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GX 339-4 is back in a faint state close to quiescence

ATel #3383; *D. M. Russell (University of Amsterdam), J. Homan, J. K. Fridriksson (MIT), F. Lewis, P. Roche (Univ. of Glamorgan, Faulkes Telescope Project, Open Univ.), C. O'Morain (Univ. of Glamorgan)*

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Subjects: Optical, X-ray, Binary, Black Hole, Transient

Referred to by ATel #: [4162](#), [5252](#)

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The black hole candidate GX 339-4 has spent more than one year in outburst. It entered outburst in 2010 January (ATel #[2380](#), #[2384](#)), brightened in the hard state (ATel #[2455](#), #[2459](#), #[2525](#)) before making a transition to the soft state in 2010 April - May (ATel #[2545](#), #[2547](#), #[2573](#), #[2577](#), #[2593](#)) and finally returned to the hard state in 2011 January - February (ATel #[3117](#), #[3191](#)).

We report here on recent Swift X-ray and Faulkes Telescope optical observations of GX 339-4. The source has returned to a faint state, close to quiescence.

Two recent ~5 ks Swift XRT observations of GX 339-4 on 2011 May 11 and May 17 indicate unabsorbed 0.5-10 keV fluxes of $5.6e-13$ erg sec⁻¹ cm⁻² and $7.2e-13$ erg sec⁻¹ cm⁻², with estimated uncertainties of ~25%. The spectra were fitted with an absorbed power-law, with the N_h fixed at $7e21$ cm⁻² and the power-law index fixed at 2 (see ATel #[196](#)). The last time GX 339-4 was this faint was in 2009 November, when its 0.3-10 keV flux was $8e-13$ erg sec⁻¹ cm⁻² (ATel #[2281](#)) which is a factor of 2 higher compared to the faintest recorded in 2003 (ATel #[196](#)).

Our monitoring of GX 339-4 with the Faulkes Telescope South (located at Siding Spring, Australia) reveals a gradually fading and reddening optical counterpart, decreasing in

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flux by a factor ~ 40 (15) in V-band (i'-band) over the last eight months. The V-band magnitudes were $V \sim 16.0$ on 2010 September 28, $V \sim 17.1$ on 2011 February 23 (ATel #3191), $V \sim 18.4$ on 2011 April 4 and $V \sim 19.1$ on 2011 April 26 (errors are < 0.1 mag). The magnitudes from our most recent observations on 2011 May 19 and May 20 were $V \sim 19.4 - 20.1$, $R \sim 18.9$ and $i' \sim 18.4 - 18.9$ from 2, 2 and 20 images, respectively.

The last time GX 339-4 was this faint in optical was in ~ 2009 October (ATel #2270). Two faint, close field stars shown in Shahbaz et al. (2001) lie within the aperture. These two stars are marginally resolved from GX 339-4 in some of the R and i'-band images, and the X-ray binary is clearly fainter than the combination of these two stars, so the magnitude of GX 339-4 itself is $R > 19.7$; $i' > 19.2$. This is consistent with the lowest magnitude reported; $r = 20.1$ (Shahbaz et al. 2001). The fractional rms variability amplitude from the 19 i'-band images spread over 5.5 hours on 2011-05-20 was 11 ± 5 % (a 2.2 sigma detection of variability). Any intrinsic variability will be suppressed by the two close stars, so if real, this variability is likely to be $\gg 11$ %, implying significant accretion activity at low luminosity.

We thank the Swift team for scheduling the X-ray observations. We also thank the following Faulkes Telescope Users for observing GX 339-4 on 2011-05-20: Rebecca Scobie (Charles Dickens School, Broadstairs, England), Thomas Doyle (Freeport Schools, New York, USA) and Ana Costa (Escola ES de Alvide, Portugal). The Faulkes Telescope observations are part of an on-going monitoring campaign of ~ 30 low-mass X-ray binaries (Lewis et al. 2008). The Faulkes Telescope South is maintained and operated by Las Cumbres Observatory Global Telescope Network. FL acknowledges support from the Dill Faulkes Educational Trust.

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