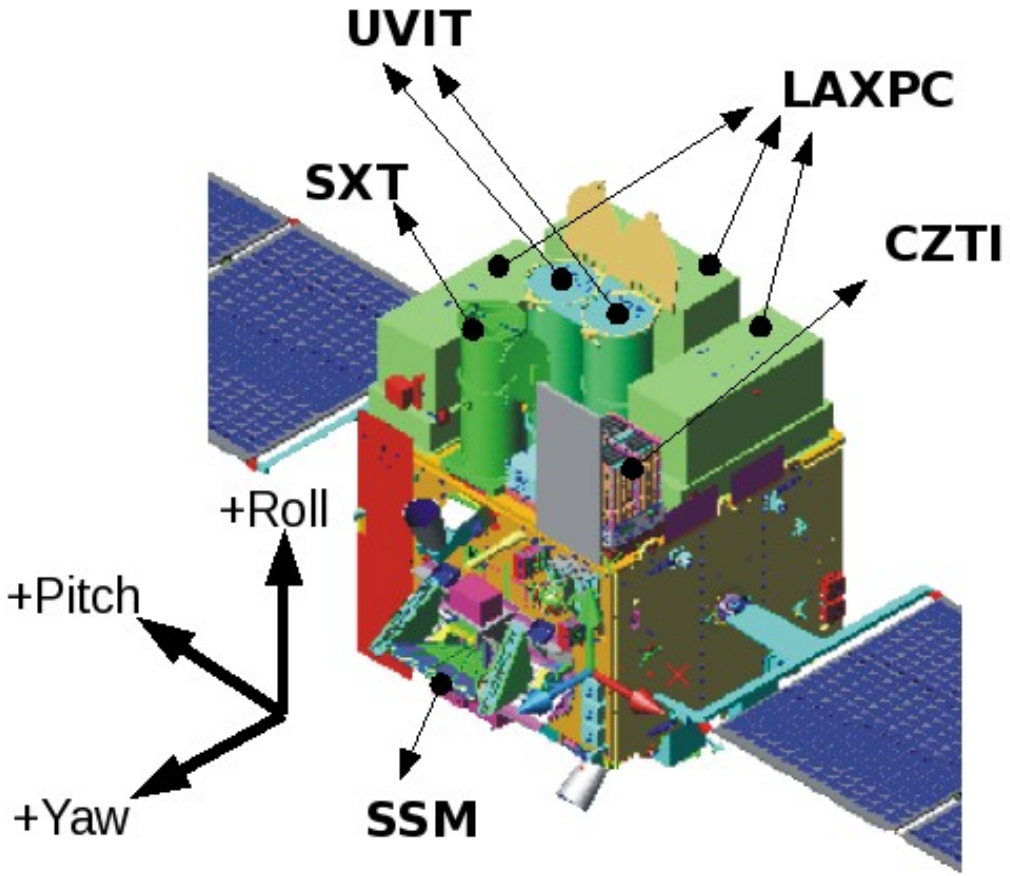


Scanning Sky Monitor





Scanning Sky Monitor mounting on ASTROSAT



eROSITA-extended ROentgen Survey with Imaging Tel. Array.

