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# Extreme Jet Ejections from the Black Hole X-ray Binary V404 Cygni: The Unique (Sub-)Millimetre Perspective

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## Abstract

Black hole X-ray binaries (BHXB) provide ideal laboratories to probe the ubiquitous coupling between accretion and jet ejection, as their rapid evolutionary timescales allow us to study these processes in real time. After 26 years of quiescence, the BHXB V404 Cygni underwent an outburst in 2015, displaying extraordinary multi-wavelength flaring activity. In this talk, I will discuss striking results from our simultaneous multi-wavelength observing campaign during the most active phase of this outburst. Our 4 hour long set of overlapping observations with the VLA, SMA, and JCMT, covers 8 different frequency bands (including the first detection of a BHXB jet at 666GHz/450 $\mu$ m). With this rich dataset, we performed detailed Markov-Chain Monte Carlo modeling of our radio through sub-mm light curves, where we find that a total of 8 bi-polar, discrete jet ejection events can reproduce the emission that we observe in all of our frequency bands remarkably well. Through combining our modeling results with rapid-timescale VLBA imaging and X-ray observations, we present detailed probes of jet speed, structure, energetics, and geometry. Our analysis demonstrates the power of simultaneous multi-band photometry of outbursting BHXBs, and the paramount importance of the mm/sub-mm bands, which offer a unique, more detailed view of the jet than can be provided by radio frequencies alone.

**Keywords:** black holes, jets and outflows, V404 Cygni, X-ray binaries

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