

# ASCA OBSERVATIONS OF THE SGRA REGION

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## 1. Introduction & Observations

The complex radio source Sgr A is embedded in a region near our Galactic Center. The dynamical center of our Galaxy is considered to be Sgr A\*, the compact non-thermal radio source. Dynamical mass within  $\sim 0.1$  pc from Sgr A\* has been estimated to be  $\sim 3 \times 10^6 M_{\odot}$ . This places Sgr A\* to be a candidate of a massive blackhole (Eckart and Genzel, 1997 and reference therein).

In spite of extensive observations, direct evidence for high energy activities from Sgr A\*, as those found in active galactic nuclei, is still lacking. *ASCA* observations near to Sgr A\* were made on three occasions: '93 Autumn, '94 Autumn & '97 Spring. The results of the former two observations have been already published in Koyama *et al.*, (1996) and Maeda *et al.*, (1996). In the SIS/*ASCA* hard-band image (2-10 keV) during '93 Autumn observations, we found two bright spots within the inner 2 arcmin from Sgr A\*. One named as the "hard source" is located  $1'.3$  away from Sgr A\*. In the '94 observations, we discovered an X-ray burst and 8.4 hr period dips from the hard source, establishing that the hard source is a new eclipsing low-mass X-ray binary (Maeda *et al.*, 1996, Kennea and Skinner, 1996). The peak of the other spot named as the "soft source" corresponds to the

position of Sgr A\*. The soft source was dominated by diffuse X-rays and exhibited no time variability. in the former two observations. Thus, in the former two observations, no direct evidence of the high-energy activity from Sgr A\* was found. However, we found a hint of intermittent and past activities from Sgr A\* (Koyama *et al.*,1996). Accordingly, we performed the third Sgr A observation on '97 Spring in order to search the suggestive activities of Sgr A\* in more detail. We report the results of this third observations, together with the previous two observations.

## 2. Results & Discussion

We detected significant X-ray emissions from the two sources of the Sgr A region in the '97 Spring observations. The fluxes of the two sources, together with those obtained with the previous two observations are given in figure 1. We found no direct evidence for the X-ray activity of Sgr A\*; neither flux variability nor spectral change of the soft source was found from the three observations. Thus we infer that Sgr A\* is currently quiescent, or at least, during the past several years. The absorption corrected luminosity has been  $L_{x,SgrA*} < 10^{36}$  erg s<sup>-1</sup> at the distance of 8.5 kpc.

The flux of the hard source in Spring '97 was the same as that in Autumn '93, but was about 1/5 of that in Autumn '94. We confirmed the periodic dips of  $\sim 8.4$  hrs, and thus conclude that the time variability in the close vicinity of Sgr A\* is due to the hard source located 1'.3 away from the Galactic Center. We note that the previous non-imaging observations of Sgr A\*, if not all, might have been contaminated by the variable hard source.

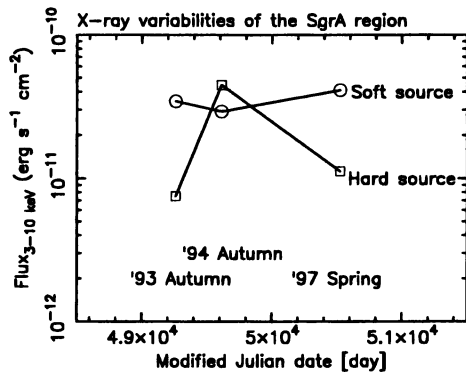


Figure 1. Plot of the 3–10 keV flux [ergs s<sup>-1</sup> cm<sup>-2</sup>] for the soft source(Circle) and for the hard source(Square), respectively.

## References

- Eckart, A. and Genzel, R. 1997, *MNRAS*, 284, 576  
 Kennea J.A. and Skinner G.K. 1996, *PASJ*, 48, L117  
 Koyama K., Maeda Y., Sonobe T., Takeshima T., Tanaka Y., and Yamauchi S. 1996, *PASJ*, 48, 249  
 Maeda, Y., Koyama, K., Sakano, M., Takeshima, Y., and Yamauchi, S. 1996, *PASJ*, 48, 417