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The puzzling NS LMXB 1RXS J180408.9-342058 in intermediate state

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1RXS J180408.9-342058 is a low mass X-ray binary (LMXB) hosting a neutron star, which shows X-ray activity at very different mass-accretion regimes, from "very faint" outbursts to almost the Eddington luminosity. In this work, we present a comprehensive X-ray study of this source using data from Swift, NuSTAR and INTEGRAL/JEM-X. In order to follow the spectral evolution, we analyzed the 2015 outburst using Swift data and three Nustar observations. Besides the canonical hard and soft spectral states, we identified the intermediate state, which is rarely observed in LMXBs hosting NSs. This was witnessed by the appearance of the accretion disk emission in the spectrum (at a disk temperature of ~ 0.7 keV) and the simultaneous cooling of the hot corona. In addition, we also unveiled a hard tail above 30 keV in this state. The fast changes in the spectra taken only days apart in this state points out that intermediate states in Neutron Stars LMXBs might last for short times, of the order of a few days, which might explain why catching these sources in intermediate state is quite challenging. In the hard state, a thermal Comptonization model with two seed photons populations ($kT \sim 1.5$ keV and $kT \sim 0.4$ keV, respectively) and a hot Comptonising plasma, represents the physically best motivated scenario to describe the data. Finally, we studied a number of type-I X-ray bursts displayed from the source, one of them at the Eddington limit (observed with JEM-X). Their characteristics, combined with the clocked behavior observed during the intermediate state, point out H/He composition for the accreted material, which makes unlikely the helium dwarf nature for the companion.

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