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A TRANSIENT BLACK HOLE LOW-MASS X-RAY BINARY CANDIDATE IN CENTAURUS A

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ABSTRACT

We report the discovery of a bright transient X-ray source, CXOU J132518.2−430304, toward Centaurus A (Cen A) using six new *Chandra X-Ray Observatory* observations in 2007 March–May. Between 2003 and 2007, its flux has increased by a factor of >770. The source is likely a low-mass X-ray binary in Cen A with unabsorbed 0.3–10 keV band luminosities of (2–3) $\times$ 10^{39}ergs s^{-1} and a transition from the steep-power-law state to the thermal state during our observations. CXOU J132518.2−430304 is the most luminous X-ray source in an early-type galaxy with extensive timing information that reveals transience and a spectral state transition. Combined with its luminosity, these properties make this source one of the strongest candidates to date for containing a stellar-mass black hole in an early-type galaxy. Unless this outburst lasts many years, the rate of luminous transients in Cen A is anomalously high compared to other early-type galaxies.

Subject headings: binaries: close — galaxies: elliptical and lenticular, cD — galaxies: individual (Centaurus A, NGC 5128) — X-rays: binaries

1. INTRODUCTION

Over the 40 years of X-ray astronomy, the detailed study of Galactic X-ray binaries (XRBs) has placed strong constraints on theories of X-ray binary evolution and accretion. X-ray variability studies have been important in understanding disk accretion and the interplay between different emission components, e.g., the jet, corona, and disk.

All Galactic low-mass X-ray binaries (LMXBs), which have companions of $\lesssim 1\ M_{\odot}$, that are confirmed BHs are also transient systems with X-ray luminosities that vary by orders of magnitude (Remillard & McClintock 2006). While most have outbursts ranging from weeks to months, one unusual transient, GRS 1915+105, has been continuously emitting since its outburst began 15 years ago. The transient behavior of BH (and some neutron star) LMXBs has been attributed to a disk instability first identified in cataclysmic variables (CVs; van Paradijs 1996). While this theory correctly identifies which XRBs are likely transients, it has yet to accurately predict the outburst lengths and recurrence times, which are necessary to determine an X-ray duty cycle (for a review, see King 2006).

The Galactic population of BH LMXBs has been studied in great detail, but the small sample size, ~190 Galactic LMXBs of which ~10%–25% are confirmed or candidate BH systems (Liu et al. 2006), and nonuniform observational sampling limit the ability of Galactic studies to measure the duty cycle. With the *Chandra X-Ray Observatory*, we can now study the tens to hundreds of identified LMXBs in individual nearby galaxies (e.g., Sarazin et al. 2000; Sivakoff et al. 2007). With multiepoch observations of early-type galaxies, we can measure the variability of extragalactic LMXBs. Interestingly, the most luminous extragalactic LMXBs are persistent on timescales of several years (Irwin 2006).

Centaurus A (NGC 5128, Cen A), at 3.7 Mpc (the average of five distance indicators; see § 6 in Ferrarese et al. 2007), is the nearest radio galaxy and the nearest optically luminous ($M_B = -21.1$; Dufour et al. 1979) early-type galaxy. Prior to 2007, *Chandra* had targeted Cen A with the ACIS detectors four times, 1999 December 5, 2000 May 17, 2002 September 3, and 2003 September 14 (observations 316, 962, 2978, and 3965). In 2007, *Chandra* performed six further deep observations (~100 ks each) of Cen A to study the X-ray properties of its jet, lobes, and XRBs (Hardcastle et al. 2007; Jordán et al. 2007; Worrall et al. 2008; Kraft et al. 2008). As the nearest luminous early-type galaxy, Cen A is one of the premier targets for studying extragalactic LMXB variability. In this analysis, we report results on the most luminous XRB candidate in Cen A, CXOU J132518.2−430304. The errors on our spectral fits refer to single-parameter 90% confidence intervals and all other errors refer to 1 σ confidence intervals. All fluxes and luminosities are in the 0.3–10 keV band.

