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NICER identification of MAXI J1348-630 as a probable black hole X-ray binary

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on 29 Jan 2019; 16:57 UT

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

Referred to by ATel #: [12456](#), [12457](#), [12470](#), [12477](#), [12480](#), [12491](#), [12497](#), [12505](#), [12520](#), [13459](#), [13465](#), [13539](#)

On 2019 January 26 at 03:16 UT, MAXI/GSC detected the new X-ray transient MAXI J1348-630 (ATel #[12425](#)), which was then quickly also observed by Swift/BAT (GCN #[23795](#), #[23796](#), #[23797](#), #[23801](#)), INTEGRAL (GCN #[23799](#), ATel #[12441](#)), iTelescope.Net T31 (ATel #[12430](#)), and the 1-m LCO telescope at Cerro Tololo (ATel #[12439](#)). Based on a 1 ks Swift/XRT observation, a coherent signal was reported around 9.8 s (or perhaps at 4.9 s), suggesting that MAXI J1348-630 may harbor an X-ray pulsar (ATel #[12434](#)). Here we report on NICER observations of MAXI J1348-630.

NICER observed MAXI J1348-630 for a total of ~8.1 ksec between 2019 January 26 20:40 UT and January 28 20:34 UT. The source flux is seen to increase systematically over this time interval, and in an observation performed on January 28 NICER detected an average of 5398 cts/sec (0.2-12 keV). The fast increase is consistent with the flux increase detected by MAXI (see [link here](#)) and Swift/BAT (see [link here](#)).

The 2-10 keV power spectrum is dominated by strong broadband noise (37% rms in the 0.1-64 Hz range on Jan 26, decreasing to 32% rms on Jan 28), characteristic of black hole X-ray binaries in the hard state. No periodic signal is detected at the frequencies of the reported 9.8 s or 4.9 s periods, but there is marginal ($<3\sigma$) evidence for a pair of weak (5-10% rms) non-harmonically-related QPOs on similar timescales, just above the low-frequency break of the broadband noise, at

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frequencies beginning at ~ 0.15 Hz in the first NICER observations on Jan 26 and moving to > 0.3 Hz in the most recent observations. We can compare the broadband power spectral shape with those obtained for a large sample of RXTE observations of accreting black holes and neutron stars, using $\hat{\nu} \text{ power color} \hat{\nu}$ ratios of integrated power from different frequency bands (see [link](#) here for the diagram including MAXI J1348-630, and for more details see Gardenier & Uttley 2018, MNRAS 481, 3761). The source power colors clearly lie along the track followed by black holes.

The continuum X-ray spectrum (0.6-10 keV), after applying the Crab correction to deal with unmodelled systematics (see, e.g., Ludlam et al. 2018, ApJL 858, L5), could be approximated with an absorbed power-law plus disk-blackbody model. The absorption column density was measured at $n_{\text{H}} = 0.66(1)E22 \text{ cm}^{-2}$, comparable to the integrated H column density of $1.5E22 \text{ cm}^{-2}$ from the Leiden/Argentine/Bonn maps. We find that during January 26-28 the power-law photon index Γ steepens from 1.66(1) to 1.84(2) while the disk blackbody temperature kT increases from 0.27(2) keV to 0.37(3) keV. The absorbed 0.6-10 keV flux increased from $6.2(2)E-9 \text{ erg cm}^{-2} \text{ s}^{-1}$ up to $2.26(2)E-8 \text{ erg cm}^{-2} \text{ s}^{-1}$. We observed residuals in the energy range 6-7 keV, likely associated with a weak iron reflection feature.

The timing and spectral properties of MAXI J1348-630 strongly suggest that it is a black hole X-ray binary in a rapidly evolving hard state. Due to the rapid rise in flux, we advise urgency in scheduling follow-up observations at other wavelengths. Further NICER observations of this source are underway; additional multi-wavelength observations are strongly encouraged.

NICER is a 0.2-12 keV X-ray telescope operating on the International Space Station. The NICER mission and portions of the NICER science team activities are funded by NASA.

References: Gardenier & Uttley 2018, MNRAS 481, 3761; Ludlam et al. 2018, ApJL 858, L5

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