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FIRST DETECTION OF AN X-RAY BURST AND A ONE HOUR INTENSITY DIP IN 4U1323-62

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ABSTRACT. We report the results of a 1.4 10^4s observation of the region of 4U 1323-62 with the EXOSAT ME. The source has a flux of 7-8 10^{-11} erg/cm^{2}s (2-10 keV) and a power-law spectrum with $1.1 < \alpha < 1.8$. During our observation, the source showed a symmetric 60% dip in its X-ray flux of ~ 1 hr. The spectrum hardens during the dip. Inside the dip we observed an X-ray burst with a 2-10 keV peak flux of ~ 7 10^{-10} erg/cm^{2}s. The burst spectrum is black-body, and shows evidence of cooling during the burst decay. The discovery of a burst from 4U 1323-62 settles the classification of the source; the observation of a dip suggests that we may be able to measure its orbital period in the near future.

1. INTRODUCTION

4U1323-62 was detected as a 3 c/s source by the UHURU satellite (1) and was also seen with Ariel V (3A 1322-616, (2)). It is located 0.3° above the galactic plane and in a direction ~ 53° from the galactic centre.

The detection of an X-ray burst places the source in the category of low-mass X-ray binaries probably containing a low-magnetic field neutron star. In several similar systems it has been possible to measure the orbital period by detecting periodically recurrent dips in the X-ray flux, which are caused by obscuration of the X-ray source by the companion star or by structure in the accretion disk (see (3) for a review).

2. OBSERVATIONS

In a program to observe error boxes of faint UHURU sources with EXOSAT, we observed the region of 4U 1323-62 for 1.4 10^4 seconds on February 11, 1984. One half of the 1500 cm^2 ME array of proportional counters was offset from the source to monitor the charged-particle background. No

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flares or dips were observed in the background during the entire observation, but there was a slight gradual change in the background spectrum.

In the intervals 16:10–18:00 and 19:15–20:45 UT, a steady source flux was observed of ~ 5 c/s (2–10 keV) over a 14 c/s background (Figure 1).

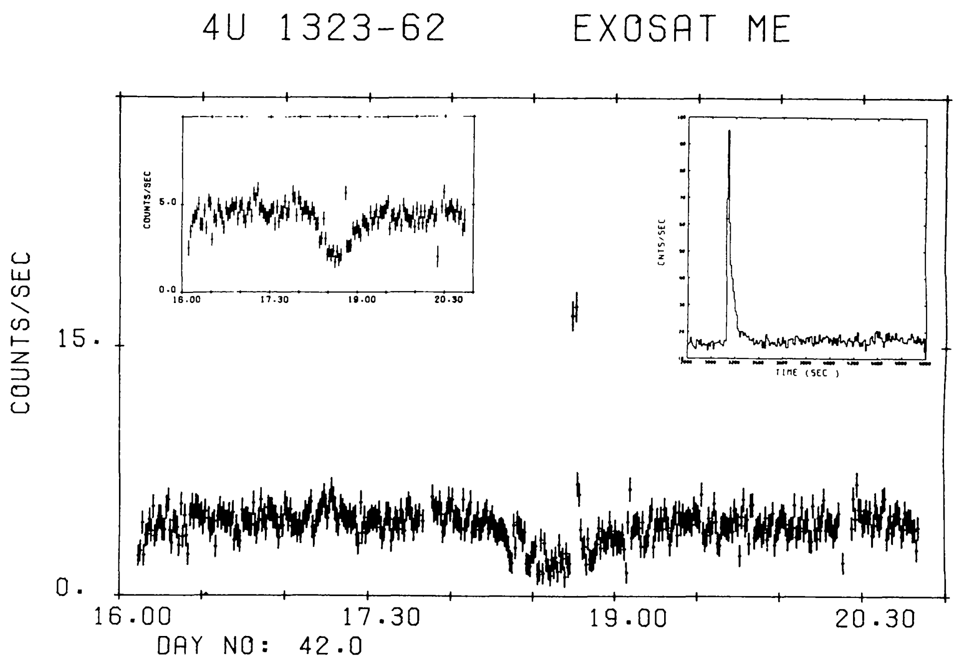

Figure 1. The 2–10 keV background subtracted counting rate observed from the region of 4U1323-62, showing simultaneously an intensity dip and an X-ray burst (insets).

