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A New Population of X-ray Transients in the Galactic Center

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Abstract. A comparison of the *XMM-Newton* and *Chandra* Galactic Center Surveys has revealed two faint X-ray transients with contrasting properties. The X-ray spectrum of XMM J174544−2913.0 shows a strong iron line with an equivalent width of ∼2 keV, whereas that of XMM J174457−2850.3 is characterized by a very hard continuum with photon index ∼1.0. The X-ray flux of both sources varied by more than two orders of magnitude over a period of months with a peak X-ray luminosity of 5×10^{34} ergs s^{-1}. We discuss the nature of these peculiar sources.

1. Introduction

The Galactic Center (GC) probably harbors many transient X-ray sources. Past X-ray observations have revealed that the majority of the transient sources with luminosities $L_X \geq 10^{35}$ ergs s^{-1} are low-mass X-ray binaries (LMXBs), containing a neutron star or black hole (e.g., Sakano et al. 2002). Recent *Chandra* and *XMM-Newton* observations have lowered the detection threshold by 1–2 orders of magnitude, thus providing access to potential new X-ray populations of sources with luminosity in the range $L_X = 10^{32}$–10^{34} ergs s^{-1}. Here we report two relatively faint X-ray transients, which exhibit unusual properties.

2. Results and Discussion

We have compared the *XMM-Newton*/EPIC and *Chandra*/ACIS Survey data obtained during the period between 2000 Sep and 2002 Jun. We detected several transients within the 0.3×0.3 deg^2 field centered at $(l, b) = (-0.^\circ1, -0.^\circ2)$. Among them we detected XMM J174544−2913.0 and XMM J174457−2850.3 at respective J2000 positions of (RA, Dec) = ($17^h45^m44.^s38$, $-29^\circ13'00.''6$) and ($17^h44^m57.^s56$, $-28^\circ50'20.''7$), with an error radius of 8″.

XMM J174544−2913.0 was detected in 2000 Sep ($L_X = 5 \times 10^{34}$ ergs s^{-1}), but not in 2001 Jul or 2001 Sep with the lowest 3σ upper limit for the 2–

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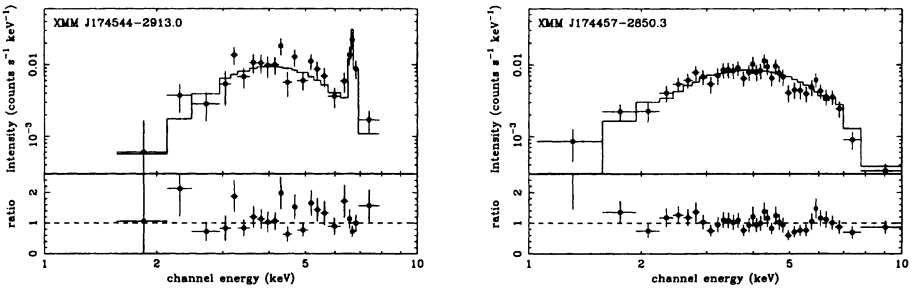

Figure 1. *XMM* MOS-1 spectra of the two transient sources.

10 keV luminosity of 3×10^{32} ergs s^{-1}, assuming a distance of 8.0 kpc. For XMM J174457−2850.3, we determined a 2–10 keV X-ray luminosity of 1×10^{33}, 5×10^{34} and 1×10^{32} ergs s^{-1} in 2001 Jul, 2001 Sep and 2002 May respectively. Furthermore, in the 2001 Jul observation the source flux declined by a factor of two or more in 10 ks.

Figure 1 shows the *XMM* spectra of the two sources when they were in the high state. XMM J174544−2913.0 was found to have an extremely strong iron line with a center energy of 6.68 ± 0.02 keV and an equivalent width (EW) of $2.4^{+0.4}_{-0.5}$ keV, whereas XMM J174457−2850.3 exhibits a very hard continuum with photon index of $0.98^{+0.33}_{-0.25}$ with a weak 6.7-keV line (EW = 180 ± 140 eV). Both the spectra are absorbed by a large column density: (12.4 ± 1.8) and $(5.9 \pm 1.1) \times 10^{22}$ cm^{-2}, respectively. XMM J174457−2850.3 showed marginal evidence for softening of the spectrum from the high state ($\Gamma \sim 1.0$) to low state (~ 1.9).

The strong iron line and transient nature of XMM J174544−2913.0 is quite similar to AX J1842.8−0423 (Terada et al. 1999). Thus, as suggested by Terada et al., it is likely to be a magnetized cataclysmic variable (CV) viewed from a pole-on inclination, which causes an apparently strong line at 6.7 keV from helium-like iron. However the large luminosity of over 10^{34} ergs s^{-1} is quite unusual for CVs and some additional component, for example a jet, may contribute to the observed emission.

The nearly featureless and flat spectrum of XMM J174457−2850.3, as well as the existence of diffuse emission around the source, suggests that it may be a neutron star or black hole binary. The weak but significant iron line and the flat index point to this being a high mass X-ray binary (HMXB). However, both the quiescent luminosity of 1×10^{32} ergs s^{-1} and the peak observed luminosity of 4×10^{34} ergs s^{-1} are unusually low, suggesting the possibility of a wide eccentric orbit characteristic of many Be star X-ray binary systems.

References

Sakano, M. et al. 2002, ApJS, 138, 19
Terada, Y. et al. 1999, PASJ, 51, 39

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