2. OBSERVATIONS AND DATA REDUCTION

New *Chandra* observations of Cen A were taken in 2007 (Table 1) and contained no high-background periods. Our analysis includes only events with ASCA grades of 0, 2, 3, 4, and 6. Photon energies were determined using the gain file acisD2000-01-29gain_ctiN0001.fits, correcting for time dependence of the gain, charge transfer inefficiency, and quantum efficiency degradation. We excluded bad pixels, bad columns, and columns adjacent to bad columns or chip node boundaries. The absolute astrometry is accurate to $\pm 0.1''$ (Hardcastle et al.

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TABLE 1
Chandra Observations of CXOU J132518.2−430304 in Centaurus A

Obs. No.	Date (2007)	Exposure (s)	OAA (arcmin)	Net Counts	Net Rate (10^{-2} counts^{-1})
7797	March 22	96888	0.9	6471	6.679 ± 0.084
7798	March 27	90839	7.3	7942	8.742 ± 0.100
7799	March 30	94783	7.3	6981	7.365 ± 0.090
7800	April 17	90843	7.4	6259	6.890 ± 0.089
8489	May 8	93936	3.3	8987	9.567 ± 0.102
8490	May 30	94425	0.5	7908	8.375 ± 0.095

Notes.—Observed counts are in the 0.5–7 keV band. The source in observations 7797, 8489, and 8490 is at small off-axis angles (OAAs), and their rates are underestimated due to event pileup.

2007). We used CIAO 3.4[10] with CALDB 3.3.0.1 and NASA HEASARC's FTOOLS 6.2[11] for data reduction and analysis. We used ACIS Extract 3.131[12] to refine the position of CXOU J132518.2−430304 by correlating the 0.5–7 keV photons near the `wavdetect` coordinates against the count-weighted, combined X-ray PSF (at 1.497 keV) of the observations. For each observation we created source regions corresponding to a polygon encircling 90% of the X-ray PSF and local circular background regions that began just beyond the region encircling 97% of the X-ray PSF and had 3 times the source area. These regions were used to extract spectra and response files for spectral fitting using XSPEC 11.3 (see footnote 11).

3. PROPERTIES OF CXOU J132518.2−430304

CXOU J132518.2−430304 is located 2.6′ southwest of the AGN in Cen A. We estimate that its position of R.A. = $13^{h}25^{m}18.24^{s}$ and decl. = −43°03′04.5″ (J2000.0) is accurate to 0.2″.

In each observation, CXOU J132518.2−430304 was the brightest nonnuclear source. At this position, there is no source in any of the four previous observations of Cen A (see Fig. 1). In those four observations, we find a combined 3 σ upper limit of 14.9 net counts. The spectral models fitted to the new observations (Table 2) give PSF-corrected, absorbed fluxes of $(8.5\text{–}11.5) \times 10^{-13}$ ergs cm^{-2} s^{-1}. The same models correspond to fluxes of $\lesssim 1.1 \times 10^{-15}$ ergs cm^{-2} s^{-1} in the old observations. The flux has increased by a factor of >770.

[10] See http://asc.harvard.edu/ciao/.
[11] See http://heasarc.gsfc.nasa.gov/docs/software/lheasoft/.
[12] See http://www.astro.psu.edu/xray/docs/TARA/ae_users_guide.html.

CXOU J132518.2−430304 is a transient source, whose outburst began after 2003 September 14. Since it is detected in all new observations, the outburst duration is at least 70 days.

We fitted the 0.5–10 keV spectra of CXOU J132518.2−430304, grouping spectral channels to have ≥25 counts. Since the spectra of Galactic XRBs are often fitted with the combination of a power-law and a multicolor disk blackbody model (Remillard & McClintock 2006), we adopted this model attenuated by a fixed Galactic absorption term ($N_{\rm H}$ = 8.41×10^{20} cm^{-2}; Dickey & Lockman 1990) and a variable local absorption term $N_{\rm H,local}$. The power-law photon index Γ, the inner temperature of the disk $kT_{\rm diskbb}$, and the normalizations of the two components were also variable parameters. Given the high count rates, multiple photons may be associated with an event, distorting the measured spectrum. Therefore, we convolved the physical model with the pileup model of Davis (2001). Its key parameters are the grade-morphing parameter α and the number of independent regions $N_{{\rm reg},p}$ over which pileup is calculated. We assumed $\alpha = 0.5$ for all fits, which was consistent with fits where α was allowed to vary. With their off-axis PSF, we determined that $N_{{\rm reg},p} = 5$ for observations 7798–7800 and pileup is minimal ($\lesssim$4%). For the nearly on-axis observations 7797, 8489, and 8490, $N_{{\rm reg},p} = 1$ and pileup is a concern (15%–23%).

