

Accretion Disc and Reflection probes during the 2025 Outburst of 4U 1630-472

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Abstract

We present time-resolved broadband spectroscopy of the 2025 outburst from the recurrent black hole candidate 4U 1630–472. Using 23 simultaneous NuSTAR and NICER observations, we tracked the event through its rise, peak and decay. Fitting the spectra with an absorbed thermal disc and relativistic reflection continuum (diskbb+relxillCp) revealed that 12 early, luminous intervals required a broad Fe K absorption component indicating a transient disc wind.

Assuming a $10 M_{\odot}$ black hole at 11.5 kpc, the unabsorbed 0.01–100 keV luminosity spans two orders of magnitude. The source does not trace the classic q-shaped track, instead following a non-monotonic hardness-intensity evolution. Spectral hardness strongly anticorrelates with the disc fraction, disc luminosity and inferred mass accretion rate proxy.

We also identified a systematic, state-dependent offset between the colour-corrected thermal inner radius and reflection-based estimates not fully captured by a fixed hardening-factor treatment. To test whether this reflects a true shift in accretion geometry rather than a modelling systematic, our ongoing analysis applies self-consistent disc atmosphere modelling (kerrbb2) and refines the treatment of the faintest intervals. Results from this ongoing analysis will be presented.