7 identical Wolter-I mirrors; 54 nested mirrors; pn-CCD sensors

~1 deg FOV; average 28” res

~0.2 to 10keV; twice more sensitive than XMM <2keV

Sky survey for 4 years

Launch- 2012/13 on SRG; L2 orbit

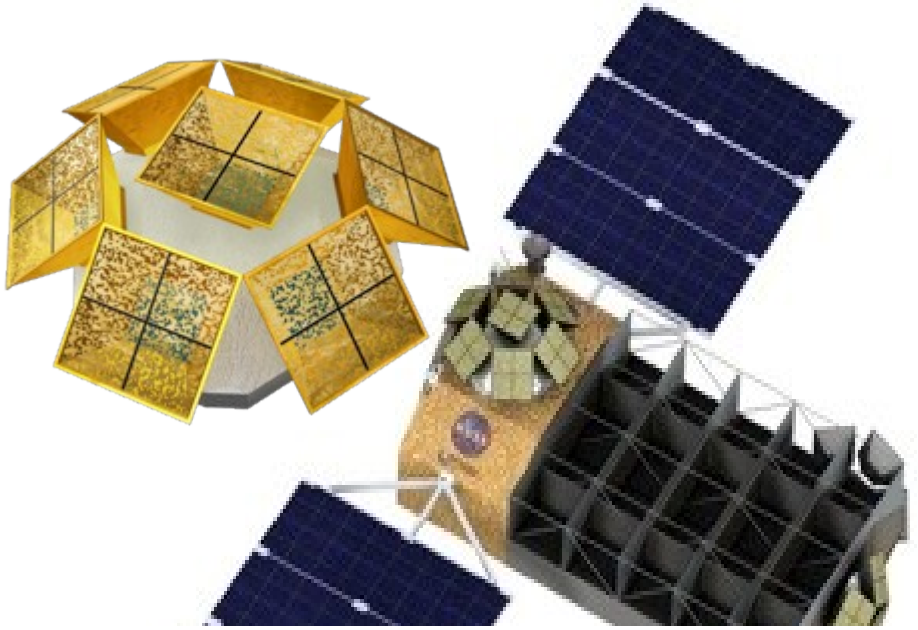
Capelluti et al, 2010

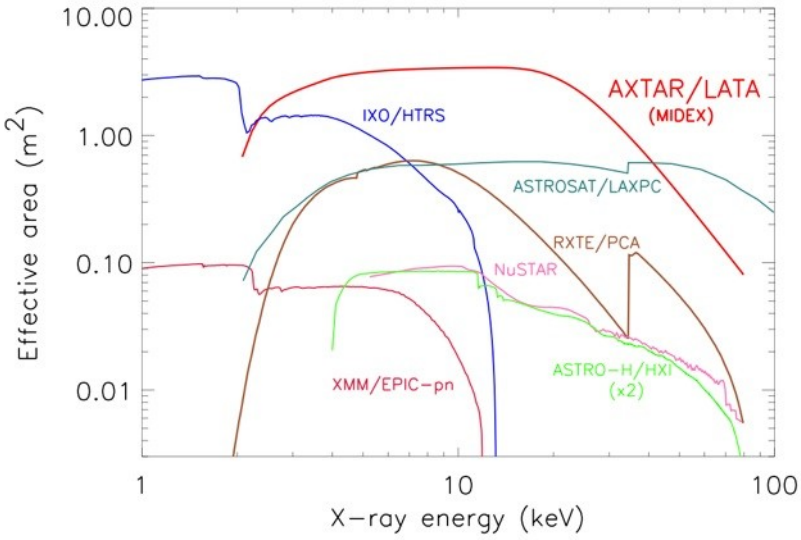
AXTAR- Advanced X-ray Timing Array

Large Area Timing Array- 3sqm;

9x9sqcm thick (2mm) Si PIN (pixellated) / SDD

Sky monitor same detectors with coded mask- 5 clusters of 7 modules each 40 x 40 sqdeg; 85% coverage





WFXT – Wide field X-ray telescope mission

Three co-aligned telescopes

1 sq deg FOV; <10” (5”)res

CCDs at focal plane (X-ray

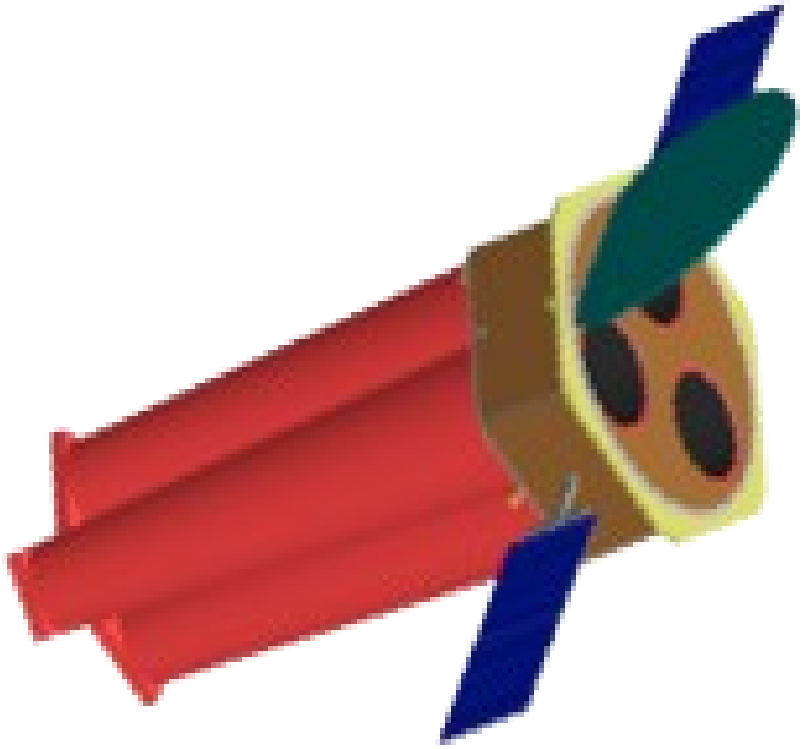
CMOS detectors?)

