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The X-ray observation of newly discovered transient XTE J1748-288 by the Indian X-ray Astronomy Experiment

S. Naik[1], P. C. Agrawal[1], B. Paul[1,2], A. R. Rao[1], S. Seetha[3] and K. Kasturirangan[3]

[1] *Tata Institute of Fundamental Research, Mumbai 400005, India*

[2] *Institute of Space and Astronautical Science, 3-1-1 Yoshinodai, Sagamihara, Kanagawa 229-8510, Japan*

[3] *IRSO Satellite Center, Airport Road, Vimanapura P. O., Bangalore 560017, India*

Abstract. The observations of X-ray transient XTE J1748-288 were made in the energy band 2 - 18 keV with the Indian X-ray astronomy experiment (IXAE) during 1998, June 14-25 with total useful exposure of 27,100 second for 1 sec integration mode and 15,440 sec for the 0.1 sec mode. The X-ray light curves showed no significant intensity variations on short time scale (< 10s). The power density spectrum obtained from timing analysis of the data show no quasi-periodic oscillations in the frequency range of 0.001 Hz to 5 Hz. From the observed X-ray characteristics it is difficult to infer the nature of the X-ray source.

Key words : X-ray transient, black hole, accretion

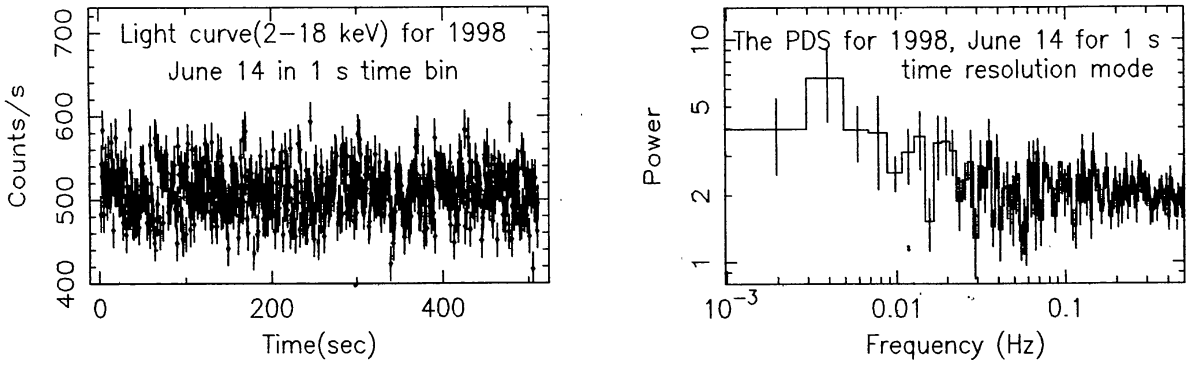
1. Introduction

The X-ray outbursts in the transient sources result from an unstable accretion from a late-type low-mass companion onto a black hole or a neutron star. It has been suggested that the normal outbursts are caused by 'explosive' rapid mass-loss of donor or by a thermal disk instability and the super-outbursts could be due to a combination of the thermal instability and a tidal disk instability (Osaki 1996). The instabilities in the accretion disk cause violent outbursts during which the X-ray luminosity increases by several orders of magnitude.

The discovery of a new transient X-ray source XTE J 1748-288 was first reported by Smith et al. (1998) from observations with the ASM on board the RXTE. A radio candidate was detected within one arc minute of the centre of the error box of the X-ray transient at a flux level of 28±2 mJy at 4.86 GHz by Hjellming et al. (1998). Further radio observations revealed that the radio source became brighter and was highly variable with a flux of about 110 mJy at 4.86 GHz on June 10 which increased to 410 mJy on June 14 (Hjellming et al. 1998). In this paper we report these results and discuss their implications.

2. Observations, Analysis and Results

Observations of the X-ray transient source XTE J1748-288 were carried out with the PPCs of the IXAE on board the IRS-P3. For details about the instruments refer Rao et al. (1998). The useful observation time is limited to the latitude range typically from 30°S to 50°N because of the sharp rise in charge particle background at high latitudes. The observations were made in the decay phase of the source XTE J1748-288. A typical light curve for one of the observations obtained on 1998 June 14 is shown in figure for the 2-18 keV energy band. It is apparent from the figure that there is no indication of any significant intensity variation on time scale of less than 10 s. The hardness ratio was computed for different observations. The ratio is found to be about 1.7 on all the days which indicates that there was no significant variation in the source spectrum during our observations. The timing behaviour of the source XTE J1748-288 was studied by taking the fast Fourier transform of the 1s and 0.1s time resolution data. The PDS are obtained for the individual data segments of the observation and then co-added and the final PDS is produced. It is found that the PDS are flat and featureless in the frequency range of 0.001 Hz to 5 Hz. A typical PDS obtained for 1s time, time resolution mode is shown in figure.



3. Discussion

The X-ray transient XTE J1748-288 has been observed extensively with the PCA on the RXTE. Fox & Lewin (1998) have reported the presence of QPOs at 0.5 Hz and a narrow peak of 32 Hz in their observation of this source on 1998 June 6.4 with the PCA. The radio characteristics of XTE J1748-288 i.e. variable radio emission and its growth in size along the East-West direction, bear resemblance to those of the superluminal sources GRS 1915+105 and GRO 1655-40 and therefore favour a black hole as the X-ray source.

The variation in the source intensity of XTE J1748-288 at higher time scales (> 10s) is similar to that of the black hole candidate LMC X-3. These variations can also be explained by a change in temperature of the accretion disk due to change in the mass accretion rate into the disk. The disk precession modulates the mass accretion rate according to the change in the

disk configuration relative to the companion star. Based on the PCA observations Swank (1998) recently reported that the low energy (< 20 keV) X-ray spectrum of XTE J1748-288 changed dramatically from a soft spectrum before June 25 to a hard spectrum after June 25. This suggests a bimodal behaviour of the source similar to that of the black hole candidates Cyg X-1, GX 339-4. This implies that the source made a transition from bright soft state (before June 25) to a low hard state (after June 25). The X-ray source in XTE J1748-288 is thus more likely to be a black hole rather than a neutron star.

4. References

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