Between 18:15 and 19:15 UT we observed an approximately symmetric dip with a 2 c/s bottom flux. An X-ray burst was seen (4) at 18:45 UT; the background subtracted peak flux was ~ 50 c/s (highest 10s average). There is evidence for hardening of the flux during the dip (Figure 2). Note also the spectral hardening near the start and the end of the observation, possibly an indication for similar events just outside the observational interval. We do not see rapid flux variations in the dip like those observed in, e.g. 4U 1755-33 (5).

The burst profile shows the characteristic (sharp rise-exponential decay) shape and narrows considerably in higher energy bands, indicating a softening of the spectrum during the decay of the burst (Fig. 3).

3. ANALYSIS AND RESULTS

X-ray spectra were obtained of the steady source flux before and after the dip, of the flux in the dip centre and of the X-ray burst. We attempted to fit thermal bremsstrahlung, black-body and power-law spectral shapes modified due to photoelectric absorption by cool (cosmic-abundances) material. The only acceptable fit to the steady flux was

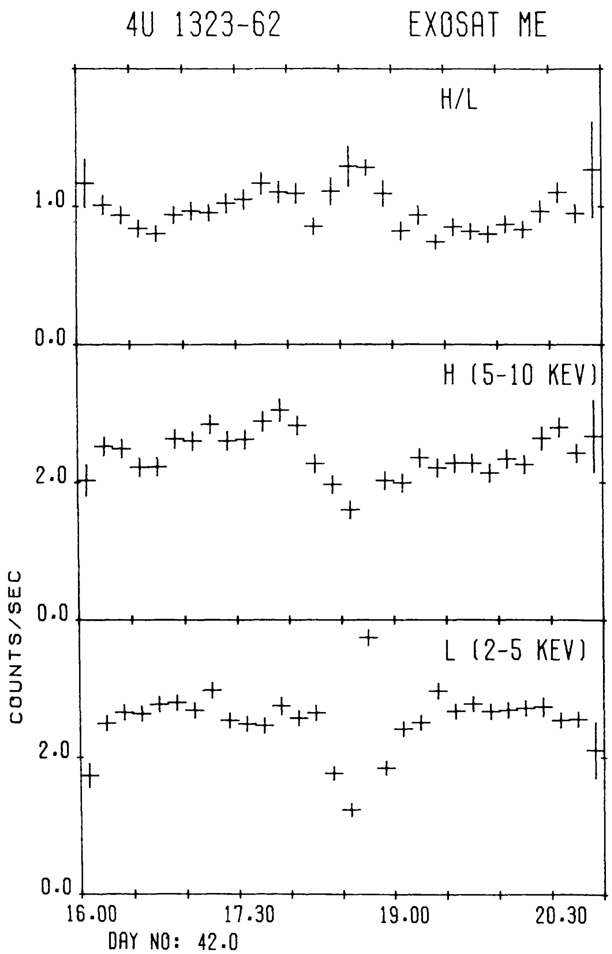

Figure 2. 5-10/2-5 keV hardness ratio plot of the full observation shows hardening of the spectrum in the dip and near the start and the end of the observation.

obtained with a power law (Figure 4a). Parameters derived were $\alpha = 1.3^{+0.5}_{-0.2}$, $N_H = 2.5^{+1.5}_{-0.6}\ 10^{22}/cm^2$, where the errors are dominated by uncertainties in the background variation.

An acceptable fit to the dip spectrum (Figure 4b) was obtained with $\alpha = 0.8^{+1.2}_{-0.5}$, $N_H = 2.1^{+5.2}_{-1.8}\ 10^{22}/cm^2$. Thus, a large increase in N_H is admitted by the data, but there is also evidence for flattening of the power law spectrum itself. The burst peak spectrum can be acceptably fitted with a black-body spectrum with kT = 1.4-1.8 keV and N_H = > 2.0 $10^{22}/cm^2$. Fixing N_H at its steady-flux value of 2.5 10^{22}/cm, we find a temperature kT = 1.7±0.2 keV.

The fact that the source shows an intensity dip implies that it may be surrounded by a region of scattering material (see (3)). The sharpness of the burst rise can in principle be used to put limits on the size of this hypothetical region. The burst rise is not very sharp, however (Figure 5): ~ 4s and it does not lead to a very stringent limit (in the context of compact low-mass X-ray binary systems) on the scattering region: 1.2 10^{11} cm.

