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Spectral and timing analysis of the Neutron star in GX 5-1 by its lower kilohertz Quasi-Periodic oscillations

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Abstract
We analyse z source 'GX 5-1' observations for the lower kilohertz QPO of GX 5-1 for 2002 by the instrument of PCA (1.5-12keV) on board RXTE. We report the high QPO to low QPO for frequency (≈20HZ) analysis for QPO horizontal branch oscillations model and relate it to observations of source GX 5-1. During the ≈ 7 years data RXTE detected many x-ray intensity variations but in our analysis, we select data for 15/07/2002 the highest x-ray intensity to lowest x-ray intensity in 2002 of GX 5-1. Our analysis is about QPO, frequency, time period of high peak to low peak for 70018-02-03-00 observation id.
Key words: ***G X 5-1, QPO, Frequency, PCA***

1. Introduction

Two types of quasi-periodic oscillations (QPOs) with frequencieslesstha100Hz (Horizontal Branch Oscillations (HBO) and Regular Branch Oscillations (NBO), twin kHz QPO peaks, and three types of rapid fickering (noise), very low frequency noise (VLFN), low frequency noise (LFN), and high frequency noise (HFN) were found in the X-ray variability study of 'Z' sources (see Van der klis, 1995; van Der Klis,Mendez&Kaaret, 2000) for reviews). Many events are among the most interesting and widely studied phenomena such as black holes (1, 2), solar flares(3), dark short and long GRBs (4, 5), umbral dots (6) and atmospheric research (7). The noise characteristic properties and the 'HBO's, such as the focal' frequency 'and the proliferation of fragmentary rms, are emphatically corresponding to a source situation along the flat branch.These relations, along with the observed expansion in the ultraviolet flux in the 'Z' source Sco X-1 (8) during the source change from the 'branch' level through the ordinary 'branch' to the erupting 'branch' loan backing to the possibility that the rate of mass accumulation increases from the 'branch' through the normal 'branch' to the erupting 'branch' (9). Nevertheless, recent findings(10, 11) along with previously noted issues (most eminently popular source 'Z' motion; (9)indicate that the situation could be extra perplexing (for example (J. Homan et al., 2001)). KHz 'QPO's have now been seen in a little more than 20 LMXBs, including all 'Z' sources (12). Conceivably they can give a key to gauge the essential characteristics of 'neutron star' and in this way oblige the condition of ultra-thick matter, and to check untested general relativistic impacts by following 'space–time' simply over the 'neutron star' surface (for example (12-17). The discovery of kHz 'QPO's in GX 5–1 was explained by (18). In 'GX 5-1' by Lewin et al., the 'HBOs' were found by(19). Radio (20) and infrared frequencies were also used to classify the ‘source'. Interestingly, we show that in GX 5-1, the kHz QPO separation frequency is not steady. We show that two additional pleasantly related big 'Lorentzian' sections are expected to get a solid match, other than the two pleasantly related low-recurrence 'QPOs' previously found on the even 'branch'. We study the force spectra and CDs of the dark opening up-and-comer ‘XTE J1550–564,' the ‘Z' source ‘GX 5–1,' and the atoll source ‘4U 1608–52,' and conclude that there are some impressive similitudes and contrasts that have previously gone unnoticed due to contrasts in analysis shows between, specifically, ‘neutron stars' and dark opening up-and-comers. During the 1960s, methods for dispatching various rockets opened up another era in cosmology (21). In the energy band of 1-10 keV, they found 'Sco X-1'. Approximately 20 X-beam 'sources' have been recognised by the end of several decades. In addition, possibly the most grounded source,' Cyg X-1', was determined to move as predicted. The wellspring of this X-beam outflow was obviously from now around then, gas incremental addition in a nearby two-fold structure. For example, however, Prendergast and Burbidge[332] argued that gas streaming in a paired structure on a reduced 'star' will have a lot of precise force to stream radially inwards. They proposed that the gas, with roughly Keplerian rakish energy, would frame a plate around the smaller star. A limited amount of internal float speed should be present. The idea of a gradual addition circle came to mind. The X-beam fluctuation of ‘Z' sources showed two types of semi sporadic motions (QPOs) with frequencies under 100 Hz (flat branch motions, HBO, and normal branch motins, NBO), twin kHz QPO pinnacles, and three types of fast glinting ('clamour'), the low-recurrence commotion (VLFN), Low repetitive commotion (LFN) and high repetitive commotion (HFN) (see(22) for surveys). For example, the characteristics of commotion highlights and the HBOs, the focal recurrence and the abundance of fragmentary rms, are firmly linked to the situation of a source along the level branch. These relationships, along with the noted expansion in the bright transition in the Sco X-1 Z source (8) as the source shifts from the flat branch through the ordinary branch to the erupting branch loan backing to the possibility of increasing the mass accumulation rate from the same branch through the typical branch to the erupting branch (see (9)). In any event, continuing views of Homanalong with previously noted issues (most exceptionally mainstream Z track movement(23), suggest that the situation could be more complicated (for example(24)). QPOs for KHz have now been used in just over 20 LMXBs, including all Z outlets (9). They may be able to provide a key to determining the fundamental properties of neutron stars (turn rates and probably desirable field qualities, radii, and masses) and, as a result, enforce the ultra-dense matter condition. and to check untested general relativistic impacts by following space–time simply over the neutron star surface (for example(14, 17, 18, 25). Wijnands et al. paid for the disclosure of kHz QPOs in GX 5–1. (1998). Van der Klis(26) discovered the HBOs, while Lewin et al. discovered the NBOs in GX 5–1. (1992). Furthermore, on radio (20) and infrared wavelengths, the source was distinguished. We present an overview of all RXTE interpretations of GX 5-1 in this paper. We show interestingly that the kHz QPO partition recurrence isn't steady in GX 5–1. We show that two additional pleasantly related large Lorentzian segments are expected to get a solid match other than the two pleasantly related low-recurrence QPOs already discovered on the flat branch. We compare and contrast the force spectra and CDs of the dark opening applicant XTE J1550–564, the Z source GX 5–1, and the atoll source 4U 1608–52, and find some striking similarities. In addition, comparisons between, specifically, neutron stars and dark opening up-and-comers that were not respected in the past due to contrasts in research shows.

