

Swift observations of GS 1826-238

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2017 The Author(s). GS 1826-238 is a well-studied low-mass X-ray binary neutron star. This source was in a persistent hard state since its discovery in 1988 and until 2014 June. After that, the source exhibited several softer periods of enhanced intensity in the energy range 2-20 keV. We studied the long-term light curves of MAXI (Monitor of All Sky X-ray Image) and Swift/BAT, and found clearly two branches in the MAXI-BAT and hardness-intensity diagrams, which correspond to the persistent state and softer periods, respectively. We analysed 21 Swift/XRT observations, of which four were located in the persistent state while the others were in softer periods or in a state between them. The XRT spectra could be generally fitted by using an absorbed Comptonization model with no other components required. We found a peculiar relationship between the luminosity and the hardness in the energy range of 0.6-10 keV: when the luminosity is larger (smaller) than 4 per cent-6 per cent L_{edd} , the hardness is anti-correlated (correlated) with luminosity. We also estimated the variability for each observation by using the fractional rms in the 0.1-10 Hz range. We found that the observations in the persistent state had a large fractional rms of ~ 25 per cent, similar to other low-mass X-ray binaries. However, the variability is mainly found in the range of 5 per cent-20 per cent during softer periods. We suggest that GS 1826-238 did not evolve into the soft state of atoll sources, and all the observed XRT observations during the softer periods resemble a peculiar intermediate state of atoll sources.

<http://dx.doi.org/10.1093/mnras/stx2908>

Keywords

Stars: individual: GS 1826-238, Stars: low-mass, X-rays: binaries

References

- [1] Asai K., Mihara T., Matsuoka M., Sugizaki M., 2015, PASJ, 67, 92
- [2] Barthelmy S. D. et al., 2005, Space Sci. Rev., 120, 143
- [3] Begelman M. C., 2014, preprint (arXiv:1410.8132)
- [4] Belloni T., Hasinger G., 1990, A&A, 227, L33
- [5] Burrows D. N. et al., 2005, Space Sci. Rev., 120, 165
- [6] Chenevez J. et al., 2016, ApJ, 818, 135
- [7] Cocchi M., Farinelli R., Paizis A., Titarchuk L., 2010, A&A, 509, A2
- [8] Cocchi M., Farinelli R., Paizis A., 2011, A&A, 529, A155
- [9] Done C., Gierliński M., Kubota A., 2007, A&AR, 15, 1
- [10] Esin A. A., McClintock J. E., Narayan R., 1997, ApJ, 489, 865

- [11] Frank J., King A., Raine D. J., 2002, *Accretion Power in Astrophysics*, 3rd edn. Cambridge Univ. Press, Cambridge
- [12] Galloway D. K., Cumming A., Kuulkers E., Bildsten L., Chakrabarty D., Rothschild R. E., 2004, *ApJ*, 601, 466
- [13] in 't Zand J. J. M., Heise J., Kuulkers E., Bazzano A., Cocchi M., Ubertini P., 1999, *A&A*, 347, 891
- [14] Ji L., Zhang S., Chen Y., Zhang S.-N., Torres D. F., Kretschmar P., Li J., 2014, *ApJ*, 782, 40
- [15] Ji L. et al., 2015, *ApJ*, 806, 89
- [16] Lewin W. H. G., van der Klis M., 2006, *Compact Stellar X-ray Sources*
- [17] Makino F., 1988, *IAU Circ.*, 4653
- [18] Matsuoka M. et al., 2009, *PASJ*, 61, 999
- [19] Munro M. P., Remillard R. A., Chakrabarty D., 2002, *ApJ*, 568, L35
- [20] Muñoz-Darias T., Motta S., Belloni T. M., 2011, *MNRAS*, 410, 679
- [21] Muñoz-Darias T., Fender R. P., Motta S. E., Belloni T. M., 2014, *MNRAS*, 443, 3270
- [22] Nakahira S. et al., 2014, *Astron. Telegram*, 6250
- [23] Ono K., Sakurai S., Zhang Z., Nakazawa K., Makishima K., 2016, *PASJ*, 68, S14
- [24] Palmer D., Swift/BAT Team, 2017, *Astron. Telegram*, 10117
- [25] Remillard R. A., McClintock J. E., 2006, *ARA&A*, 44, 49
- [26] Rodi J., Jourdain E., Roques J. P., 2016, *ApJ*, 817, 101
- [27] Thompson T. W. J., Rothschild R. E., Tomsick J. A., Marshall H. L., 2005, *ApJ*, 634, 1261
- [28] Thompson T.W. J., Galloway D. K., Rothschild R. E., Homer L., 2008, *ApJ*, 681, 506
- [29] Ubertini P., Bazzano A., Cocchi M., Natalucci L., Heise J., Muller J. M., in 't Zand J. J. M., 1999, *ApJ*, 514, L27
- [30] Wilms J., Allen A., McCray R., 2000, *ApJ*, 542, 914
- [31] Wu Q., Gu M., 2008, *ApJ*, 682, 212
- [32] Zdziarski A. A., Johnson W. N., Magdziarz P., 1996, *MNRAS*, 283, 193
- [33] Życki P. T., Done C., Smith D. A., 1999, *MNRAS*, 309, 561