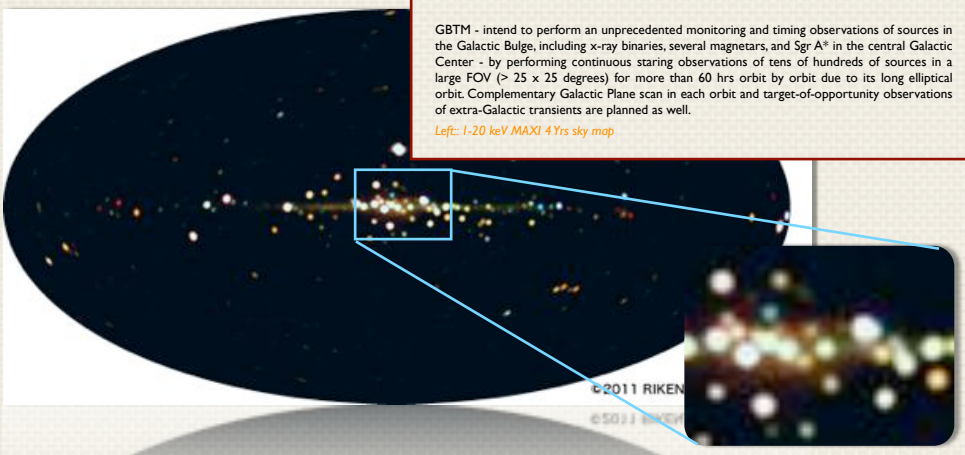
THE GALACTIC BULGE TRANSIENT MONITOR (GBTM)



GBTM - intend to perform an unprecedented monitoring and timing observations of sources in the Galactic Bulge, including x-ray binaries, several magnetars, and Sgr A* in the central Galactic Center - by performing continuous staring observations of tens of hundreds of sources in a large FOV (> 25 x 25 degrees) for more than 60 hrs orbit by orbit due to its long elliptical orbit. Complementary Galactic Plane scan in each orbit and target-of-opportunity observations of extra-Galactic transients are planned as well.

Left:: 1-20 keV MAXI 4 Yrs sky map

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ON BEHALF OF A LARGE TEAM SUPPORTED BY 1ST ROUND CAS PRE-PHASE SPACE MISSION CONCEPT STUDY PROGRAM

GBTM - a new x-ray monitoring and timing machine

Galactic Bulge Transient Monitor

Galactic Bulge Transient Monitor (GBTM) is an x-ray monitoring and timing machine dedicated to the x-ray monitoring of tens or even hundreds of black hole and neutron star x-ray binaries in the central region of the Galactic Bulge (GB) with a FOV more than 25 x 25 degrees. It was based on a proposed of an all-sky monitor in 2009-2010 to CAS and was among one of four funded space astronomical proposals in the 1st round CAS pre-phase study program, together with two missions under "background-studies" - X-ray Timing and Polarization (XTP) and Space VLBI (SVLBI). The original team members of the all-sky monitor studies include scientists in the Institute of High Energy Physics, the Purple Mountain Observatory and Shanghai Astronomical Observatory. The original GBTM proposal was proposed to CAS in 2011. As a dedicated monitor, if equipped with the most advanced technology available, it will surpass all previous x-ray all-sky monitors on the science of X-ray binaries and Sgr A* due to its unique observing mode and its orbit. Its unique staring observation model allows GBTM to accumulate uninterrupted timing data of high time resolution of multiple sources during each entire orbit and its unique long elliptical orbit provides data uninterrupted for up to more than 200 ks per orbit. In its mission life time planned for about 3-5 years, it will provide more than 1000 light curves, each with a length of 200 ks for each source in the field of view. It is also incorporated with a complementary Galactic Scan to monitor pulsars and target-of-opportunity observations of new extra-Galactic transients.

