

Measurement of the Orbital Period of the X-ray Burster GS 1826-238 Based on Observations of Its Optical Brightness Variations

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Abstract

The variability of the optical and X-ray fluxes from the binary GS 1826-238 is investigated. An epoch-folding analysis of the optical data obtained with the RTT-150 telescope in 2003-2004 has revealed periodic brightness variations in the source with a period $P_{orb} = 2.24940 \pm 0.00015$ h with a high statistical significance. When estimating the detection significance of the periodic signal, we have specially taken into account the presence of a powerful aperiodic component ("red noise") in the source's brightness variability. The source's power density spectra in the frequency range $\sim 10^{-5}$ -0.01 Hz have been obtained. We have detected a statistically significant break in the power density spectrum of GS 1826-238 at a frequency $\nu_{br} \approx (8.48 \pm 0.14) \times 10^{-5}$ Hz in both optical and X-ray energy bands. We have estimated the orbital period of the binary GS 1826-238 using the correlation between the break frequency in the power density spectrum and the orbital period of binaries, $P_{orb} \propto 1/\nu_{br}$, found by Gilfanov and Arefiev (2005): $P_{orb} = 3.7 \pm 0.8$ h and $P_{orb} = 11.3 \pm 5.9$ h when using Sco X-1 and 1H 16267-273, respectively, as reference sources. It seems to us that the method for estimating the orbital periods of low-mass X-ray binaries using the correlation $P_{orb} \propto 1/\nu_{br}$ may turn out to be very promising, especially for persistent low-luminosity X-ray binaries. © 2010 Pleiades Publishing, Ltd.

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Keywords

GS 1826-238, low-mass X-ray binaries, optical observations, orbital period, power density spectrum