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Soumitra Sengupta · Samrat Dey · Saurya Das · Dhruba J. Saikia · Sudhakar Panda · Ramakrishna Podila *Editors*

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Chapter 31
Relation Between the Variability of the Kilo-Hertz Quasi-Periodic Oscillations and the Low-Frequency Noise in 4*U* 1608−52

Soma Mandal

Abstract The neutron star low-mass X-ray binary 4*U* 1608−52 is known to show kHz QPOs as well as low-frequency noise. The energy dependence of the fractional r.m.s. amplitude of the kHz QPO reflects the underlying radiative mechanism responsible for the QPOs irrespective of their dynamical origin. In this work, we compute the energy dependence for 26 instances of kHz QPO observed by *RXTE*. We typically find as reported before that the r.m.s increases with energy in the slope of ~ 0.4. This indicates that the variation is in the hot thermal compotonization component and, in particular, the QPO is likely to be driven by variation in the thermal heating rate of the hot plasma. For the same data, we compute the energy-dependent r.m.s. variability of the low-frequency noise component by considering the light curves. In contrast to the behavior seen for the kHz QPO, the energy dependence is nearly flat, i.e., the r.m.s. is energy independent. This indicates that the driver here may be the soft photon source. Thus, the radiative mechanism driving the low-frequency noise and the high-frequency QPO is different in nature.

31.1 Introduction

Quasi-periodic oscillations (QPOs) are near-sinusoidal variability observed in both black hole and neutron star systems. QPOs appear as one or more relatively narrow peaks in the Fourier power density spectra. For neutron star systems, their frequencies are roughly between millihertz (mHz) and kilohertz (kHz) [1, 2]. Since kHz frequencies are of the same order as the orbital frequency close to the compact object, the phenomenon is associated with regions close to the surface of the neutron star. KHz QPOs are often seen in pairs and are named as the higher and the lower kHz QPOs. The frequencies of the kHz QPOs are strongly correlated with spectral and other timing properties [3–6]. Several authors have investigated the correlations between the upper and the lower kHz QPO frequencies [7–12] and these have been used to

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