Same Data, New Insights: Virial Analysis of Ammonia-Identified Clumps in GMCs

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The KEYSSTONE (KFPA Examinations of Young STellar Object Natal Environments; Keown+, 2019) Survey observed NH₃ (1,1) line emission toward 11 high-mass star-forming regions. In their 2019 data release they used results of their single-component ammonia fitting in combination with dust data from the HOBYS (Herschel OB Young Stars) Survey to identify and perform virial analysis on star-forming cores.

We re-analyse the NH₃ data applying a multiple-component fitting model to more accurately measure the gas kinematics. Here we show early analysis of the Cygnus X North (CygX) region, shown in Fig. 1.

![Fig. 1: H₂ column density map for CygX, as presented by Motte+, 2010. The coloured contours show outlines of the dense clumps identified from our NH₃ fitting results.](image)

To fit multiple velocity components we use an iterative process that extends the MUFASA algorithm (Chen+, 2020). Our method which fits up to three components is called the Single Component Ammonia Reduction (SCAR+MUFASA). Fig. 3 shows how the spectral line fits can change dramatically between models. When calculating mass, we assign H₂ column density to each component proportional to its relative NH₃ moment zero. This approach likely contributes to our lower mass values.

We found that all KEYSSTONE regions require multicomponent fitting in an average of 16% of pixels, with regions such as M17 and W48 reaching multicomponent proportions over 30%. Future analysis will delve into external pressure on cores and statistical comparisons between regions.