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Intermediate mass BH candidate HLX-1 in ESO 243-49: New outburst after ~457 days

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Using our currently on-going Swift GI monitoring of HLX-1, we report on the detection of another delayed outburst of the best intermediate mass black hole candidate (IMBH) ESO 243-49 HLX-1 (Hyper Luminous X-ray source 1 - Farrell et al. 2009; Wiersema et al. 2010), observed with the Swift-XRT. This outburst started on 2015 January 8th. This corresponds to a delay of ~54 days with respect to the time interval measured between the outbursts in 2012 and 2013 (~403 days).

The Swift-XRT light-curve over the past 6 years shows 5 well sampled Fast Rise Exponential Decay-like outbursts separated by nearly 1 yr from 2009 and 2012. The outburst in 2013 was delayed with respect to the previous outbursts by more than a month. In Lasota et al. (2011), we proposed that the X-ray lightcurve is due to mass transfer episodes when a companion star orbiting the IMBH in a ~1-yr highly eccentric orbit passes at periapsis and is tidally stripped. Godet et al. (2014) showed through SPH simulations of the eccentric binary model that the 2013 delay could be due to the development of stochastic fluctuations inside the companion star due to tidal forces once the star passes at periapsis; these fluctuations induce stochastic changes in the orbital period (i.e. either an increase or a decrease in the orbital period from one orbit to the next). We also showed that the orbital period first decreases until reaching a minimum, and then tends to increase over several periapsis passages due to tidal effects and increasing mass transfer, leading ultimately to the star ejection. In Godet et al. (2014), we predicted that if HLX-1 is indeed emerging from a minimum in orbital period, then the orbital period (and hence the time interval between two outbursts) would generally increase with each passage, although substantial stochastic fluctuations can be superposed on this trend from one orbit to the next. The increased time delay in the outburst occurrence in 2015 is consistent with the picture drawn above (i.e. an increasing orbital period). This might indicate that the companion star may become unbound after a few additional periapsis passages.

The 0.3-10 keV count rate at 2014-01-15 is equal to 0.023 +/- 0.004 (1 sigma) cts/s. The spectral analysis of the data from 2015-01-13 to 2015-01-15 (2.9 ks) shows that the spectrum is soft. The spectral fitting using an absorbed disk black-body with N_H = 4e20 cm^-2 gives a temperature of kT = 0.23 +0.07/-0.06 keV consistent with the values found for previous outbursts (Servillat et al. 2011, Godet et al. 2012). The 0.2-10 keV unabsorbed luminosity on 2015 January 15th is (9.9 +/-1.9)e41 erg/s.

We thank the Swift team for scheduling these observations through the Swift GI program (PI: O. Godet). Further Swift-XRT data are planned. Follow-up observations at other wavelengths are encouraged.

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