We first attempted to jointly fit the spectra, requiring a fixed physical spectral shape, but allowing the normalizations to vary between observations. This fit is unacceptable with χ^2 = 1248.4 for 999 degrees of freedom (dof), suggesting that there is spectral variability between the six observations. We next allowed each observation to have its own spectral shape. We present the spectra in Figure 2 and summarize those fits in Table 2. Added together, the $\chi^2 = 992.1$ for 979 dof is an acceptable fit that is significantly preferred over models with only an absorbed power-law ($\chi^2 = 1239.9$ for 991 dof) or absorbed disk blackbody ($\chi^2 = 1416.1$ for 991 dof). Using error-weighted averages, it is clear that the first four observations are dominated, $L_{\rm unabs,pow}/L_{\rm unabs,tot} = 0.77 \pm 0.05$, by a power-law component, $\Gamma = 2.29 \pm 0.08$, attenuated by a $N_{\rm H,local}$ of $(2.3 \pm 0.5) \times 10^{21}$ cm^{-2}. The subdominant disk component has a temperature that is unconstrained in observations 7797 and 7800, but that observations 7798 and 7799 find to be $kT_{\rm diskbb} = 0.9 \pm 0.2$ keV. In the last two observations, a disk blackbody component, $kT_{\rm diskbb} = 1.01 \pm 0.03$ keV, dominates, $L_{\rm unabs,pow}/L_{\rm unabs,tot} = 0.10 \pm 0.06$, over a poorly con-

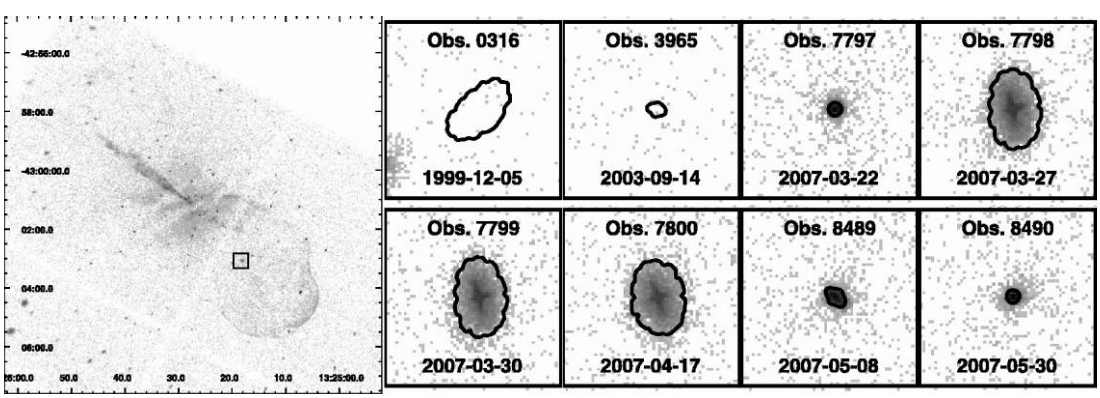

Fig. 1.—*Left*: *Chandra* 0.3–2 keV image of Cen A from observation 7797, with a logarithmic intensity scale and Gaussian smoothing (FWHM = 3 pixels). The image is limited to soft energies to minimize the readout streak from the central AGN. The ∼30″ × 30″ box indicates the location of CXOU J132518.2−430304. *Right*: *Chandra* 0.3–10 keV subimages (30″ × 30″) of CXOU J132518.2−430304 with the source extraction region indicated for all *Chandra* observations except 0962 and 2978, both of which show no source. The logarithmic intensity scale has been changed. The source clearly went into outburst between observations 3965 and 7797 and has remained bright for at least 70 days. The source regions due to the varying PSFs are overlaid.

