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X-ray Spectroscopy of the HMXB Pulsar GX 301–2 with Chandra

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Abstract. We present analysis of X-ray spectra of the accreting pulsar GX 301–2, from two observations with the Chandra X-ray observatory made during different phases of its orbital period. Analysis of the zeroth order ACIS spectra and the high energy resolution grating spectra show that the spectra obtained in both the orbital phases can be fitted with a partial covering power-law model. Strong K_α and K_β iron emission lines with finite width and iron absorption edges are present in both the spectra. In one of the observations we found another one broad emission component, probably formed by Compton scattering.

Keywords : X-rays: stars - pulsars: individual: GX 301–2

1. Introduction

GX 301–2 (4U 1223–62) is an X-ray pulsar in a binary system with the supergiant WRAY 15-977 as its companion. Many of its interesting X-ray properties arise from its 41.5 days orbital period and high eccentricity of 0.462 (Sato et al. 1986; Koh et al. 1997). X-ray spectroscopy of the pulsar in different orbital phases is a way to probe the predominantly equatorial wind characteristics of the companion star.

Table 1. Spectral parameters measured from the Chandra observations.

ObsId	N_H^1 / N_H^2 (10^{22}/cm^2)	E_{Fe} (keV)	FWHM (eV)	Edge (keV)	CvrFrac
103	35.0 / 80.0	6.4, 7.04	80, 65	7.18	0.30
2733	43.0 / 80.0	6.4, 7.04, 6.3	90, 50, 660	7.15	0.76

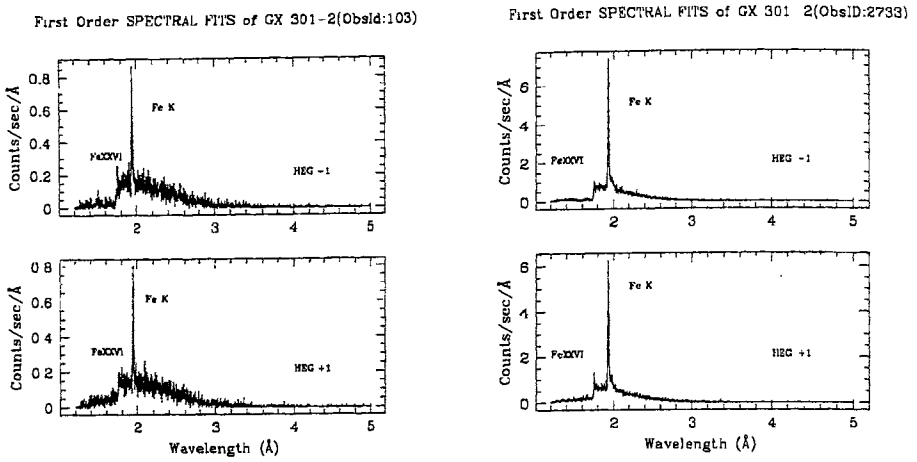

Figure 1. The -ve and +ve first order HEG spectra of GX 301–2 for the two Chandra observatrions are shown here in the left and right panels along-with the best fitted spectral models as histograms.

2. Analysis and Results

Two Chandra observations were made, one (March 16, 2000; ObsID 103) was in the low state of its binary phase while the other (January 13, 2002; ObsID 2733) was during the decay of its binary flare, following the periastron passage.

We have analysed ACIS spectra from the zeroth order image of both the observations and the High and Medium Energy Grating (HEG & MEG) spectra using XSPEC and SHERPA respectively. We have used the partial covering absorber model (Endo et al. 2002). Two narrow emission lines (E_{Fe}: 6.4 keV and 7.04 keV) and one absorption edge near 7.15 keV were added. The respective covering fractions (CvrFrac) and hydrogen column densities (N_H) were obtained. The second observation, which was made following the periastron passage also showed presence of another one broad emission feature.

The X-ray spectra of GX 301–2 measured with Chandra ACIS and HETG in two different orbital phases confirm the partial covering absorber model for this source. The two narrow iron emission lines show a finite width of about 70 eV while one spectrum also shows a broad 6.3 keV line. The latter can be due to Compton Scattering of the fluorescence line.

References

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