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A new population of X-ray transients in the Galactic Centre

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Abstract. A comparison of the *XMM-Newton* and *Chandra* Galactic Centre (GC) 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 characterised by a very hard continuum with photon index ∼1.0. The X-ray flux of both sources varied by more than 2 orders of magnitude over a period of months with a peak X-ray luminosity of 5×10^{34}erg s^{-1}. We discuss the nature of these peculiar sources.

1. Introduction

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

2. Results & Discussion

We have compared the *XMM-Newton*/EPIC and *Chandra*/ACIS Survey data obtained during the period between September 2000 and June 2002. We detected several transients within the 0.3×0.3 deg^2 field centred at $(l,b)=(-0.^\circ1, -0.^\circ2)$. Among them we detected XMM J174544−2913.0 and XMM J174457−2850.3 at the respective J2000 positions of (RA, Dec) = ($17^{\rm h}\ 45^{\rm m}\ 44^{\rm s}.38$, $-29^\circ\ 13'\ 0''.6$) and ($17^{\rm h}\ 44^{\rm m}\ 57^{\rm s}.56$, $-28^\circ\ 50'\ 20''.7$) coordinates with an error radius of $8''$.

XMM J174544−2913.0 was detected in September 2000 ($L_{\rm X} = 5{\times}10^{34}$erg s^{-1}), but not in July or September 2001 with the lowest 3σ upper limit for the 2–10

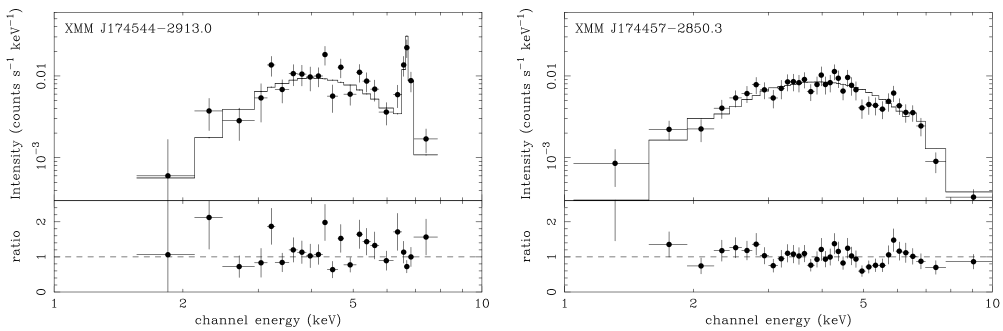

Figure 1. *XMM-Newton* MOS1 spectra of the two transient sources.

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

Fig. 1 show 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 centre 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±1.1 $\times 10^{22}$ H 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 magnetised 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}erg 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}erg s^{-1} and the peak observed luminosity of 4×10^{34}erg s^{-1} are unusually low, suggesting the possibility of a wide eccentric orbit characteristic of many Be star X-ray binary systems.

References

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