TABLE 2
X-Ray Spectral Fits to Individual Observations of CXOU J132518.2−430304

Obs.	$L_{abs,tot}$ (10^{39} ergs s^{-1})	$N_{H,local}$ (10^{21} cm^{-2})	$L_{unabs,tot}$ (10^{39} ergs s^{-1})	Γ	$L_{unabs,pow}$ (10^{39} ergs s^{-1})	kT_{diskbb} (keV)	$L_{unabs,diskbb}$ (10^{39} ergs s^{-1})	$L_{unabs,pow}/L_{unabs,tot}$	χ^2/dof
7797	$1.49^{+0.05}_{-0.05}$	$2.8^{+1.2}_{-1.3}$	$2.76^{+1.12}_{-0.64}$	$2.34^{+0.66}_{-0.44}$	$2.63^{+0.57}_{-1.03}$	1.23 (unc)	0.13 (< 0.68)	0.95 (> 0.75)	140.2/151
7798	$1.69^{+0.06}_{-0.05}$	$2.3^{+1.2}_{-1.0}$	$2.91^{+1.14}_{-0.51}$	$2.45^{+0.67}_{-0.37}$	$2.20^{+0.79}_{-0.57}$	$1.20^{+0.28}_{-0.31}$	$0.71^{+0.39}_{-0.08}$	$0.76^{+0.05}_{-0.08}$	159.4/168
7799	$1.50^{+0.04}_{-0.04}$	$2.4^{+1.4}_{-0.6}$	$3.42^{+1.65}_{-0.90}$	$2.29^{+0.11}_{-0.08}$	$2.60^{+0.31}_{-0.17}$	0.07 (unc)	0.81 (< 2.15)	0.76 (> 0.57)	142.6/156
7800	$1.39^{+0.04}_{-0.05}$	$1.5^{+1.3}_{-1.1}$	$1.99^{+0.59}_{-0.31}$	$2.04^{+0.38}_{-0.57}$	$1.50^{+0.92}_{-0.67}$	$0.66^{+0.33}_{-0.12}$	$0.49^{+0.36}_{-0.33}$	$0.75^{+0.18}_{-0.26}$	163.1/144
8489	$1.88^{+0.02}_{-0.02}$	$0.5^{+3.3}_{-0.3}$	$2.20^{+3.69}_{-0.06}$	2.25 (unc)	0.05 (< 3.75)	$0.99^{+0.04}_{-0.06}$	$2.15^{+0.02}_{-0.25}$	0.02 (< 0.64)	186.4/186
8490	$1.80^{+0.00}_{-0.09}$	$0.5^{+0.3}_{-0.3}$	$2.04^{+0.05}_{-0.11}$	−3.00 (< 0.80)	$0.20^{+0.05}_{-0.12}$	$1.05^{+0.04}_{-0.06}$	$1.84^{+0.03}_{-0.12}$	$0.10^{+0.03}_{-0.06}$	200.4/174

Notes.—PSF-corrected luminosities in the 0.3–10 keV band are calculated assuming a distance of 3.7 Mpc. Errors indicate 90% confidence intervals. Brackets indicate parameter is unconstrained in at least one direction. An additional Galactic $N_H = 8.41 \times 10^{20}$ cm^{-2} is also included.

strained power-law component. In addition, the $N_{H,local}$ is also lower, $(0.5 \pm 0.3) \times 10^{21}$ cm^{-2}. In observation 8489, a very steep power-law component with high absorption leads to poor constraints on column density and $L_{unabs,pow}/L_{unabs,tot}$.

We used the Rayleigh statistic to search observations for periodic signals with frequencies between 10^{-5} and 10^{-1} Hz, testing every 10^{-5} Hz. We only found periodic signals related to known instrumental effects. We looked for additional count-rate variability within each observation using the Kolmogorov-Smirnov (K-S) test. Initial tests on the 0.3–10.0 keV band indicated 99.96% significant variability in observation 7797 and 7800. The total flux variations are of order 10% and 20%, respectively. Additional K-S tests on the 0.3–1.0 keV (soft), 1.0–2.0 keV, and 2.0–10.0 keV (hard) bands show that the variability in observation 7797 (a $\sim 5 \times 10^3$ s flare and a lower rate over $\sim 5 \times 10^4$ s) and 7800 (a $\sim 8 \times 10^3$ s dip and a higher rate over $\sim 5 \times 10^4$ s) primarily originates in the hard and soft bands, respectively.

