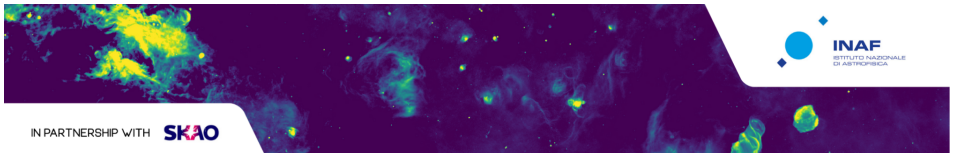

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Large-scale jets from black hole X-ray binaries in the SKA era

Thursday 27 November 2025 15:30 (15 minutes)

Black hole X-ray binaries (BH XRBs) can launch powerful outflows in the form of radio-emitting discrete jet ejecta, which are observed to be produced during outburst phases, at the transition between different accretion states.

Once spatially resolved, these components are observed to propagate up to parsec scales far from the BH, often displaying apparent superluminal motion. However, little is known about the powering mechanism, the formation and composition of these jets, and studying them is important for understanding both their physics and the feedback that BH XRBs have on the surrounding environment. While discrete ejecta have been historically difficult to detect and to follow in their motion away from the compact object, MeerKAT is now "changing the game"in this field with its exceptional sensitivity and imaging capabilities at GHz frequencies.

In this talk, I will show how MeerKAT observations of active BH XRBs taken as part of the ThunderKAT LSP and the subsequent X-KAT program have been fundamental for obtaining an extensive, unprecedented coverage of the jet propagation at parsec scales, allowing us to easily double the sample of discrete ejecta known today. Thanks also to new monitoring strategies, these new data-sets are becoming more and more suitable for a complete physical modelling that includes constraints on the jet energy, speed and mass.

In the talk, I will highlight what will be possible to to achieve with the advent of SKA in its AA* stage. Thanks to its enhanced sensitivity and resolution, we will be able to probe in detail the final phases of the jet propagation, while, at the same time, resolving the ejecta much earlier after their launch. Taking advantage of the broad radio spectral coverage (band 1 to 5b), we will probe the jet spectral properties and their evolution, gaining insight into the details of particle acceleration throughout the jet motion. Finally I will discuss how this new wealth of information will be essential for new joint radiative-kinematical modeling efforts that are currently starting and which allow us to effectively use these jets as laboratories where the shock evolution can be studied in real time.

Topics

Transients & GW follow-up

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