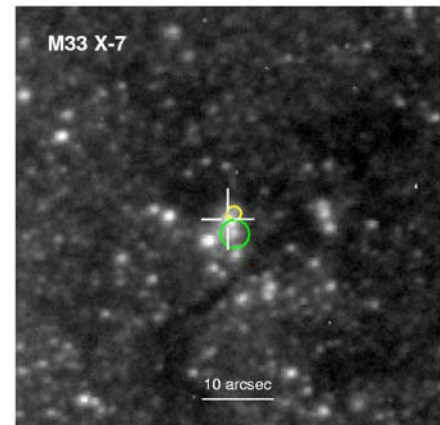
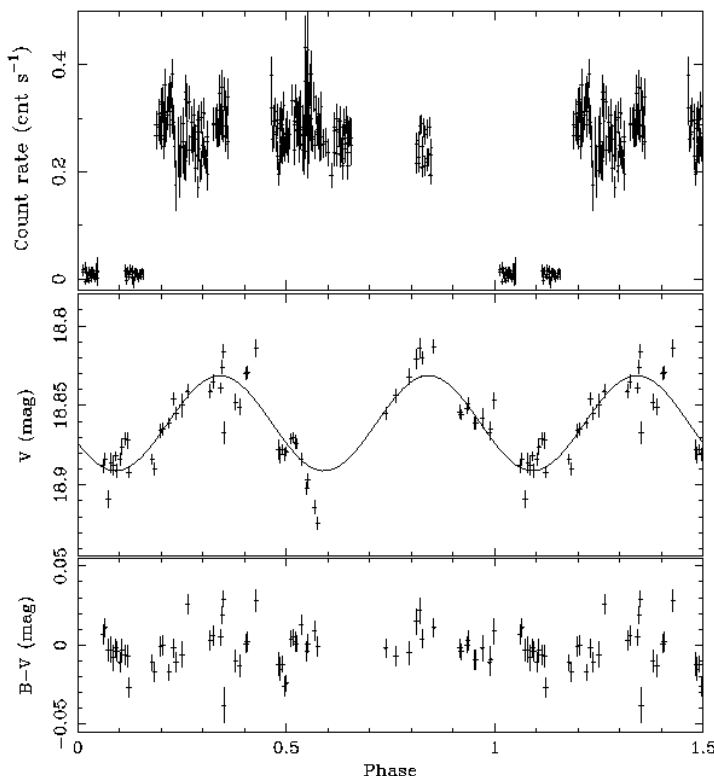


We determined an improved period and ephemeris of the eclipsing X-ray binary (XRB) M33 X-7. We identified the optical counterpart by its ellipsoidal heating light curve. The data indicate that the source may be the first eclipsing high mass black hole (BH) XRB.

The *Einstein* source X-7 in the Local Group galaxy M 33 was identified as an eclipsing XRB in ROSAT observations (see Dubus et al. 1999 and references therein). Before the detection of eclipses in the XRB X-17 in the starburst galaxy NGC 253 in the Sculptor group of galaxies (Pietsch et al. 2003) it was the most distant eclipsing XRB known (795 kpc).

M 33 X-7 was detected in the field of view during several observations of our XMM-Newton M 33 survey (Pietsch et al. 2004b) and in the archival *Chandra* observation 1730 which cover a large part of the 3.45 d orbital period. We detected emission of M33 X-7 during eclipse and a soft X-ray spectrum of the source out of eclipse that was best described by bremsstrahlung or disk black body models. No significant regular pulsations of the source in the range 0.25-1000 s were found. The average source luminosity out of eclipse was $5 \cdot 10^{37}$ erg s⁻¹ in the (0.5-4.5) keV band. In a special analysis of DIRECT observations we identified as optical counterpart a B0I to O7I star of 19.89 mag in V which showed the ellipsoidal heating light curve of a high mass XRB with the M 33 X-7 binary period (see Figs., Pietsch et al. 2004a).

The location of the X-ray eclipse and the optical minima allowed us to determine an improved binary period and ephemeris of mid eclipse. The mass of the compact object derived from orbital parameters and the optical companion mass, the lack of pulsations, and the X-ray spectrum of M 33 X-7 may indicate that the compact object in the system is a BH. M 33 X-7 would be the first detected eclipsing high mass BH XRB.



Above: ROSAT (green) and *Chandra* (yellow) position of M 33 X-7 on a V image of the DIRECT survey. The optical identification, i.e. the star showing the 3.4 d variability, is marked by the cross hair.

Left: Light curve of M 33 X-7 in the 0.5-3 keV band and in optical V and B-V folded over the 3.45 d orbital period using ephemeris of D99. Added is a double-sinusoidal approximation to the V data.

References:

- Dubus, G., Charles, P.A., Long, K.S., et al. 1999, MNRAS, 302, 731 (D99)
- Pietsch, W., Haberl, F., Vogler, A. 2003, A&A, 402, 457
- Pietsch, W., Mochejska, B.J., Misanovic, Z., et al. 2004a, A&A, 413, 879
- Pietsch, W., Misanovic, Z., Haberl, F., et al. 2004b, A&A, 426, 11