A *Hubble Space Telescope* (*HST*) Advanced Camera for Surveys observation (J8Z012010) indicates that any counterpart has $m_{F606W} > 24.9$ (AB). From *HST* WFPC2 observations (U3LBA101M–U3LBA106M), the dereddened galaxy color $(V-I)_0$ at the position of CXOU J132518.2−430304 is 1.13 ± 0.04, which is consistent with K giants (Pickles 1998). Since O/B stars would significantly alter the measured $(V-I)$ color, we rule out their presence and the possibility that CXOU J132518.2−430304 is a high-mass X-ray binary. A 2007 June Very Large Array observation places a 3 σ, 8.4 GHz upper limit of 0.24 mJy (J. L. Goodger et al., in preparation).

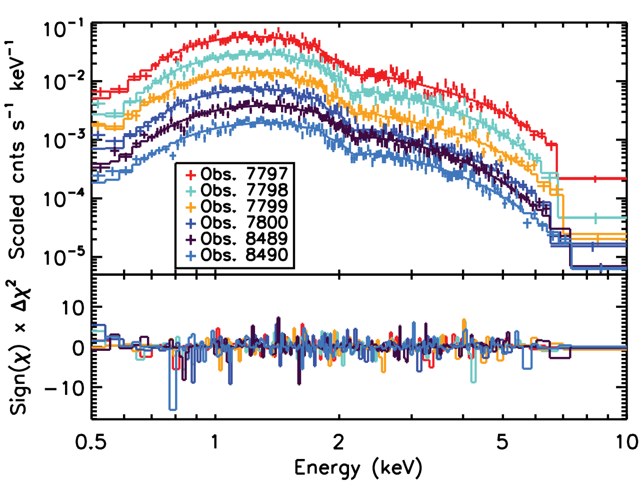

Fig. 2.—Spectra of CXOU J132518.2−430304 (0.5–10.0 keV) with the best-fit spectral model for each of the new observations. All spectra have been rescaled for visibility. The spectral fit parameters are listed in Table 2. A spectral transition from the steep-power-law state to the thermal-dominant state appears to occur between observations 7800 and 8489.

4. DISCUSSION

CXOU J132518.2−430304 is a transient source with an outburst duration of >70 days. Among transient sources, its large X-ray to optical flux ratio of $\log(F_X/F_{opt}) \gtrsim 3.5$ is characteristic of only strongly absorbed AGNs, CVs, and XRBs. The local column density of $N_{H,local} \sim 2 \times 10^{21}$ cm^{-2} is inconsistent with the source being a strongly absorbed AGN. If the source is Galactic in nature, its X-ray luminosity is $\lesssim 4 \times 10^{35}$ ergs s^{-1} and any potential companion must be a K dwarf or later in the outskirts of the Galaxy. Since the spectra are poorly fit by thermal bremsstrahlung models, we rule out that CXOU J132518.2−430304 is a luminous Galactic CV. While the source could be a Galactic LMXB, the field density of such sources is extremely low and transient LMXBs are typically more luminous in outburst. Thus, it is unlikely that CXOU J132518.2−430304 is a Galactic LMXB. Thus, we conclude that CXOU J132518.2−430304 is most likely an XRB in Cen A. Our measured color of the galaxy at the position of this source rules out the possibility of it being a high-mass XRB.

Assuming CXOU J132518.2−430304 is a transient LMXB in Cen A, its 0.3–10.0 keV unabsorbed luminosities are (2–3) $\times 10^{39}$ ergs s^{-1}, which is above the lower limit used to define an ultraluminous X-ray source in the *Chandra* band (Irwin et al. 2004). Although a handful of Galactic LMXBs with BHs also have similar peak luminosities (Jonker & Nelemans 2004), CXOU J132518.2−430304 appears to be one of the most luminous extragalactic transient LMXBs discovered to date. The proximity of Cen A allows us to study this LMXB in greater detail than in any other early-type galaxy.

