SOFT X-RAY FLICKERING OF AM HER

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1. Introduction

I present preliminary results from an analysis of the flickering in the only off-axis, high-state observation of AM Her with the ROSAT PSPC. At high $\dot{M}$, the ROSAT count rates are dominated by optically-thick emission from the white-dwarf surface, which is heated directly by the accretion flow. This emission is very soft, predominantly below 0.4 keV, and exhibits strong flickering.

2. Flickering

The brightness of AM Her and the unprecedented sensitivity of ROSAT combine to extend sensitivity to flickering to time-scales less than 1 s. Fig. 1 shows the light curve of one data section, binned at 1 s. The power spectrum of this light curve is plotted in Fig. 2, which shows a red noise spectrum, steepening to a slope of $1/f^2$ at high frequencies.

This is characteristic of shot noise, which is a reasonable interpretation considering the blobby accretion proposed to explain the direct heating of

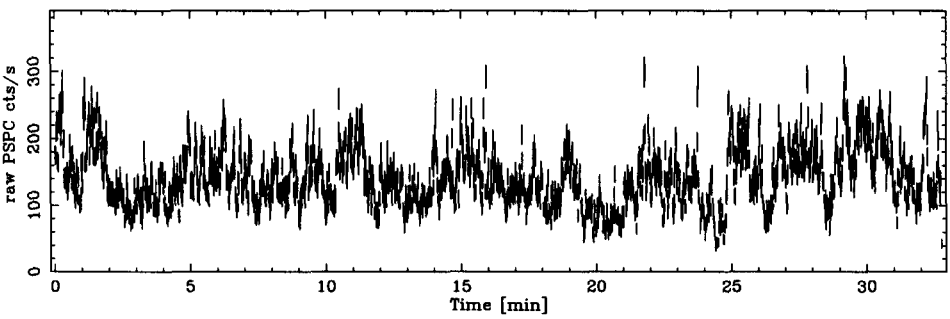

Figure 1. ROSAT PSPC light curve of AM Her

A. Evans and J. H. Wood (eds.), Cataclysmic Variables and Related Objects, 211–212.

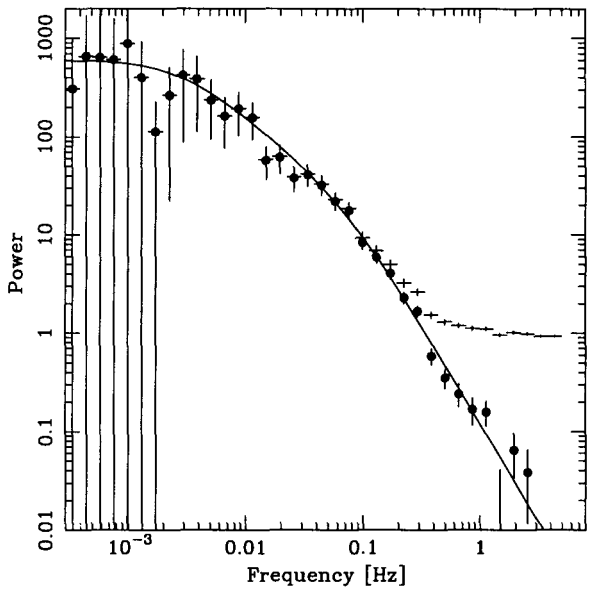

Figure 2. Power spectrum of the light curve of Fig. 1. The filled circles show the spectrum after subtraction of the white noise. The curve shows an example fit with a shot-noise model (see text).

the white-dwarf photosphere (Kuijpers & Pringle 1982). The solid curve in Fig. 2 represents a fit to the shot-noise model of Lehto (1989). In this case, exponentially-decaying shots are evenly distributed over time-scales in the range 5 to 300 s.

The steepening to a slope of $1/f^2$ is crucial, since it constrains the short time-scale limit. In this interpretation (possibly not unique) the flickering is dominated by time-scales longer than ~ 5 s. This may reflect the accretion time for the shortest structures, or alternatively the fastest time-scales on which the white dwarf surface can react to perturbation by the accretion flow: either its cooling or dynamical time-scale.

3. Colour of flickering

The flickering appears suprisingly grey. The variability of the PSPC hardness ratio is in the range expected from counting noise alone ($\chi^2_\nu = 1.18$). However, cross-correlating the hardness ratio with the light curve does reveal spectral variations. These are always positive (i.e. harder when brighter) and are apparent at a range of time-scales (as short as 10 s). The significance of this result has been tested through simulations. Work is in progress to quantify these spectral variations in terms of physical quantities.

References

Kuijpers, J., Pringle, J.E., 1982, A&A, **114**, L4
Lehto, H.J., 1989, in 23rd ESLAB Symp. on Two Topics in X-ray Binaries, p499