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NICER Observes Transition to the Intermediate State in MAXI J1631-479

ATel #12440; *J. van den Eijnden (UvA), R. M. Ludlam (U. Michigan), J. Homan (Eureka Scientific & SRON), K. C. Gendreau, Z. Arzoumanian (NASA/GSFC), D. Altamirano (U. Southampton), J. Steiner, R. Remillard (MIT), N. Degenaar, T. Russell, P. Uttley (UvA), A. L. Stevens (Michigan State U. & U. Michigan), J. M. Miller (U. Michigan)*
*on **28 Jan 2019; 19:03 UT***
Credential Certification: Jakob Van den Eijnden (a.j.vandeneijnden@uva.nl)

Subjects: X-ray, Transient

Referred to by ATel #: 12504

NICER has observed the new X-ray transient MAXI J1631-479 (Kobayashi et al., ATel #12320; Miyasaka et al., ATel #12340) on a daily basis since January 15, 2019. An analysis of these data confirms an earlier report by Negoro et al. (ATel #12421) that the source started its transition out of the soft state and into an intermediate state on January 23.

Although NICER hardness ratios indicate that X-ray spectral hardening had begun between January 23 ~09:30 UTC and ~19:00 UTC, clear changes in the X-ray variability properties were not seen until January 24 ~12:00 UTC. The weak power-law noise that was present in the power spectra before that time was replaced by stronger peaked noise and type-C QPOs, while the total power in the 0.1-100 Hz range increased from ~2% rms to ~12% rms (3-12 keV). During the past few days, as both the flux and spectral hardness fluctuated, the QPO frequencies varied between ~4 Hz and ~8 Hz and often showed strong harmonics. The QPO shows a hard phase lag of ~0.1 rad between the 4-6 and 6-10 keV energy bands, consistent with the QPO phase lags seen in low-inclination black-hole X-ray binaries (Van den Eijnden et al. 2017).

We extracted an energy spectrum from an observation on January 24, selecting events outside high-latitude radiation zones (cut-off rigidities > 4 GeV/c), and normalized to the Crab Nebula as per Ludlam et al. (2018) for an exposure of 2.98 ks. The spectrum can be described by an absorbed disk blackbody and power-law model [tbnew*(diskbb+pow)] with a temperature of 1.12(1) keV (90% confidence level) and the photon index is 2.02(2). This photon index is consistent with the transition into an intermediate state suggested by the variability properties. There are strong emission features consistent with reflection emission near 1.1 keV and 6.4 keV.

Related
12504 Optical follow-up and archival X-ray/optical observations of the new X-ray transient MAXI J1631-479
12440 NICER Observes Transition to the Intermediate State in MAXI J1631-479
12438 Optical observations of MAXI J1631-479
12421 MAXI/GSC detection of a soft-to-hard state transition of MAXI J1631-479
12418 INTEGRAL detection of the new transient MAXI J1631-479
12396 ATCA radio detection of the new X-ray transient MAXI J1631-478
12340 MAXI J1631-479 is a new X-ray transient
12320 MAXI/GSC detection of a bright hard X-ray outburst probably from AX J1631.9-4752

The absorbed flux in the 0.5-10 keV energy band was ~3.3E-8 erg/cm2/s with a flux in the 0.5-2 keV energy band of ~1.3E-9 erg/cm2/s. We measure an absorption column along the line of sight of N_H=5.00(2)E22 cm^-2 with a non-solar silicon abundance of 1.63(2) due to strong absorption below 2 keV. The absorption column is larger than the value reported in ATel #12340, but our values for the disk component and power-law are in good agreement with the NuSTAR values.

Continued multi-wavelength monitoring is encouraged. An overview of planned NICER observations of MAXI J1631-479 can be found here.

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:
Van den Eijnden et al. 2017, MNRAS, 464, 2643
Ludlam et al. 2018, ApJL, 858, L5

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