Since its average outburst luminosity is ~17 times the Eddington limit for a solar-mass object accreting ionized hydrogen, CXOU J132518.2−430304 is more likely to be a BH XRB than a neutron star XRB. If we assume that the compact object mass is less than 30 $M_\odot$, CXOU J132518.2−430304 is accreting at an Eddington efficiency of $\gtrsim 0.5$. This source appears to be a very efficiently accreting BH XRB. Active BH XRBs are often divided into three states, a thermal state (high/soft state), a hard state (low/hard state), and the steep-power-law state (very high state) (Remillard & McClintock 2006). The steep-power-law state is characterized by a $\Gamma > 2.4$ power-law dominating over a ~1 keV disk blackbody component, which is well matched to the spectra of CXOU J132518.2−430304 in the first four observations; typically, the power-law component in the hard state has $1.4 < \Gamma < 2.1$. In two of these observations, we saw some evidence for intraobservation variability. The mixture of bands that vary points to $\sim 10^4$ s timescale variability in both the disk and power-law components. The last two observations are clearly best fit by the thermal state, with disk temperatures that are consistent with Galactic BH LMXBs (e.g., McClintock & Remillard 2006). Thus, we conclude that CXOU J132518.2−430304 has likely undergone a state transition from the steep-power-law state to the thermal-dominant state. The accretion column density also changes during the transition; however, to our knowledge no such change has been observed in Galactic BH LMXBs. It is unclear whether the local accretion column density is actually changing or whether the power-law model does not sufficiently capture the still unknown physics of the steep-power-law state at the lower energies observed by *Chandra*.

Many Galactic BH LMXBs are relatively short-term transients with infrequent outbursts with durations of about a month (McClintock & Remillard 2006). One notable exception is the recurring transient GX 339−4, which outbursts every few years. In Kraft et al. (2001) a luminous transient source, CXOU J132519.9−430317 ($L_X \sim 2 \times 10^{39}$ ergs s^{-1}), was detected 21″ east-southeast of CXOU J132518.2−430304 in observation 316, but was undetected 5 months later. The transient source 1RXH J132519.8−430312, which has been associated with CXOU J132519.9−430317, was luminous over 10 days in 1995, but undetected in other *ROSAT* observations spanning an 8 year timescale from 1990 to 1998 (Steinle et al. 2000). Our deep ACS image reveals that the counterpart found by Ghosh et al. (2006) is an aggregate of several stars consistent with being red giants in Cen A. CXOU J132519.9−430317, which appears to be a recurring transient with one outburst of at least 10 days and a second outburst with an upper limit of 835 days (Steinle et al. 2000; Kraft et al. 2001), appears similar to GX 339−4. Some BH XRB transients, e.g., XTE J1550−564 and GRO J1655−40, have intermediate-duration outbursts lasting months, while GRS 1915+105 has remained bright since its outburst approximately 15 years ago (McClintock & Remillard 2006). In Cen A, CXOU J132518.2−430304 is in outburst for at least 70 days with roughly constant luminosity, which could be consistent with outburst timescales of months or years.

Luminous ($L_X > 8 \times 10^{38}$ ergs s^{-1}) LMXBs in other early-type Galaxies tend to be persistent sources. In Irwin (2006) none of the 18 (15) luminous LMXBs attributed to NGC 1399 (M87) were transient sources. This study used two (six) epochs spanning 3.3 (5.3) yr. This places a 95% lower limit of 50 yr for the outburst duration of such sources. On the other hand, the two luminous nonnuclear sources in Cen A have both been identified as transients. Since the current data do not strongly constrain the duration of either transient, we first assumed that the previously known transient in Cen A undergoes 100 day outbursts and that CXOU J132518.2−430304 is undergoing a long-duration (years) outburst akin to GRS 1915+105. In that case, the rate of 100 day outburst transients in Cen A is $0.6^{+1.5}_{-0.5}$ yr^{-1}. Since both NGC 1399 and M87 have absolute K_s-band magnitude ≈1.5 mag brighter than Cen A (Tonry et al. 2001; Skrutskie et al. 2006), they each have approximately 4 times the stellar mass of Cen A. By scaling the number of 100 day outburst transients with stellar mass and considering when the galaxies were observed, we find the rates are consistent with no such transients being found by the Irwin (2006) study of NGC 1399 and M87.

On the other hand, CXOU J132518.2−430304 may have an outburst duration much shorter than decades. If we assume both Cen A sources are transients with 100 day outbursts, the rate of such transients is $1.3^{+1.7}_{-0.8}$ yr^{-1}, and we would predict the Irwin (2006) study should have found $8.4^{+11.1}_{-5.4}$ such transients in NGC 1399 and M87. The lower limit is only consistent with no detected transients at the 5% level.

