Contribution ID: **123** Type: **Contributed talk**

From core to disk fragmentation in high-mass star formation

Monday, 15 May 2023 16:00 (15 minutes)

There is growing consensus that the formation of high-mass stars proceeds through disk accretion, similar to that of lower mass stars. To this end, we have undertaken a large observational program (CORE) making use of interferometric observations from the NOrthern Extended Millimetre Array (NOEMA) for a sample of 20 high-mass protostellar objects in the 1.3 millimetre wavelength regime reaching ~0.4" resolution (800 au at 2 kpc). We find rotational signatures in dense gas perpendicular to bipolar molecular outflows in most regions. Modelling the level populations of various rotational transitions of the dense gas tracer CH3CN, we find the disk candidates to be on average warm (~200 K). Studying the Toomre stability of the disk-like structures reveals that most high-mass young stellar objects are gravitationally unstable and prone to disk fragmentation. Since most high-mass stars are found to have companions, disk fragmentation seems to be an important mechanism by which such systems may be formed. While observations at hundreds of au resolution have now shown that rotational signatures are common around such young and massive accreting protostars, it is difficult to differentiate between rotating and infalling envelope material and true disk structures which likely reside on much smaller scales. In this talk, I will take you on a tour across scales from our findings at hundreds of au resolution with NOEMA reaching down to sub 100 au observations with ALMA showcasing a keplerian disk surrounding a massive binary system.

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Session Classification: Parallel session

Track Classification: NOVA NW2