Telescopes- 40-80 nested

shells- polynomial

perturbation of the Wolter-I

mirrors



SSMurray +WFXT team 2010

WFXT – Wide field X-ray telescope mission

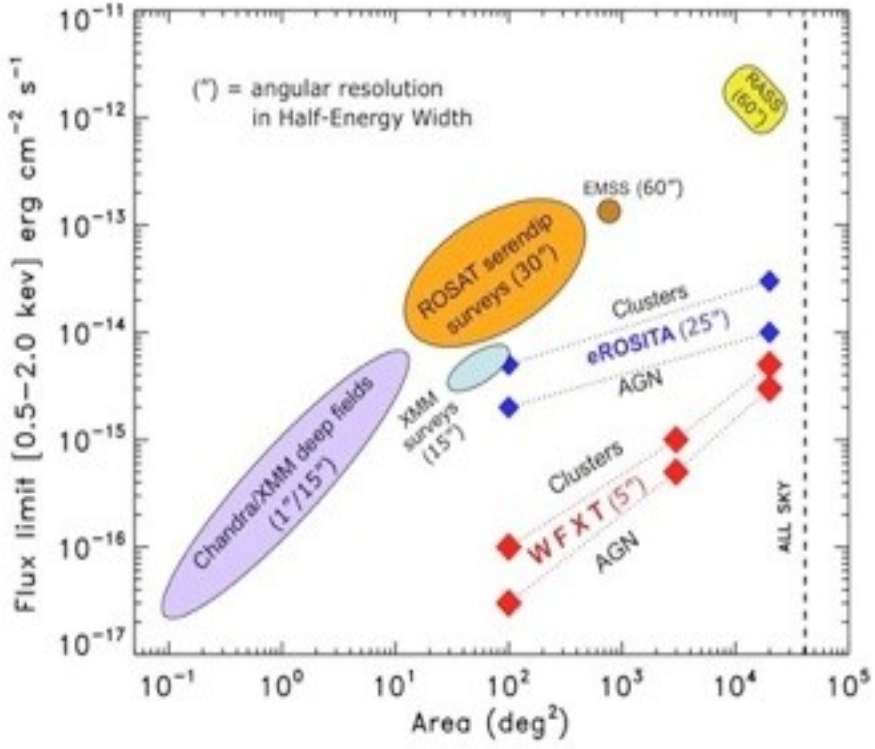
Survey 20,000 sqdeg -100-1000 times sensitive compared to ROSAT