As a more model independent comparison of the rates of transients, we calculate the fraction of sources with outburst durations shorter than years. If the outburst of CXOU J132518.2−430304 lasts for decades, the difference in the fractions between Cen A (0.5 ± 0.4) and NGC 1399 and M87 (<0.04) are different only at the 80.9% level. However, if the outburst is much shorter, the fraction in Cen A is >0.40, while the fraction in NGC 1399 and M87 is <0.04; these fractions are different at the 98.5% level of confidence.

Extensive X-ray observations of the bulge of M31 have revealed ∼60 transient sources (Trudolyubov et al. 2006; Williams et al. 2006; Voss & Gilfanov 2007) over ∼4.6 yr, all with $L_X < 4 \times 10^{38}$ ergs s^{-1}. Since the M_{K_s} of Cen A is about 0.3 brighter than M31, one expects to find $4.5^{+5.9}_{-2.8}$ luminous transients in M31, if both Cen A transients undergo 100 day outbursts. Thus, it is not surprising that no such luminous transients in M31 have been observed.

New observations of Cen A are needed to determine whether CXOU J132518.2−430304 is undergoing an outburst of months or years and whether the rate of luminous transients in Cen A is anomalously high compared with other early-type galaxies.

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Facilities: CXO(ACIS), HST(ACS/WFC,WFPC2), VLA

REFERENCES

Davis, J. E. 2001, ApJ, 562, 575
Dickey, J. M., & Lockman, F. J. 1990, ARA&A, 28, 215
Dufour, R. J., Harvel, C. A., Martins, D. M., Schiffer, F. H., III, Talent, D. L., Wells, D. C., van den Bergh, S., & Talbot, R. J., Jr. 1979, AJ, 84, 284
Ferrarese, L., Mould, J. R., Stetson, P. B., Tonry, J. L., Blakeslee, J. P., & Ajhar, E. A. 2007, ApJ, 654, 186
Ghosh, K. K., Finger, M. H., Swartz, D. A., Tennant, A. F., & Wu, K. 2006, ApJ, 640, 459
Hardcastle, M. J., et al. 2007, ApJ, 670, L81
Irwin, J. A. 2006, MNRAS, 371, 1903
Irwin, J. A., Bregman, J. N., & Athey, A. E. 2004, ApJ, 601, L143
Jonker, P. G., & Nelemans, G. 2004, MNRAS, 354, 355
Jordán, A., et al. 2007, ApJ, 671, L117
King, A. R. 2006, in Compact Stellar X-Ray Sources, ed. W. Lewin & M. van der Klis (Cambridge: Cambridge Univ. Press), 507
Kraft, R. P., Kregenow, J. M., Forman, W. R., Jones, C., & Murray, S. S. 2001, ApJ, 560, 675
Kraft, R. P., et al. 2008, ApJ, submitted
Liu, Q. Z., van Paradijs, J., & van den Heuvel, E. P. J. 2006, A&A, 455, 1165
McClintock, J. E., & Remillard, R. A. 2006, in Compact Stellar X-Ray Sources, ed. W. Lewin & M. van der Klis (Cambridge: Cambridge Univ. Press), 157
Pickles, A. J. 1998, PASP, 110, 863
Remillard, R. A., & McClintock, J. E. 2006, ARA&A, 44, 49
Sarazin, C. L., Irwin, J. A., & Bregman, J. N. 2000, ApJ, 544, L101
Sivakoff, G. R., et al. 2007, ApJ, 660, 1246
Skrutskie, M. F., et al. 2006, AJ, 131, 1163
Steinle, H., Dennerl, K., & Englhauser, J. 2000, A&A, 357, L57
Tonry, J. L., Dressler, A., Blakeslee, J. P., Ajhar, E. A., Fletcher, A. B., Luppino, G. A., Metzger, M. R., & Moore, C. B. 2001, ApJ, 546, 681
Trudolyubov, S., Priedhorsky, W., & Cordova, F. 2006, ApJ, 645, 277
van Paradijs, J. 1996, ApJ, 464, L139
Voss, R., & Gilfanov, M. 2007, A&A, 468, 49
Williams, B. F., Naik, S., Garcia, M. R., & Callanan, P. J. 2006, ApJ, 643, 356
Worrall, D. M., et al. 2008, ApJ, 673, L135