A Search for Serendipitous Chandra Periodic and Transient Systems

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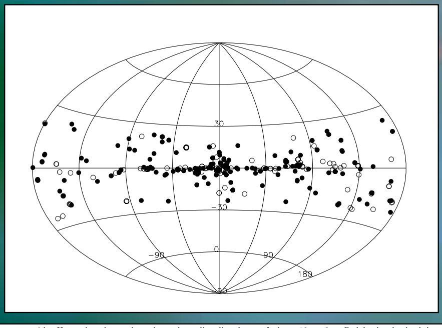

Fig. 1.— Aitoff projection showing the distribution of the *Chandra* fields included in the study, centred on the Galactic plane. The open circles represent ACIS-I observations and the filled ones are ACIS-S.

Data Analysis Methods and Initial Results

- Our study includes *Chandra* ACIS-I and ACIS-S archival imaging data from observing cycle 3 onwards. We have concentrated on deep observations of 20 ks and over within 25 degrees of the Galactic plane, shown in **Fig. 1**.
- Calibration and source detection was carried out with the XPIPE pipeline developed by Kim et al (2004). Data were reduced with a Bayesian Blocks segmentation algorithm and an FFT algorithm. IDL epoch and period folding procedures, EPFOLD and PFOLD, are used to analyse possible periods.
- To test our methods we analysed source RX J0806.3+1527 found by Israel et al (1999) in a similar ROSAT survey and found a strong signal at the reported 321 s (see **Fig. 2** for the folded light curve), indicating that we should be able to detect any bright periodic sources (constrained to periods in the range of $\sim$10-10^4 s).
- We have already detected some variability in the form of flares, see for example **Fig. 3**. The source of the flares in this case is likely to be young stellar objects, which are well known sources of X-ray emission, since those we have detected have tended to be in star-forming regions.

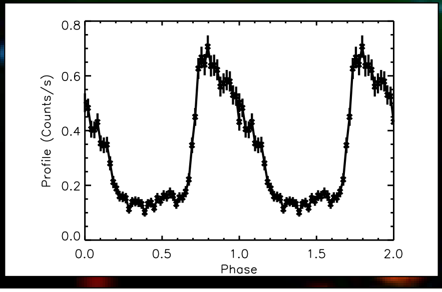

Fig. 2.— The $\sim$ 20*ks* *Chandra* light curve of RX J0806.3+1527 folded on the 321s period discovered by Israel et al (1999).

Introduction

The study of interacting binaries provides a deep insight into the physics of accreting compact objects (e.g. van Paradijs & McClintock, 1995). As most of these systems are highly variable in the X-ray, we have embarked on a variability study of serendipitious sources discovered with *Chandra* to identify new accreting binaries in our Galaxy. These would betray their presence as transient systems, or systems with regular pulsations in their X-ray lightcurves.

This survey is motivated by, for example, the ROSAT HRI results of Campana et al (1999) and Lazzati et al (1999) and their serendipitous source survey. This led to the discovery of RX J0806.3+1527, a catclysmic variable with an orbital period of 321 s. Short period systems such as these, are expected to be important sources of gravitational waves for the LISA observatory, as well as presenting considerable challenges to our current understanding of binary evolution.

Conclusions

We have commenced a variability survey of the Chandra data archive, with the purpose of searching for new, high-inclination compact binaries.

So far, with only a small fraction of the few hundred fields we will eventually study analysed, we have not yet detected any new periodic sources: however, we believe the detection of such short period systems is entirely feasible with the complete data set.

Feasibility

Although the detection of interacting binaries using their X-ray variability will be rare, any such system will be interesting in its own right, particularly because of its short orbital period and relatively high inclination.

The ROSAT survey (see Introduction) involved a search of $\sim$ 3000 lightcurves for periodicities: our sample of *Chandra* data contains upwards of this number of sources for which a comparable analysis (e.g. FFT) is feasible.

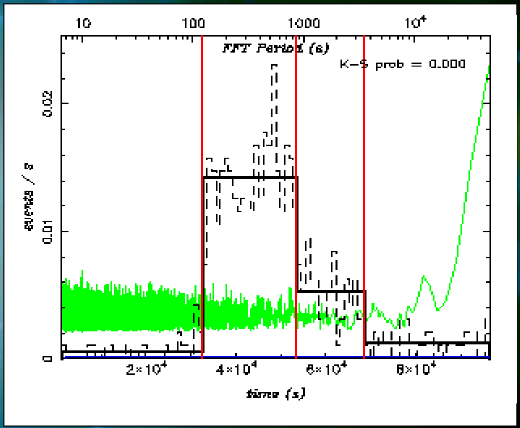

Fig. 3.— A flare detected by the Bayesian Blocks algorithm in an NGC 2264 source.

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