ON THE LONG–TERM LIGHT CURVE BEHAVIOUR OF THE INTERMEDIATE POLAR TX COL

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1. Introduction

TX Col (1H0547−407; $P_{\rm orb}$ = 5.72 h) is an intermediate polar (IP) with spin and synodic (beat) periods of 1911 s and 2106 s respectively (Buckley & Tuohy 1989). EXOSAT observations (Tuohy et al. 1986) showed the beat period dominated at higher energies (ME; 1...9 keV), while the spin period was stronger in softer X-rays (LE1; 0.1...1 keV). The high flux level, and pulse fraction (>70%), of the soft X-rays were unique in an IP at that time. Now three other IPs, recently discovered from the ROSAT survey, have been found to show a true separate soft X-ray component, similar to the polars (Motch & Haberl 1994).

The strength of the synodic X-ray period in TX Col was, until the recent discovery of the variable polarised IP, RX J1712.6−2414 (Buckley et al. 1995), unique. This was taken as evidence for direct accretion onto the magnetosphere (e.g. Mason, Rosen & Hellier 1988), through a component of the accretion stream overflowing the disc (Hellier 1992).

2. Long-term monitoring

High speed, white-light photometry of TX Col was conducted over the last ∼9 yr, in annual runs lasting typically 7...10 d. Most of the data come from the SAAO, supplemented with occasional multi-site data from CTIO and MJUO (New Zealand). While a detailed analysis is still in progress, a number of interesting results have already arisen:

– the amplitude of the 2106 s beat period has decreased. It is now only ∼3% in the 1994 observations, a factor of 2 less than in 1985.

A. Evans and J. H. Wood (eds.), Cataclysmic Variables and Related Objects, 185–186.

- the 1989 data were dominated by the harmonic of the synodic period, at 1053 s (Buckley & Sullivan 1992). This was attributed to two-pole reprocessing, or emission from both sides of the accretion curtain.
- since 1990 the periodograms have been dominated by low frequency QPO-like behaviour, with typical periods of 80...100 m.

The light curves of TX Col, which used to be dominated by the 2106 s beat period, now show gross aperiodic variations, typical of flickering, but at much longer time-scales than usual. This is exemplified in the 1994 data (from SAAO, CTIO and MJUO), which show a strong 102 m period, and other significant low frequency variations. These changes in the light curve over time have never been seen to this extent in other IPs, although most have probably not been as closely scrutinised as TX Col.

Most intriguing is the development of large amplitude, low frequency 'QPO-like' variations, and possibly even more coherent variability at ~100 m. The origin of these low frequency variations is unknown, although they may be related to disc instabilities and superhump phenomena. These strong QPOs are close to 1/3 of the orbital period.

The beat amplitude changes seen in both TX Col and RX J1712.6−2414 may be related to stochastic changes in the accretion stream, and in particular the amount of mass transferred directly into the magnetosphere. Whereas a disc mediates the accretion, a discless component is more susceptible to short-term changes in the mass transfer rate from the secondary. It is intriguing that both objects are strong candidates for discless accretion, or at least a component which is discless (e.g. from stream overflow).

It remains to be seen whether TX Col shows similar changes in its X-ray light curves. To date there is only one published X-ray observation, by EXOSAT (Tuohy et al. 1986), at a time when it exhibited a strong optical synodic periodicity, and lower frequency QPOs were absent.

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