Circinus X-1

Observation plan

Cir X-1 was selected as a Category-C target with 40 ks exposure. Since this is only 3% of the 16.7-days (=1,442 ks) entire orbital period, we cannot cover the entire orbital cycle. Therefore, as discussed at the proposals, we concentrate on the orbital phase around the periastron passage, where the prominent iron emission/absorption line features are predicted. In fact, based on the recent MAXI and NICER monitoring campaigns (Tominaga et al., in prep), the orbital X-ray light curves are stable and reproducible at each orbit. Furthermore, the H-like and He-like iron lines show the transition from emission lines to absorption features at around the orbital phase of 0.93-0.96 when the X-ray flux abruptly increases. The XRISM observation should cover this important orbital phase of 0.85-1.05 with four snapshots at 10 ks each. We plan to assign a longer exposure to the former of the low luminosity state than the latter (high luminosity state) to make the difference of X-ray photon statistics smaller between the two states. However, an over-optimized plan may fail to capture both desired states due to the actual accretion conditions. We can further adjust this when a realistic satellite operation plan is discussed. We will use filters (or windows) to the bright state, which reaches 2e-8 erg/s/cm2.

Immediate objectives

[1] At the low flux state before the transition (at the orbital phase of 0.85-0.93), we expect the emission lines at 6.4, 6.7 and 7.0 keV. We will perform the (photoionized) plasma diagnostics of stellar wind or disk (we could consider several scenarios of the line process).

[2] At the high flux state after the transition (at the orbital phase of 0.96-1.05), we expect the absorption features at the iron lines. We will try interpretation disk wind analyses.

[3] We will study the absorption edges at around 7 keV. (e.g., an XMM observation of Cir X-1 at the lowest flux before periastron in 2006.

[4] We will search iron and other line features for the P-Cygni profile to study the stellar wind physics.

[5] If we can coordinate multiwavelength campaign (e.g., optical and radio bands), we will try time lag analyses.

[6] If an outburst happens during the XRISM observations, we can further perform timing analysis, burst spectroscopies and so on.