High redshift AGN and clusters of galaxies to z~2 astrophysics- cosmology

3000 sqdeg to Chandra/XMM sens

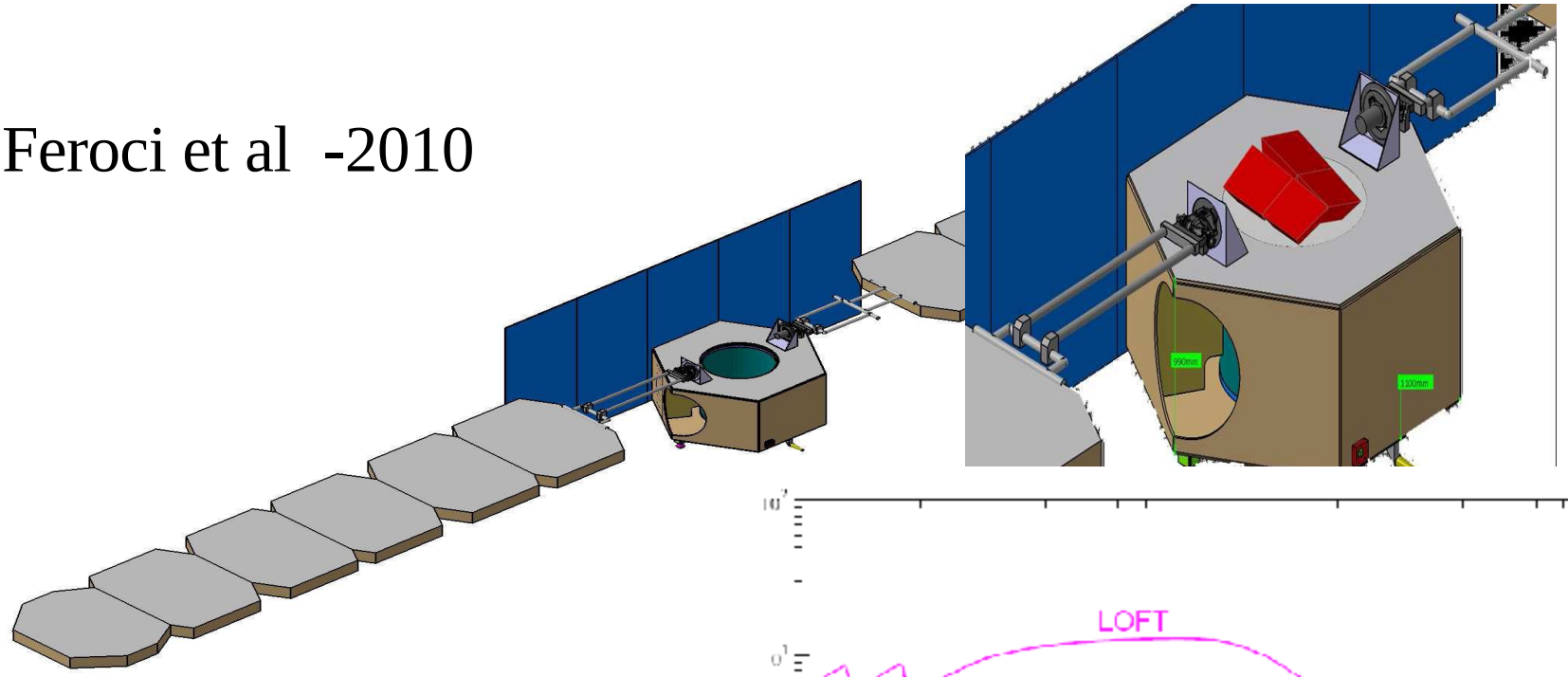
Launch- March 2016

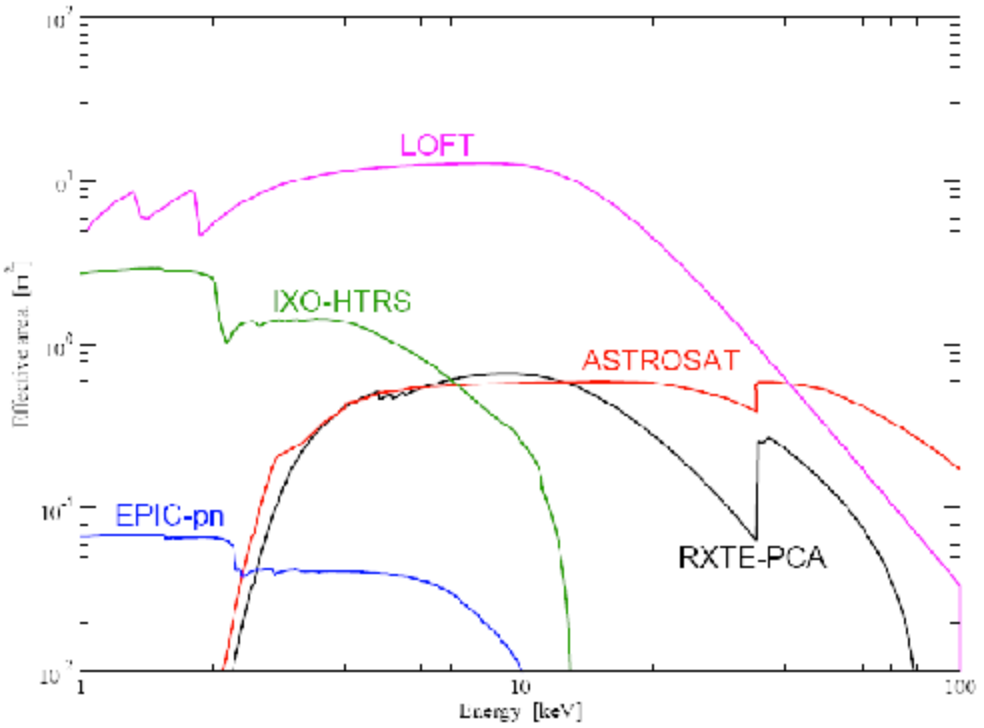
Yearly release of data



LOFT-Large Observatory For x-ray Timing.

Feroci et al -2010





Timing mission with large area

All sky monitor - 4 coded mas

resolution <7'; source locati

sensitivity- 0.8Crab/s;

Thank you

Acknowledgements

adsabs, webpages on various

missions, arXiv