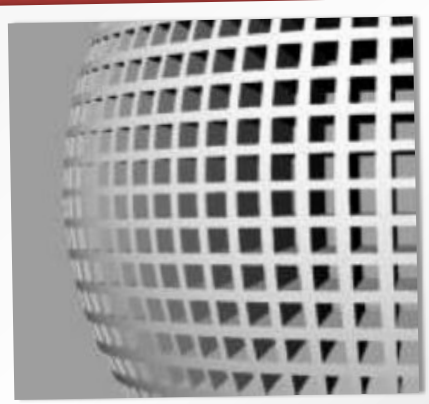
Science Objectives

GBTM is better than previous and currently operating x-ray monitors, such as MAXI, RXTE/ASM, Swift/BAT, BeppoSAX etc. , on the scientific objectives on black hole and neutron star x-ray binaries, transient events from magnetars, and massive black hole Sgr A* in the central region of our Galaxy, by providing uninterrupted 200 ks staring observations of XRBs, magnetars and Sgr A* residing in the Bulge down to as short as millisecond time resolution in each single orbit. It also surpasses all previous x-ray timing or spectral observatories based on pointed X-ray observations such as RXTE, GINGA, and EXOSAT etc. by providing continuous timing data of tens or hundreds of sources at the same time which repeats on a roughly daily basis. GBTM therefore provides both short-term and long-term monitoring of XRBs, several magnetars, and unique sources such as Sgr A*. It allows both short-term (approaching ms) and long-term (approaching months) timing studies, spanning in time scales over 10 orders of magnitude .The main scientific objectives are:

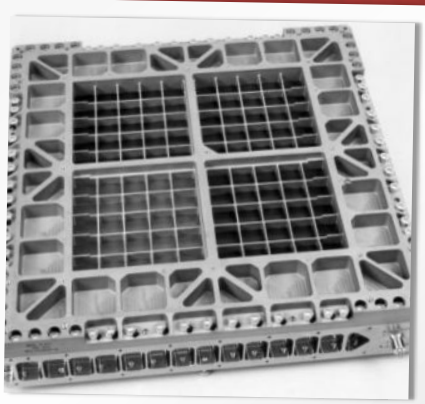
- **Discovery of tens of BH and NS systems in the GB** - with its data alone, including accretion-powered millisecond pulsars (APMSPs), magnetars, weak neutron star LMXBs - *guaranteed as the first to catch new x-ray sources in its FOV*
- **Physics of ultra-dense matter and strong magnetic fields from explosive events** - *by accumulating unprecedentedly complete samples of x-ray bursts in tens of neutron star LMXBs and several magnetars, detection of mHz QPOs in several NS LMXBs and detection of possible magnetar giant flares from magnetars*
- **Evolution of x-ray pulsars and their radiation mechanism and magnetic fields** - *by monitoring spin-ups and spin-downs of a variety of X-ray pulsars, including accreting x-ray pulsars, magnetars, and accretion-powered millisecond pulsars.*
- **Discovery of the first ultra-compact BH XRBs and measurements or constraints on black hole and neutron star masses** - *through detections of orbital periods of a few to ten black hole and neutron star LMXBs*
- **Accretion physics in low mass accretion rate regimes** - *by monitoring the activities of Sgr A* and by detections of a few tens to several hundreds of bright x-ray flares unprecedentedly*
- **Accretion physics in high mass accretion rate regimes** - *by monitoring spectral state and power spectral states of tens of bright black hole and neutron star XRBs*
- **Accretion physics on extremely long accretion time scales and power spectra of BH and NS systems over an unprecedented large frequency range** - *by monitoring bright black hole and neutron star XRBs in the Galactic Bulge to obtain X-ray Fourier power spectra over 10 orders of magnitude: from 10^-7 - 10^3 Hz.*

Current Status

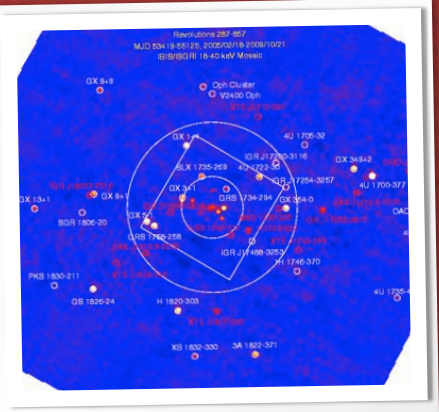
In the process of a justification of current instrumental options to meet the scientific objectives - Lobster Eye (LE) and Coded-Mask (CM) technologies are among the best available options.



OPTION 1: LOBSTER EYE
CZECH, UK, CHINA



OPTION 2: CODED-MASK
ITALY, NETHERLANDS, CHINA



FIELD OF VIEW IN HARD X-RAYS
VARIABLE X-RAY SKY ON MS SCALE