A PROPER MOTION STUDY OF THE LUPUS CLOUDS

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Abstract

We present the first results of a proper motion study in the Lupus clouds, a well-known nearby region of low-mass star formation. We have compiled a list of more than 300 members and candidate members of Lupus 1, 3 and 4 from the literature, and used Virtual Observatory (VO) tools to cross-match it against three proper motion catalogues, UCAC3, USNO-B1 and PPMX. The Lupus objects with counterparts in those catalogs can be divided into two main groups based on their proper motions. We discuss the properties of each of these groups and their association to the dark clouds.

Kinematic groups in Lupus

We compiled a list of low-mass members and candidate members of Lupus 1, 3 and 4 from the works by Comerón (2008), Merín et al. (2008) and Comerón et al. (2009). A Multiple-Cone-Search was performed in three astrometric catalogs (UCAC3, USNO-B1 and PPMX) using the VO-tool TOPCAT to get proper motion measurements for the objects.

In the vector point diagrams (Fig. 1) two main groups are seen, especially in the UCAC3 sample, the one containing the largest number of objects. These groups are also visible in two of the dark clouds separately (Lupus 1 and 3), but not in Lupus 4, probably due to the low number of sources belonging to this cloud.
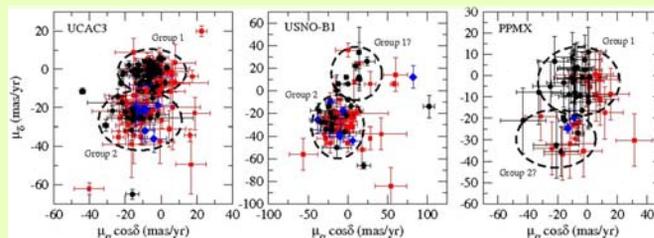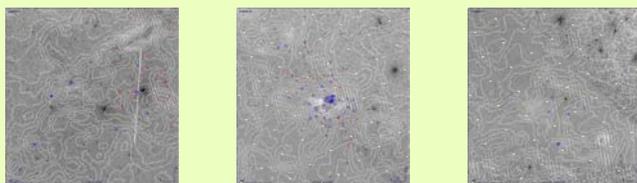

Figure 1
Vector point diagrams of the Lupus 1, 3 and 4 sources (black, red and blue, respectively) with counterparts in each of the astrometric catalogs.
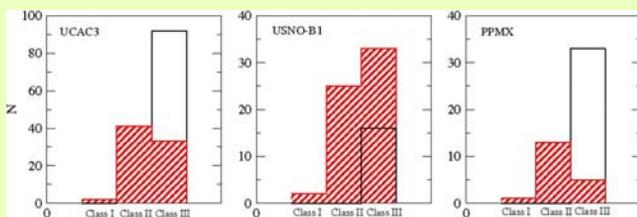
Properties of the groups

The sources in Group 2 tend to be grouped in the cloud cores, in contrast to those in Group 1, which are more dispersed and tend to avoid the densest cloud areas (Fig. 2). This fact, together with the lower proper motions, suggests that Group 1 represents a population of stars located behind the Lupus clouds. In addition, we find that Group 1 is almost exclusively composed of class III (diskless) sources,

while Group 2 contains both class II and III sources, and even some class I sources (Fig. 3), suggesting a less evolved stage of evolution. However, the ages of the stars in both groups, as a sample, are similar (lower left panel of Fig. 4). The rest of properties of Groups 1 and 2 are very similar, but Group 2 seems to include more massive and older stars (Fig. 4).
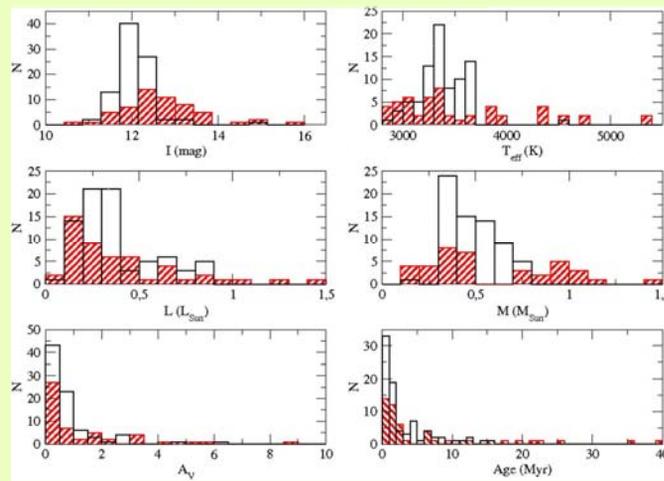

Figure 2
DSS images showing the spatial distribution of the Group 1 and 2 populations (blue and red symbols, respectively) towards the Lupus 1, 3 and 4 clouds (from left to right). The extinction contours derived from a SFD dust map are also overplotted.


Figure 3:
Composition of Group 1 and 2 (blank and hashed histogram, respectively) in terms of class I (protostars), class II (stars with disks) and class III (diskless stars).

Figure 4
Properties of the Group 1 and 2 populations (blank and hashed histograms, respectively) according to the photometry and SED fitting results from Comerón et al. (2009).

Comparison with other populations
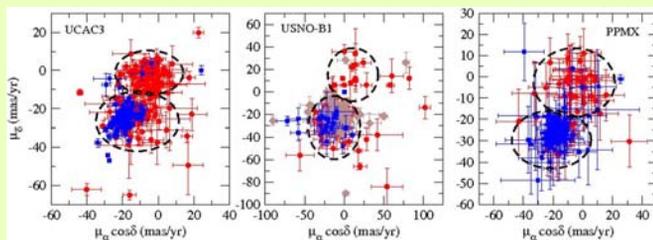
We compared the proper motions of our Lupus objects with the weak-lined T Tauri star population towards Lupus discovered by Krautter et al. (1997), which has been proposed to represent an older population of stars belonging to the Gould Belt, and with the low-mass population in the Upper Scorpius OB association (also in the Gould Belt) studied kinematically by Bouy & Martín (2009). Our Group 2 sources have proper motions compatible with those of both populations (Fig. 5).

Figure 5
Vector point diagrams of our Lupus sources (red) for each of the astrometric catalogs, compared to the ROSAT WTTS (blue) and the Upper Scorpius population (brown).

First conclusions

We have identified two distinct kinematic populations towards the Lupus clouds. Group 2 has properties compatible with its belonging to the dark clouds and with other Gould Belt populations. We are currently testing the reliability and the origin of Group 1, which seems to represent a population of young low-mass objects behind the clouds.

References

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