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Hard X-ray detection of the black hole candidates 4U 1630-47 and IGR J17091-3624 up to 200 keV with INTEGRAL

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Subjects: X-ray, Gamma Ray, Binary, Black Hole, Transient

During monitoring observations of the Norma and Inner Perseus Arms (rev. 1209: 2012 Sept. 6 from 18:18:23 to 22:00:21 UTC), INTEGRAL-ISGRI revealed that the accreting black hole candidates 4U 1630-47 and IGR J17091-3624 have brightened in the hard X-rays. Mosaic images consisting of 12.6 ks worth of observations of this field show that the two objects are detected in both the soft (18-40 keV) and hard (40-100 keV) ISGRI bands.

For 4U 1630-47, count rates in the ISGRI soft and hard bands are 7.1 ± 0.4 cts/s (34 ± 2 mCrab, 20-sigmas) and 3.1 ± 0.3 cts/s (30 ± 3 mCrab, 12-sigmas), respectively. The former is statistically compatible with the source flux measured by Swift-BAT on that date in a similar energy range (28 ± 4 mCrab: <http://heasarc.nasa.gov/docs/swift/results/transients>). In JEM-X, 4U 1630-47 has count rates of 94.0 ± 2.2 cts/s (534 ± 13 mCrab, 43-sigmas) in the 3-10 keV band, and 6.4 ± 0.9 cts/s (90 ± 13 mCrab, 7-sigmas) in the 10-25 keV band. The spectrum from 4U 1630-47 extends to ~ 200 keV and can be fit with a power law ($\Gamma = 2.4 \pm 0.3$; red. $\chi^2/\text{dof} = 1.4/10$; observed flux = $7e-10$ erg/cm²/s in 20-100 keV) with no improvement to the fit when a cutoff is added. As recently as four days ago (rev. 1207: 2012 Sept. 2 from 05:18:43 to 09:00:29 UTC), 4U 1630-47 was not detected above the 6-sigma level in either ISGRI band, and could only be detected in the soft JEM-X band (3-10 keV). We note that during the previous brightening in hard X-rays, the source was not detected in the ISGRI hard band (ATel #[3945](#)), nor were there reports that the source was detected above 50 keV by Swift-BAT (ATel #[4077](#)).

Count rates for IGR J17091-3624 in the ISGRI soft and hard bands are 3.4 ± 0.5 cts/s (16 ± 2 mCrab, 7-sigmas) and 3.3 ± 0.3 cts/s (32 ± 3 mCrab, 11-sigmas), respectively. The soft-band flux is lower than the 24 ± 5 mCrab measured by Swift-BAT on that date in the 15-50 keV band, while the hard-band flux is higher than the value in the same energy range during the previous outburst (20 ± 3 mCrab: ATel #[3916](#)). This source was outside the field of view of JEM-X. The source spectrum can be fit with a power law ($\Gamma = 1.7 \pm 0.4$; red. $\chi^2/\text{dof} = 1.5/10$; observed flux = $6e-10$ erg/cm²/s in 20-100 keV) up to ~ 200 keV with no evidence for a cutoff. It was also detected above the 6-sigma level in both ISGRI bands during the previous observation of the field (rev. 1207). A possible transition to the hard state was recently suggested (ATel #[4282](#)) using Swift-XRT data. The detection of hard X-ray emission from IGR J17091-3624 confirms that the transition to the hard state is taking (or has taken) place.

INTEGRAL will continue to monitor these sources in the coming weeks. Light curves and images of these sources (and others in the field) can be found at the ISA project home page (<http://sprg.ssl.berkeley.edu/~bodaghee/isa>). We thank the ISDC shift team for their support.

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