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The 3D Dynamics of Young Star Clusters from Gaia DR3 and GES

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The formation and evolution of young star clusters and OB associations is fundamental to our understanding of the star formation process, the conditions faced by young binary and planetary systems, and the formation of long-lived open and globular clusters. The Gaia-ESO Survey (GES) has spectroscopically observed 18 young star forming regions, star clusters and OB associations, providing spectroscopic indicators of youth and radial velocities to complement Gaia DR3 proper motions. We have conducted a 3D dynamical study of ~2500 young stars across the 18 young star clusters observed by GES, combining Gaia proper motions with GES radial velocities and youth indicators. This is the first large-scale and comprehensive 3D dynamical study of multiple star clusters. We measure 3D velocity dispersions, quantifying virial states, and search for evidence of (and quantify) expansion, rotation, anisotropy and energy equipartition. We compare the dynamical properties of these systems with their mass, density and age, revealing trends that hint at the formation of these systems, their dynamical evolution, and their eventual dispersal into the field.

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