X-ray pulsars at extremely high mass accretion rates

A. A. Mushtukov[1*]

[1]Anton Pannekoek Institute, University of Amsterdam, Science Park 904, 1098 XH Amsterdam, The Netherlands

X-ray pulsars (XRPs) form a special class in family of accreting neutron stars (NSs) [1]. They stand out from the other classes due to their strong magnetic field, which typically exceed 10^{12} G and affects even fundamental properties of matter [2]. Magnetic field funnels the accretion flow and its gravitational energy is released in the form of X-rays coming from the compact area on the NS surface. Resent discoveries of pulsations from ultra-luminous X-ray sources (point-like X-ray sources with the observed luminosity well above 10^{39} erg/s) - ULXs - have open a new chapter in studies of XRPs [3]. The classical theoretical limitation for luminosity is given by the Eddington value, which is about 2×10^{38} erg/s for NSs. Discovery of ULXs powered by accreting NSs is a challenge for modern astrophysics. At the same time we know a few bright transient XRPs, which might be considered as a link between normal XRPs and ULXs. I will discuss the basic features of XRPs, which arise and become essential at high mass accretion rates: accretion columns, which arise at super-critical mass accretion rates [4, 5] and provide a principal possibility to exceed the Eddington value [6], and optically thick envelopes [7], which are formed by hot accretion flow at the magnetospheric surface and can affect the spectral and timing properties of bright XRPs and ULXs.

References

[1] R. Walter et al., *A&ARv* 23, 2 (2015)
[2] A. Harding & D. Lai, *Rep.Prog.Phys.* 69, 2631 (2006)
[3] M. Bachetti et al., *Nature* 514, 202 (2014)
[4] A. A. Mushtukov et al., *MNRAS* 447, 1847 (2015)
[5] M. M. Basko & R. A. Sunyaev, *MNRAS* 175, 395 (1976)
[6] A. A. Mushtukov et al., *MNRAS* 454, 2539 (2015)
[7] A. A. Mushtukov et al., *accepted for publication in MNRAS* (2017), arXiv:1612.00964

*E-mail: al.mushtukov@gmail.com