



Timing and Spectral analysis of 2010 outburst of black hole candidate GX339-4

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Abstract: In this poster we investigate the quasi periodic oscillation (QPO) behavior of the black hole candidate GX339-4 during its 2010's outburst using RXTE/PCA data. We perform a full analysis (spectral and temporal) of the observations, where the QPO exists. We analyze the relationship between the centroid frequency of QPO and the spectral parameters. The correlation of spectral and temporal properties can be used to estimate the mass of Black Hole – scaling method (Shaposhnikov, 2007). Using this method we estimate a mass of 7.48 solar mass of GX339-4.

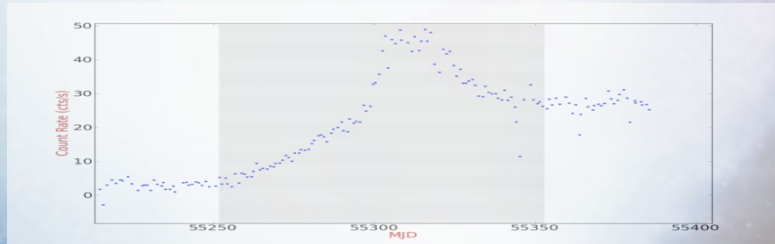


Fig. 1 ASM/RXTE light curve of GX339-4 2010's outburst, the grey part is the data we use for analysis (MJD 55256-55357).

Spectral analysis

Timing analysis

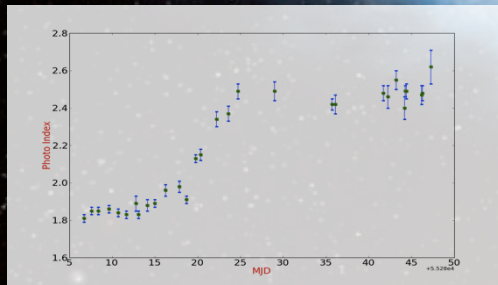


Fig. 2 The change of photon index with time.

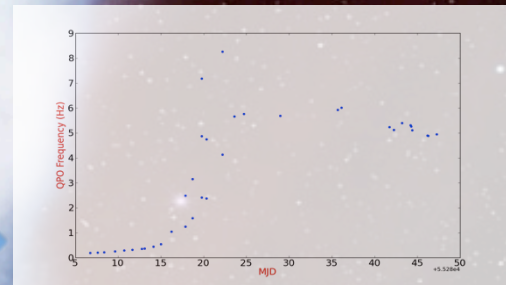


Fig. 3 The change of QPO frequency with time.

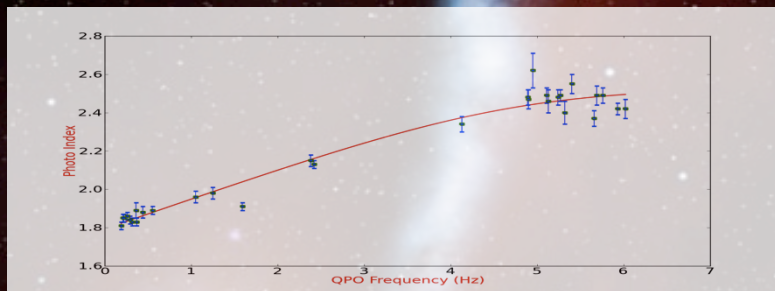


Fig. 4 Relation between photon index and QPO frequency, a turn off can be seen around 5 Hz.

Scaling Method: The dependence of photon index and QPO frequency can be well fit by the analytical function:

$$f(\nu) = A - DB \ln \left[\exp \left(\frac{\nu_c - \nu}{D} \right) + 1 \right]$$

For determination of the mass of GX339-4, we need to get the value of B_{GX339} from the fitting, then by comparing this value with the source GRO J1655-40 (B_{1655}), which has already had a well determined mass ($M_{1655} = 6.3 \pm 0.5 M_{\odot}$) from optical method, we get

Conclusion: In this poster we studied the evolution of spectral and timing properties of GX339-4 during the 2010's outburst using available RXTE data, specifically concentrating on the transition phase, when the source exhibited low-frequency QPOs. We determined the mass of GX339-4 by a scaling method to $7.5 \pm 0.8 M_{\odot}$. This is consistent with previous prediction $M_{GX339} \geq 6 M_{\odot}$ (Hynes, 2003).

$$\begin{aligned} M_{GX339} &= B_{GX339} \times \\ &M_{1655} / B_{1655} = \\ &7.5 \pm 0.8 M_{\odot} \end{aligned}$$

References:

- Hynes R.I. et. al., 2003, ApJ, 583, L95
- Reis R.C. et. al., 2008, MNRAS, 387, 1489
- Shaposhnikov N. et. al., 2007, ApJ, 663, 445