Poster

DETERMINISTIC CHAOS IN THE X-RAY SOURCES

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The temperature in the hottest parts of the black hole binaries accretion disks often exceeds 10^7 K. Hence we can expect thermal X-Ray emission from disk with power at the order of $10^{37} - 10^{38}$ ergs per seconds. The material in the disk is heated due to turbulent viscous dissipation.

Hardly any of the observed black hole accretion disks exhibits the radiation flux being constant with time. When the local stochastic variations of the disk are correlated with its global structure and occur at specific regions where a resonant behaviour takes place, the coherent vatiations are known as the apperance of quasi-periodic oscillations (QPOs)

Our aim is to tackle a problem of stochastic versus deterministic nature of the black hole binaries radiation, using both the observations and analytical methods.

We explore the ability of the recurrence analysis, a powerful tool for time series analysis used in broad field of application ranging from economy to geophysics or medicine, to reveal important information about the BHXBs, especially to find traces of non-linear, possibly choatic behaviour, on the basis of their X-ray light curves. We study the occurence of long diagonal lines in the recurrence plot of observed data series and compare it to the surrogate series. Especially we follow the dependence of the lenght of the longest diagonal line on the used threshold and compare the estimates of dynamical invariants - e.g. the second order Renyis entropy K_2. We compare our methods and results with similar approaches published on this topic earlier.

For our work, we use the X-Ray data from six X-Ray binaries, in which the radiation pressure instability is considered to occur. These objects are GRS 1915, IGR J17091, GRO 1655-40, XTE J1650-500, XTE J1500-564 and GX 339-4. We extract the time series using *XSELECT*, which is a part of *Heasoft 6.16* high energy astrophysics software package. We adjust the proper binning time to minimize the error and simultanously to not lose the information about oscillations at the scale of several seconds or several tens of seconds.