A KINEMATIC STUDY OF THE LUPUS STAR-FORMING REGION

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In this paper, we study the southern star-forming region located in Lupus that constitutes one of the richest associations of T Tauri stars. Based on the convergent point (CP) method combined with a k-NN analysis we identify 109 pre-main sequence stars in this region that define the Lupus association of co-moving stars, and derive individual distances for all group members.

A precise determination of the distance to individual stars is required to reliably infer the fundamental parameters (mass and age) of young stars. While the average distance to nearby star-forming regions (< 300 pc) is often known, the distances to individual stars are usually unknown. Most pre-main sequence stars, including the faint young solar-type T Tauri stars, were neither observed by the Hipparcos satellite due to their magnitude nor have any trigonometric parallax measured from the ground due to their distance. However, another method based on the determination of the CP of a comoving group of stars exists and allows for the determination of individual distances.

Individual distances for members of young associations can be inferred from their proper motions and radial velocities provided that the CP of the moving group is known. The CP can be derived from our new version of the CP method (Galli et al. 2012) that simultaneously determines the CP position and selects the most likely group members. The new method rests on the idea of representing the stellar proper motions by great circles on the celestial sphere and visualizing their intersections as the CP of the moving group (see Fig. 1).

In this context, we applied our new CP method to a sample of 217 stars identified as Lupus candidate members in previous works. We investigate the kinematic properties of Lupus stars using the proper motions and radial velocities from published astrometric catalogs and spectroscopic surveys. Because of their close proximity (in the plane of the sky) to the
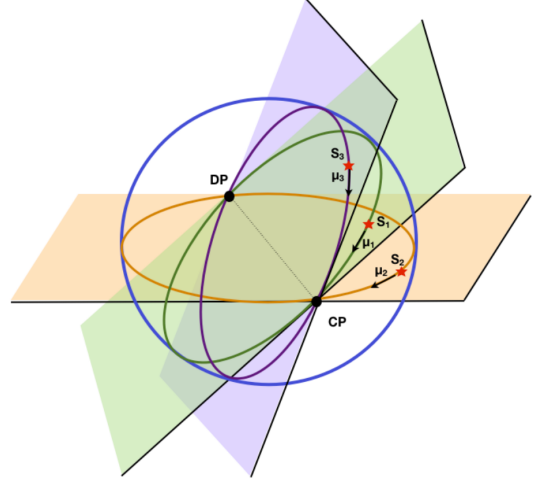

Fig. 1. Motion over a great circle for three stars of the moving group (S_1, S_2, S_3), with proper motions μ_1, μ_2 and μ_3. The intersection of great circles defines the CP.

stars of the Upper Centaurus Lupus (UCL) subgroup of the Scorpius-Centaurus association we decided to combine the CP method with the k-NN algorithm to perform a membership analysis in this region to better distinguish between both populations (see Galli et al. 2013, for more details). Our strategy allowed us to identify 109 pre-main sequence stars that define the comoving association of Lupus stars. Using the stellar proper motions, radial velocities and the CP position of the moving group we calculated individual distances for each group member.

Based on our distances results we show that the classical T Tauri stars (CTTS), located in the immediate vicinity of the main star-forming clouds, form a background population of the Lupus complex while the weak-emission line T Tauri stars (WTTS) are dispersed not only in angular extent but also in depth. We also confirmed the existence of important depth effects (~ 100 pc) in this region, and that the Lupus association is undergoing expansion.

REFERENCES

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