ACCRETION PROPERTIES OF LOW-MASS STARS IN THE YOUNG σ ORI AND λ ORI CLUSTERS .

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1 Introduction

σ Ori and λ Ori are two nearby (d~400 pc) young clusters (3-10 Myr), both characterized by the presence of a rich low-mass stellar population around a high-mass central star and by a very low reddening. We observed 147 low-mass stars in σ Ori and λ Ori, using the FLAMES/VLT multi-object spectrograph (Pasquini et al. 2002), with the aim to select cluster members, to study the accretion properties by means of emission lines analysis and to investigate the star formation history of the clusters. First results from these observations, regarding the age spread in the σ Ori cluster, are reported in Sacco et al. (2007); here, we discuss the analysis of accretion signatures in both clusters.

2 Selection of members

We observed 98 sources in σ Ori and 49 sources in λ Ori, in the magnitude ranges 13<R<18 and 11<J<15, using FLAMES with the high resolution (R~20000) grating HR15N (647-679 nm). Targets of the σ Ori cluster were selected using optical, infrared and X-ray data retrieved from the 2MASS catalog and the literature. Targets of the λ Ori cluster were retrieved from the catalogs reported in Dolan & Mathieu (1999) and Barrado y Navascués et al. (2004).

Cluster members were identified using three independent criteria: radial velocity (RV) within 3 σ from the cluster mean velocity, Hα line in emission, and Li line (670.8 nm) pseudo-equivalent width (pEW) greater than 200 mÅ. We found 65 members and 33 non-members in the σ Ori sample and 45 members and 4 non-members in the λ Ori sample.

3 Accretion signatures

To investigate the accretion properties of cluster members, we measured the pEW of the Hα line, of the He I line (6678 Å) and of the forbidden N II and SII lines at 6538, 6716 and 6731 Å, which are usually interpreted as signatures of outflow phenomena. We also measured the width of the Hα line at 10% of the peak, from which we derived the MARs using equation (1) of Natta et al. (2004).

Figure 1 shows the Hα pEW as a function of the width at 10% of the peak and of the MAR, while Table 1 reports the fraction of CTTSs in the two clusters derived using 4 different criteria. It is evident that there is a difference between the accretion properties of the two clusters.

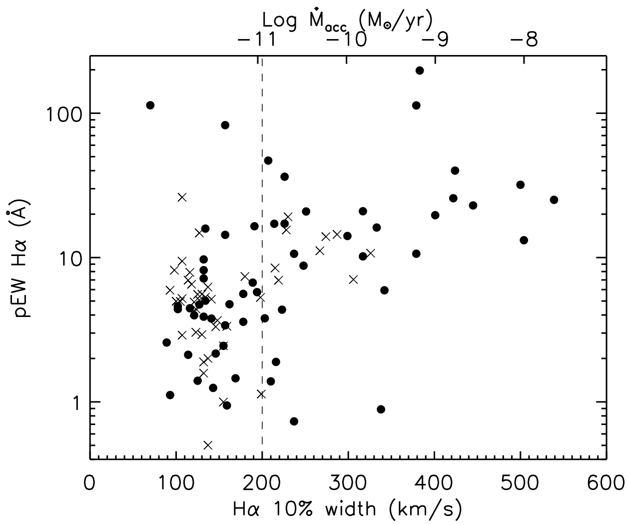

Figure 1: Hα pEW as a function of the width at 10% of the peak (lower axis) and MARs (upper axis). Filled circles and crosses indicate σ Ori and λ Ori members, respectively, while the dashed line shows the threshold used to select accreting objects from the Hα width.

Table 1: Fraction of CTTSs in the σ Ori and in the λ Ori clusters[a] derived from the different accretion signatures.

	Hα EW	Hα width[b]	HeI 6678 Å	other lines
σ Ori	38±8%	47±9%	33±7%	40±8%
	(24/63)	(28/59)	(21/63)	(25/63)
λ Ori	14±6%	18±7%	21±8%	6±4%
	(6/44)	(7/39)	(7/34)	(2/34)

a: In parenthesis the number of CTTSs vs. the total number of stars. Errors are calculated as $\sqrt{N}$/total.
b: Width at 10% of the peak larger than 200 km/s.