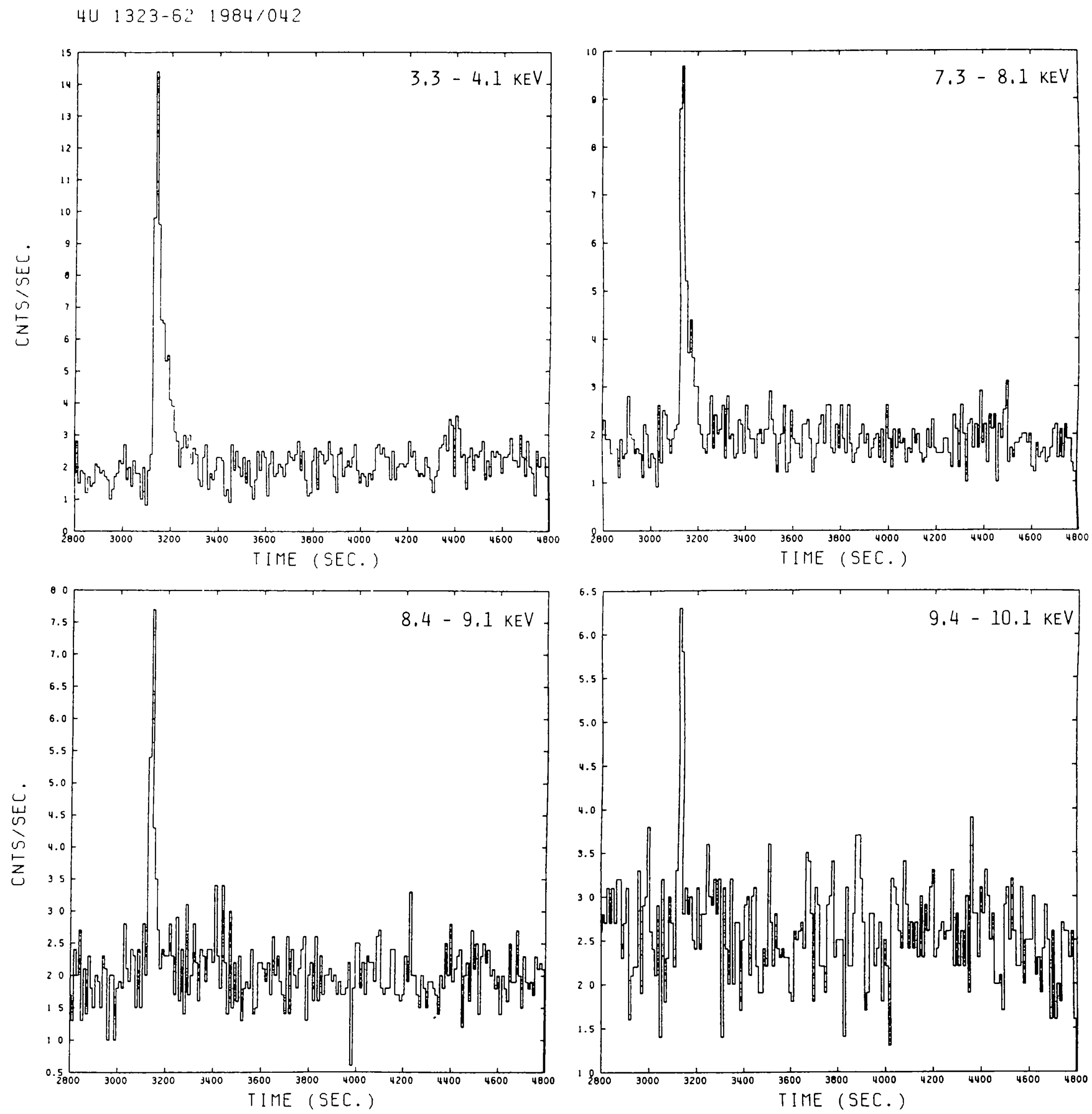

Figure 3. Intensity profiles of the X-ray burst get more narrow in higher energy bands, indicating a softening of the spectrum during burst decay.

