

Switches between accretion structures during flares in 4U 1901+03

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Abstract

We report on our analysis of the 2019 outburst of the X-ray accreting pulsar 4U 1901+03 observed with Insight-HXMT and NICER. Both spectra and pulse profiles evolve significantly in the decaying phase of the outburst. Dozens of flares are observed throughout the outburst. They are more frequent and brighter at the outburst peak. We find that the flares, which have a duration from tens to hundreds of seconds, are generally brighter than the persistent emission by a factor of ~ 1.5 . The pulse-profile shape during the flares can be significantly different from that of the persistent emission. In particular, a phase shift is clearly observed in many cases. We interpret these findings as direct evidence of changes of the pulsed beam pattern, due to transitions between the sub- and supercritical accretion regimes on a short time-scale. We also observe that at comparable luminosities the flares' pulse profiles are rather similar to those of the persistent emission. This indicates that the accretion on the polar cap of the neutron star is mainly determined by the luminosity, i.e. the mass accretion rate.

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Keywords

Stars: neutron, X-rays: binaries, X-rays: individual: 4U 1901+03

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