2. Methodology

All available GX5-1 data were analysed from the RXTE observation that the proportional counter array (PCA;(27)) was used only because the other High Energy x-ray timing experiments instruments were not in good working condition after 2009. According to the RXTE cook book, we reduced the data using the HEASOFT package version 6.16. To extract PCA spectra from standard 2 data, we used the saextrct method, where only the event was selected from the best calibrated PCU2 detector. We also get the start time stop time and exposure of the event. Here we analyzed the power spectrum of the different events of GX5-1 for the QPO. Here we got the maximum QPO was 14.66 and this QPO for the LXBS. Here range between 6-12 kev. Here we use Lorentz fitting for graph analysis.

3. Observation Data

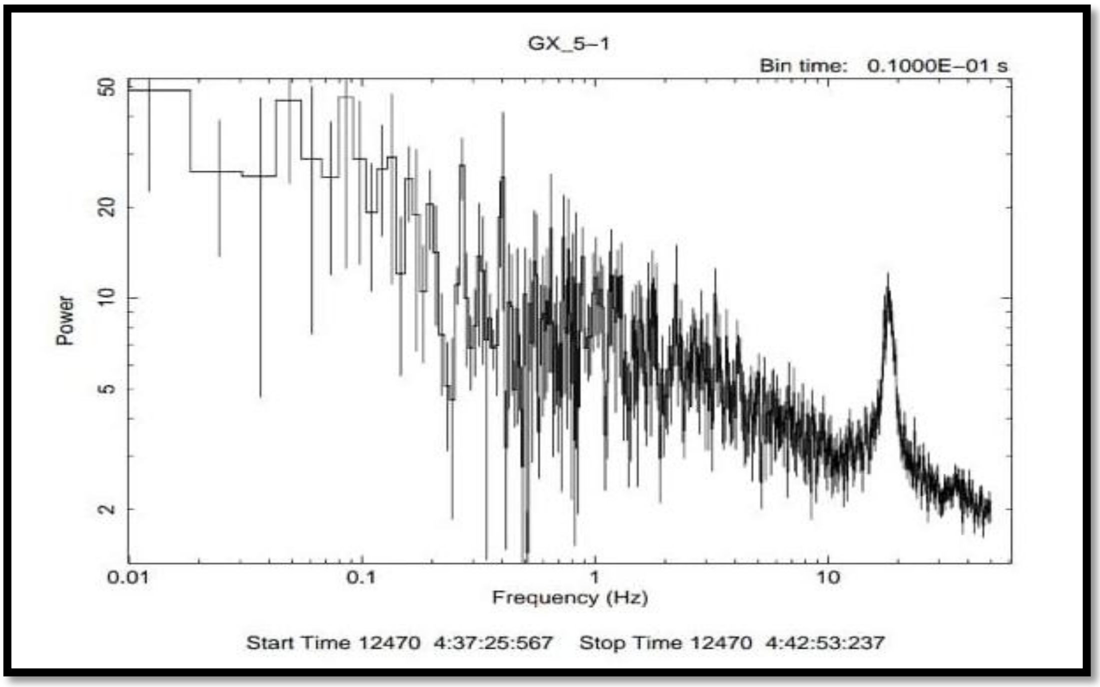

Fig.1 –GX 5-1 Frequency for event data on the date 15/07/2002 for 70018-02-03-00 observation id

