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Publication date

2024

Document Version

Final published version

Published in

The astronomer's telegram

License

Unspecified

[Link to publication](#)

Citation for published version (APA):

Rout, S. K., Alabarta, K., Russell, D. M., Bramich, D. M., Saikia, P., Baglio, M. C., Homan, J., Lewis, F., Russell, T., Degenaar, N., & Fijma, S. (2024). LCO detects new outburst from Aql X-1. *The astronomer's telegram*, 16822. <https://www.astronomerstelegram.org/?read=16822>

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LCO detects new outburst from Aql X-1

ATel #16822; *Sandeep K. Rout, Kevin Alabarta, David M. Russell, D. M. Bramich, and Payaswini Saikia (NYU Abu Dhabi), M. Cristina Baglio (INAF-OAB), Jeroen Homan (Eureka Scientific), Fraser Lewis (Faulkes Telescope Project & Astrophysics Research Institute, LJMU), Thomas Russell (INAF-IASF), Nathalie Degenaar, and Stefanie Fijma (API, Amsterdam)*

on 19 Sep 2024; 17:54 UT

Distributed as an Instant Email Notice Transients

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Subjects: Optical, Binary, Neutron Star, Transient

Referred to by ATel #: 16823, 16826, 16829, 16840, 16841, 16843, 16888

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We report the onset of the new outburst from the neutron star low-mass X-ray binary Aquila X-1 (Aql X-1) detected by the Las Cumbres Observatory (LCO) telescope network (ATel #16821). Aql X-1 undergoes recurrent outbursts every 1-2 years (e.g. ATel #16147, ATel #15401, ATel #14437, ATel #13953). The previous outburst of the source began on 23 July 2023 (MJD 60148.26) (ATel #16147). That outburst lasted for a little over two months, with Aql X-1 returning to quiescence on 5 October 2023 (MJD 60222.02), following a fast rise and exponential decay. We continued to observe the source throughout its quiescence period with LCO.

We detected a rise in the optical flux in Aql X-1 in different bands observed after 11 September 2024. The optical magnitudes of the most recent three epochs in the five filters are tabulated below. The mean quiescence levels, and the corresponding standard deviations, for all the filters are also mentioned in the last column. The optical rise most likely began between the 11th (MJD 60564.78) and 14th (MJD 60567.86) of September 2024. Until 18 Sep 2024 (MJD 60571.87), the source had risen by more than 1 magnitude in V, R, and i bands. It is worth noting that the rise in V band, above the

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quiescence, is greater than the corresponding rise in the i' band consistent with previous outbursts, getting bluer when brightening ([Maitra & Bailyn 2008](#))

| | Magnitude (Epoch 3) | Magnitude (Epoch 2) | Magnitude (Epoch 1) | Quiescence |
|----------------|-----------------------|-----------------------|-----------------------|--------------|
| V | 17.81 ± 0.04 (Sep 18) | 18.31 ± 0.16 (Sep 14) | 19.26 ± 0.05 (Sep 04) | 19.32 ± 0.12 |
| R | 17.22 ± 0.02 (Sep 18) | 17.86 ± 0.10 (Sep 14) | 18.48 ± 0.09 (Sep 11) | 18.52 ± 0.10 |
| g | 18.99 ± 0.07 (Sep 15) | 19.76 ± 0.02 (Sep 09) | 19.90 ± 0.04 (Sep 02) | 19.86 ± 0.13 |
| r | 18.14 ± 0.02 (Sep 15) | 18.74 ± 0.01 (Sep 09) | 18.84 ± 0.02 (Sep 02) | 18.78 ± 0.06 |
| i | 17.14 ± 0.02 (Sep 18) | 17.68 ± 0.02 (Sep 15) | 17.72 ± 0.10 (Sep 14) | 18.27 ± 0.09 |
| z _s | 17.90 ± 0.01 (Sep 09) | 17.97 ± 0.02 (Sep 02) | 17.93 ± 0.01 (Aug 27) | 17.92 ± 0.05 |

The outburst rise has also been detected in X-rays with the Einstein Probe on 14 Sep 2024 (ATel #16821). The flux in the MAXI 2-20 keV band also increased to 0.14 ± 0.02 ph/s/cm² (~ 36 mCrab) on 19 Sep 2024 (MJD 60572.5). The source is in a fast rising phase, and thus, prompt multi-wavelength observations are encouraged. X-ray and radio monitoring programs have been triggered and we will continue observations with LCO.

Aql X-1 is being regularly monitored with the 1m and 2m telescopes of the LCO network as part of a large observational campaign of X-ray binaries ([Lewis et al. 2008](#)). All the obtained images are reduced using an automated pipeline XB-NEWS (X-ray Binary New Early Warning System) developed in-house ([Russell et al. 2019](#), [Goodwin et al. 2020](#), and [Alabarta et al. 2024](#), in prep).

LCO lightcurve of Aql X-1

| | |
|-------|---|
| 14563 | telescope |
| 14563 | Aquila X-1 returns to quiescence : optical monitoring of the 2021 outburst |
| 14437 | Optical brightening of Aql X-1 detected by ZTF |
| 14079 | MAXI/GSC detections of a new superburst from Aql X-1 |
| 13981 | Aql X-1: new optical outburst |
| 13961 | Swift/XRT Detects Hard-State X-ray Emission from the 2020 Outburst of Aquila X-1 |
| 13953 | XB-NEWS detects a new outburst from Aquila X-1 |
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