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The NGC 6334-43 field with ALMA: protostellar multiplicity and a young streamer-fed protobinary

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Massive stars (> 8 Msun) are likely found in binaries or higher order multiples throughout their lives; however, due to observational challenges, the relative importance of the formation mechanisms giving rise to this multiplicity are not well constrained. The youngest multiple systems, whose system parameters best constrain theoretical models, are the most deeply embedded, and in the high-mass regime only a few examples of young multiples -that have not yet developed ultracompact/hypercompact HII regions or bright IR emission- have been identified. I will present high angular resolution (~0.27", 357 AU) ALMA observations taken as part of the The Complex Chemistry in hot Cores with ALMA (CoCCoA) survey that offer sufficient sensitivity and angular resolution to undertake a case study of multiplicity in the massive star forming environment NGC 6334-43. We identify nine protostellar and prestellar sources that reside within a single filamentary structure. A simple energy analysis using our derived system parameters is consistent with a quadruple system formed via filament fragmentation and a triple system that contains two hot core components and a young protobinary system both formed via core fragmentation. The 1530 AU protobinary is of particular interest: its components have a gas mass of 0.34 and 0.53 Msun, show very low continuum brightness temperatures (< 2 K) and display weak and sparse line emission, indicating a lack of significant central heating, which suggests a young evolutionary state. However, the nature of the system is confirmed as protostellar due to the detection of a single outflow lobe in CO. Further, the system displays a prominent spiral-arm-like feature traced by continuum and H13CO+ emission, which we characterise as a 3400 AU streamer. Two independent analyses find a substantial mass flow rate along this streamer of between 1 x 10^-5 to 8 x 10 ^-5 Msun yr^-1.

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