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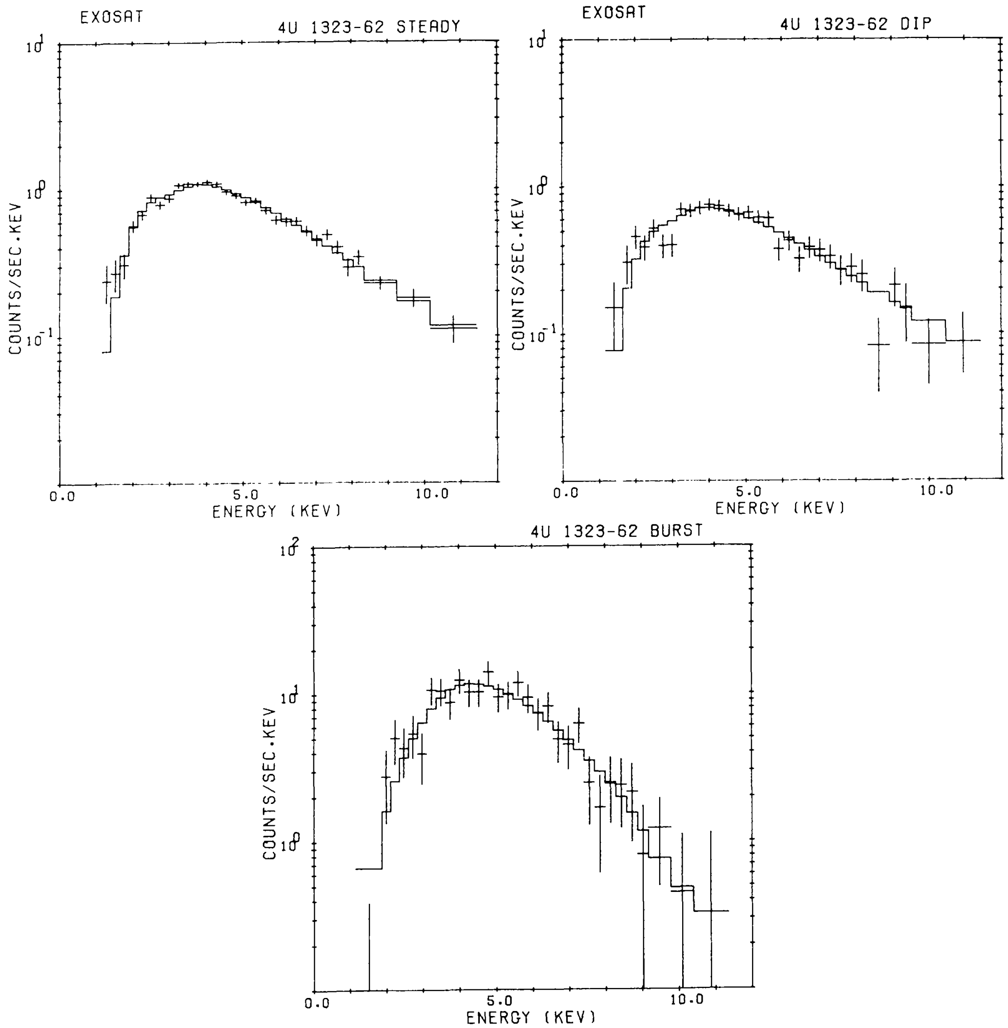

Figure 4. Spectra of the steady flux, dip bottom flux and burst peak with best fits as described in the text.

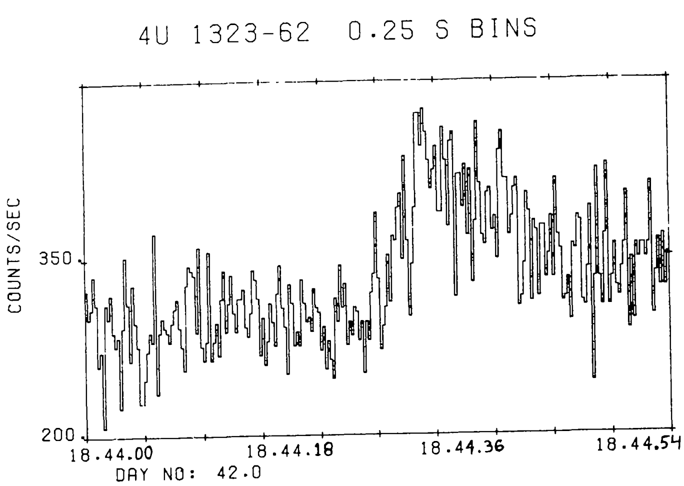

Figure 5. High resolution plot of burst profile (no background subtracted) shows gradual rise to burst peak.