GBTM - a new x-ray monitoring and timing machine

**Galactic Bulge Transient Monitor**

GBTM (Galactic Bulge Transient Monitor) 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 proposal 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 YLL (SVL). 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 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 or more. In its orbit, GBTM intends 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.

**Science Objectives**

GBTM is better than previous and currently operating x-ray monitors, such as MAXI, RXTE/ASM, Swift/BAT, BeppoSAX etc., by 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. GBTM is also incorporated with a Galactic Plane scan to monitor pulsars and target-of-opportunity observations of extra-Galactic transients.

- **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.
- **Accretion physics in low mass accretion rate regimes** - by monitoring the activities of Sgr A* and by detections of a few to tens of hundreds of bright x-ray flares unprecedentedly.
- **Discovery of the first ultra-compact BH XRBs and measurements or constraints on black hole and neutron star masses** - by detections of orbital periods of a few to ten black hole and neutron star LMXBs.
- **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^{-1} - 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.