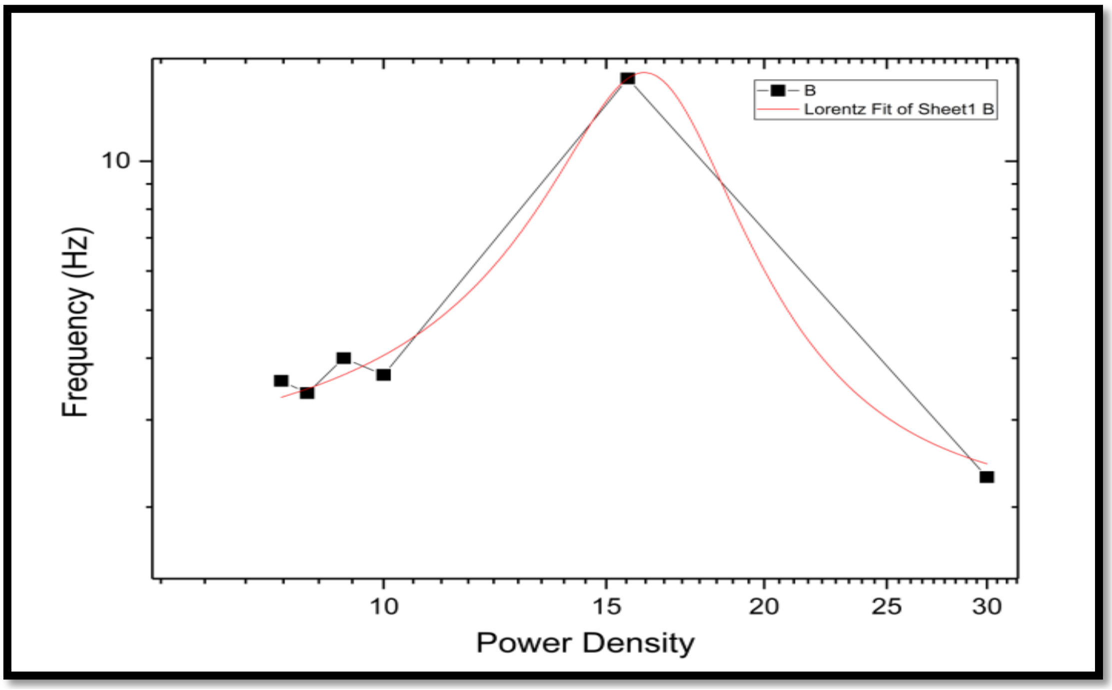

Fig.2 – GX 5-1 Frequency Fitting for event data on the date 15/07/2002 for 70018-02-03-00 observation id

4. Result

In our study aims is analyse Z sourse GX 5-1 observations for the lower kilohertz Quasi-periodic oscillations of GX 5-1 for 2002 by the instrument of PCA (1.5-12keV) on board RXTE. We analyse one event data on the date 15/07/2002 for 70018-02-03-00 observation id and in this id we find start pick flux 3.62, pick flux 14.66 and peak flux 2.25 so the difference between start frequency and peak frequency is 11.04, the difference between peak frequency and end frequency is 12.41 and the difference between start frequency and end frequency is 1.3. Our Lorentz fitting equation y = y0 + (2*A/pi)* (w/(4*(x-xc)^2 + w ^ 2)) and Chi square fitting result is R-Square (COD) = 0.99714.

Table 1. Data for GX 5-1 power spectrum

Peak no	Frequency (Hz)	Power density	Peak no	Frequency (Hz)	Power density	Peak no	Frequency (Hz)	Power density
1	0.01	62	26	0.47	12	51	3.8	5.5
2	0.04	45	27	0.53	13	52	3.9	8
3	0.06	30	28	0.58	10	53	4.3	5.4
4	0.07	54	29	0.59	11	54	4.6	5.45
5	0.075	32	30	0.62	12	55	4.8	5
6	0.085	28	31	0.71	10	56	5.2	6
7	0.087	67	32	0.73	11	57	5.6	5
8	0.09	37	33	0.81	9	58	5.8	6
9	0.1	28	34	0.88	11	59	5.2	6
10	0.12	38	35	1.00	9	60	7.6	5
11	0.14	35	36	1.2	12	61	7.7	6
12	0.15	13	37	1.3	11	62	7.8	4
13	0.16	30	38	1.4	11	63	7.9	5
14	0.17	20	39	1.5	11	64	8.3	3.6
15	0.18	15	40	1.6	6	65	8.7	3.4
16	0.21	7	41	1.7	7	66	9.3	4
17	0.25	22	42	1.9	8	67	10	3.7
18	0.27	11	43	1.91	8	68	15.6	14.7
19	0.31	15	44	2.2	11	69	30	2.3
20	0.32	11	45	2.3	7	70	20.3	2.2
21	0.34	9	46	2.4	6	71	20.5	2.1
22	0.38	15	47	2.7	7	72	22.4	2
23	0.39	12	48	2.8	9	73	22.6	1.8
24	0.41	8	49	3.2	6			
25	0.44	7	50	3.5	9			

5. Conclusion

We conclude that we get QPO of LMXBs , so the companions of Neutron star are low mass (<M⊙) star. Because some Neutron star found accreting materials from companions.

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