

The origin of the powerful jets from Cyg X-3 in the soft spectral state

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The high-mass accreting binary Cyg X-3 is distinctly different from low-mass X-ray binaries (LMXBs) in having radio and gamma-ray emitting jets in its soft spectral state. Furthermore, those jets are much brighter in both radio and gamma-rays than those in the hard state of this object. Analysis of those emissions (Zdziarski et al. 2018) yields the location and the profiles of the orbital modulation of both, as well as the physical processes responsible for the emission. The transition from the hard state to the soft one in Cyg X-3 is first associated with quenching of the hard-state radio emission, similarly to LMXBs. The powerful soft-state jets form, on average, ~ 50 d later. The initial jet quenching appears to be due to the hard-state vertical magnetic field quickly diffusing away in the thin disc present in the soft state. The subsequent formation of the gamma-ray emitting jets occurs due to advection of the magnetic field from the donor, as proposed in Cao & Zdziarski (2020). We find this happens only above certain threshold accretion rate associated with appearance of magnetically driven disc outflows. The ~ 50 d lag is of the order of the viscous timescale in the outer disc, while the field advection is much faster. This process does not happen in LMXBs due to the magnetic fields of their donors being weaker than that in the Wolf-Rayet donor of Cyg X-3. Our results provide a unified scenario of the soft and hard states in both Cyg X-3 and LMXBs.

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