4 FLAMES vs. Spitzer

We cross-correlated our list of targets with the catalogs of members observed by Spitzer and published by Hernandez et al. (2007) for σ Ori and by Barrado y Navascues et al. (2007) for λ Ori. Our sample of targets shares 78 sources with the catalog of Hernandez et al. (2007), 62 members and 16 field stars according to our analysis, and 44 sources with that of Barrado y Navascues et al. (2007), 40 classified by us as members and 4 as field stars. Figure 2 shows the IRAC color-color diagrams for the σ Ori (upper panel) and the λ Ori (lower panel) cluster members, where filled and empty symbols indicate, respectively, accreting and non-accreting stars selected by means of the Hα width at 10% of the peak. Class III diskless stars are located around the photospheric region ([3.6]-[4.5]~0.0, [5.8]-[8.0]~0.0), while the excess IR emission due to the disk moves the stars towards the upper-right corner.

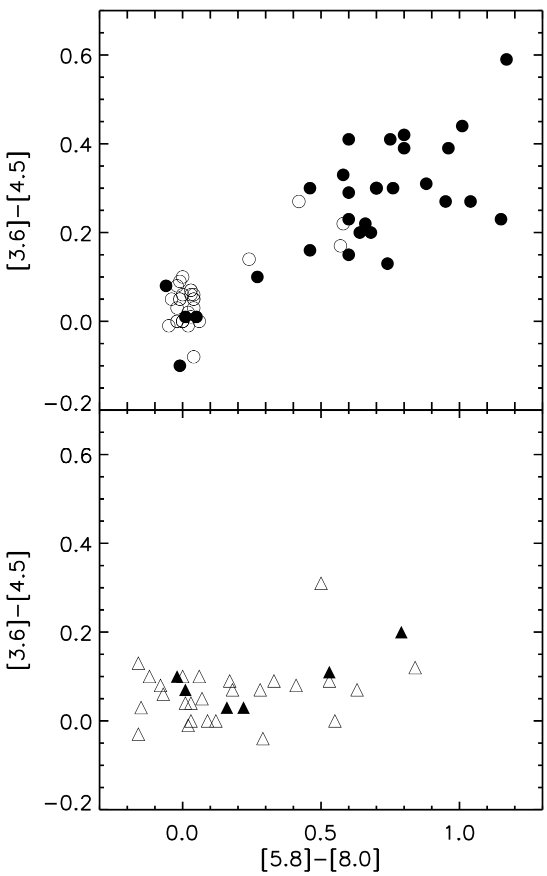

Figure 2: IRAC/SPITZER color-color diagrams of the σ Ori (upper panel) and λ Ori members (lower panel). Filled and open symbols represent the sources with Hα width at 10% of the peak higher and lower than 200 km/s.

Two main differences between the clusters are evident from the analysis of the figure: a) while in the σ Ori diagram the stars with and without disk are clearly distinct, in the λ Ori one the two populations overlap; b) in the σ Ori sample the disk and the accretion signature are strongly correlated, while in the λ Ori sample this correlation disappears.

5 Conclusions

The discrepancy between the two clusters does not seem to depend on the target selection, but might be attributed to different ages. In particular, the idea that the σ Ori population of

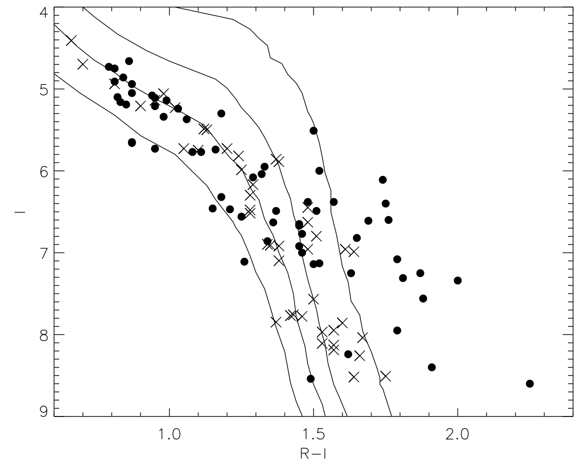

Figure 3: Color-magnitude diagram of the selected members, in σ Ori (filled circles) and λ Ori (crosses) clusters. Magnitudes are corrected for distance modulus and for reddening. Continuous lines are the Baraffe et al. (1998) isochrones at 2, 5, 10 and 20 Myr.

CTTSs is more evolved could explain the fainter accretion signatures and the different disk properties. The color-magnitude diagram (CMD) in Fig. 3, which shows the clusters members with isochrones at 2, 5, 10, 20 Myr (Baraffe et al. 1998), does not evidence a clear difference in age of the clusters, except for the lowest-mass stars. On the other hand, large uncertainties due to the effect of the disk and accretion and to the errors on distance strongly affect the age determination from the CMD. New observations are needed to better constrain stellar ages.

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