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Tracking the Short Timescale Evolution of the Linearly Polarized Jets from V404 Cygni's 2015 Outburst

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Accretion-powered relativistic jets are a ubiquitous element of systems with accreting black holes. Despite the ubiquity of these jets, we have yet to construct a complete picture of the underlying mechanisms that control their evolution. In these jets, synchrotron emission leads to partial linear polarization, with fractional polarization levels and polarization angles that depend on the local magnetic conditions. Thus, we can use polarimetry to probe the magnetic field directly and better constrain the evolution of jets.

Black hole X-ray binaries (BHXBs; i.e., accreting stellar-mass black holes) effectively probe the temporal evolution of accretion-powered relativistic jets, typically on timescales of minutes to weeks. In 2015 the BHXB V404 Cygni was detected as it entered an extremely luminous outbursting state. Follow-up radio observations taken with the Very Large Array (VLA) uncovered multiple bright flaring events. Additional simultaneous observations with the Very Long Baseline Array (VLBA) conclusively revealed that the jet axis was precessing and that the emission originated from both resolvable jet ejecta and an unresolved compact core. In this work, we build on the previous analyses of V404 Cygni to include a time-resolved investigation of the linear polarization VLA data, constituting one of the most rapid cadence studies of radio polarimetry in BHXBs to date. Here, I will present how the short timescale polarized variability (~15 minutes) that we detect evolves in frequency and time. We observe an offset in time between the fractional polarization peaks and the total intensity. Moreover, the intrinsic electron vector polarization angle evolves rapidly. These observations are characteristic of a rapid evolution of both the jet morphology and the structure of its internal magnetic fields.

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