The origin of super-Eddington flares in the high-mass X-ray binary LMC X-4

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LMC X-4 is a bright X-ray pulsar in a high-mass X-ray binary system. It exhibits super-Eddington flares (up to $\sim 10^{40}$ erg s^{-1}) lasting up to few kiloseconds which are accompanied by changes in the pulse profile [1]. Accretion onto NS with a strong magnetic field is accompanied by the transfer of angular momentum between the star and its accretion disk [2]. The origin of the flares is unknown and may be related to the accretion rate increase, as well as to processes associated with the neutron star (NS) — changes in the magnetic field structure or rapid changes in angular momentum. The study of flaring activity is of the greatest interest in the context of fundamental physical processes. This is due to the accumulation of a significant amount of energy and the development of non-stationary processes that lead to the release of this energy in a short time. The goal of this work is to determine the presence of significant changes in the pulsar's spin dynamics and irregularities in the pulse profile shape during flaring activity. In the present paper it has been shown that during flares, no changes in the spin period and its derivative are observed. Changes in the pulse profile are regular with the X-ray flux. Thus, the observed features are caused by changes in the accretion rate, while the structure of the accretion column during flares remains unchanged.

[1] Shtykovsky A E, Arefiev V A, Lutovinov A A and Molkov S V 2018 *Astronomy Letters* **44** 149–161 (*Preprint* 1712.05322)

[2] Ghosh P and Lamb F K 1979 **234** 296–316