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KINEMATIC DISTANCES OF PRE-MAIN SEQUENCE STARS IN THE LUPUS STAR-FORMING REGION

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RESUMEN

El problema de la determinación de las distancas ha jugado siempre un papel central en la astronomía. Sin embargo, ha habido poco avance reciente en la determinación de las distancias a objetos estelares jóvenes y débiles, como las estrellas pre-secuencia principal (PMS). Muchos estrellas PMS no fueron observadas por el satélite *Hipparcos* (por su magnitud), ni tienen paralajes trigonométricas medidas desde la Tierra (por su distancia). Investigamos las propiedades cinemáticas del grupo en movimiento de Lupus, con el objeto de obtener paralajes individuales para cada miembro de este grupo de estrellas en formación.

ABSTRACT

The problem of the determination of distances has always played a central role in astronomy. However, little recent progress has been made in the distance determination of faint young stellar objects such as pre-main sequence (PMS) stars. Many of the PMS 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. Here we investigate the kinematic properties of the Lupus moving group with the primary objective of deriving individual parallaxes for each group member of this star-forming region.

Key Words: parallaxes — proper motions — stars: distances

The procedure that we use here to derive individual parallaxes is based on the convergent point strategy and makes full use of the directly observed data: position, proper motion and radial velocity. Our sample consists of 275 PMS stars spread over the Lupus star-forming region with proper motion data from the SPM4 (Girard et al. 2011), TYCHO2 (Høg et al. 2000) and Ducourant et al.(2005) catalogues. In order to develop our strategy, an exhaustive search, as complete as possible, in the CDS databases for PMS stars in our sample with known radial velocity has been conducted. We also use radial velocity data collected with FEROS at the 2.2 m MPG/ESO telescope during our observing campaign (087.C-0315).

The algorithm that we use to calculate the convergent point (CP, hereafter) and select the members of a moving group is described in Galli et al. (2012). Once the moving group is defined one can derive the individual parallax of each group member by:

$$\Pi_{\rm ind} = \frac{4.74\mu}{V_{\rm rad}\tan\lambda}\,, \qquad (1)$$

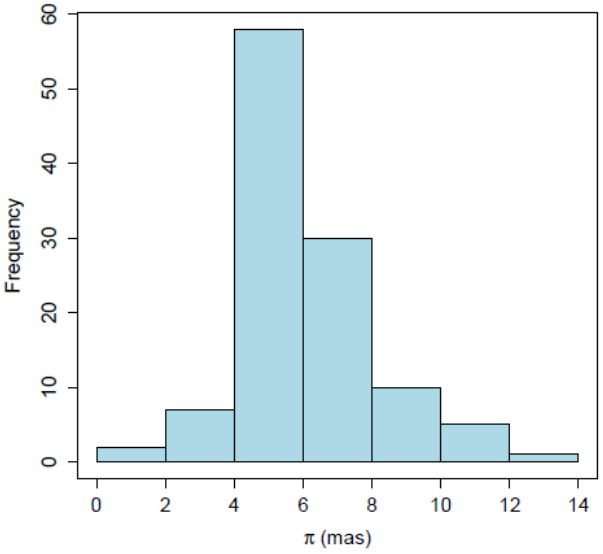

Fig. 1. Distribution of parallaxes for all 113 members of the Lupus moving group.

where μ and $V_{\rm rad}$ are, respectively, the proper motion and the radial velocity and λ is the angular distance between the star and the CP of the moving group. We identified a moving group of 113 members and found reliable radial velocity measurements for only 23 stars of this sample. We use these stars and the

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derived parallaxes as given by equation (1) to compute the space velocity of the moving group. Then, we derive approximate parallaxes for moving group members with unknown radial velocities by

$$\Pi_{\rm app} = \frac{4.74\mu}{V_{\rm space} \sin\lambda}\,, \qquad (2)$$

where $V_{\rm space}$ is the space velocity of the moving group. Our parallax results are presented in Figure 1. We conclude that the Lupus complex spans a large volume in space. These new parallaxes will be used in our forthcoming analysis to derive their physical parameters (luminosity, mass and age).

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