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Kinematic study of the Orion Complex in the GAIA era

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The study of Young Stellar Clusters (YSCs) has gained relevance in modern astrophysics thanks to the role played by large scale surveys with unprecedented precision. In particular, in the solar neighborhood, multiple star-forming regions will be used to characterize YSCs in terms of kinematics, stellar masses and chemical composition, the main ingredients to understand the dynamical evolution during their early stages. With astrometric information provided by GAIA DR3, we have selected a star sample below 30 Myr in the Orion Complex to identify kinematic groups. After applying the clustering algorithm HDBScan in the 5D parameter space (sky position, proper motions, and parallax), we found between 10 and 14 big stellar groups, according to the parameters provided to HDBScan. The majority of the detected groups show expansion, contraction, or rotation, which can give us a clue about the dynamic effects the region is undergoing. Including spectroscopic data from APOGEE and GALAH, we can explore a general characterization of each cluster considering atmospheric parameters, obtaining subtle differences in metallicity and ages. After this analysis, the identified groups can be used by performing N-body simulations and evaluate statistically the likely scenarios in which the clusters formed and also will evolve. This study will allow us to create a proof of concept to extrapolate toward other star-forming regions in the Galaxy.

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