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LAMBDA ORIONIS STAR FORMING REGION: TOWARD A COMPREHENSIVE STUDY OF THE STELLAR AND SUBSTELLAR POPULATION

D. Barrado y Navascués[1]

The distance to the Lambda Orionis Star Forming Region (LOSFR) is 400 pc (Murdin & Perston 1977). There are 11 B stars around the λ^1 Ori 08 III star, which is exciting a HII region named S 264. Zhang et al. (1989) detected with IRAS a dust ring (diameter of 9 deg) centered around this star. Two dark clouds, Barnard 30 and 35 (B30 and B35) are located within this ring. The structure of the complex is illustrated by Figure 1, where we display a IRAS image taken at 12 microns. Based on a Hα emission survey, Duerr, Imhoff & Lada (1982), identified three stellar clusters centered around λ^1 Ori (Collinder 69) and the dark clouds B30 and B35. Dolan & Mathieu (1999, 2001, 2002, =D&M) collected deeper photometry (VRI filters) in an area about 8 sq.deg. centered on the OB association, discovering a significant population of low mass stellar members, and obtained medium resolution multifiber spectroscopy for those candidates closest to the central star. According to them, the turn-off age for the massive stars is ~6 Myr.

We have carried out a deep search with the 12 K mosaic camera of the Canada-France-Hawaii Telescope in the Rc, Ic filters. Figure 2 displays a Color-Magnitude diagram with field stars, cluster members from D&M and our new, fainter candidate members. The 2MASS database was mined to complement these data with $JHKs$ photometry and to remove spurious members from the initial list of candidates.

We have used near-IR photometry to look for color excesses due to circum(sub)stellar disks. The SFR possesses a large amount of them, essentially clustered around B30 and B35 (Figure 1). GTC/EMIR and GTC/CanariCam can play an important role in the search and characterization of fainter, cooler accreting disks around BDs.

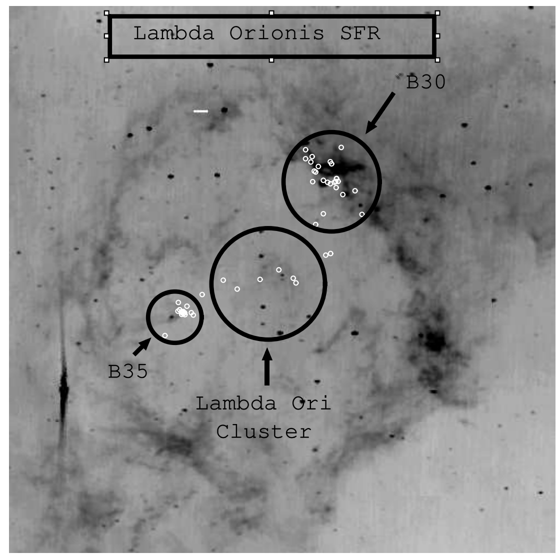

Fig. 1. IRAS image at 12 microns, 12.5x12.5 deg. North is up, East is left. Small circles located TTauri stars.

Spectroscopic information

Low and medium resolution spectroscopy from Keck and Magellan telescopes (Figure 3) have used to derived spectral types, lithium and Hα equivalent widths as well as other properties. These data are essential to remove from the membership list the few spurious members (foreground field dwarfs and background giants) left by the optical-infrared photometric selection. Since most of these objects are very faint, this step can only done by using large telescope (or a multi-slit spectrograph with a large FOV). GTC/ELMER and GTC/Osiris could play a important role in this study.

Figure 4 displays a HR diagram for the low mass spectroscopically confirmed members of the Lambda Orionis cluster, whose age is constrained by the 3 and the 10 Myr isochrones. Optical-infrared Color-Magnitude diagrams corresponding to B30 and B30 indicate that these two associations might be younger (between 1 and 5 Myr).

We have also compared the lithium and Hα equivalent widths versus the spectral type. Lithium is rapidly depleted in late-type stars. In the case

[1]LAEFF-INTA, Madrid, Spain.

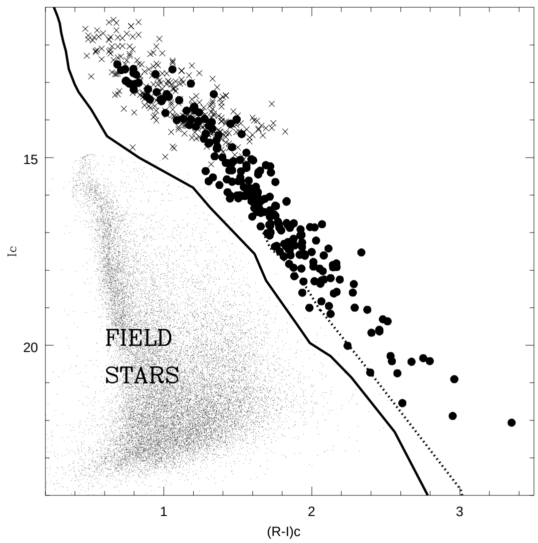

Fig. 2. Our initial search in the R, I filters. Our selection of candidate members appears as solid circles, whereas data from D&M are displayed as crosses. A 5 Myr Isochrone and an empirical MS are included.

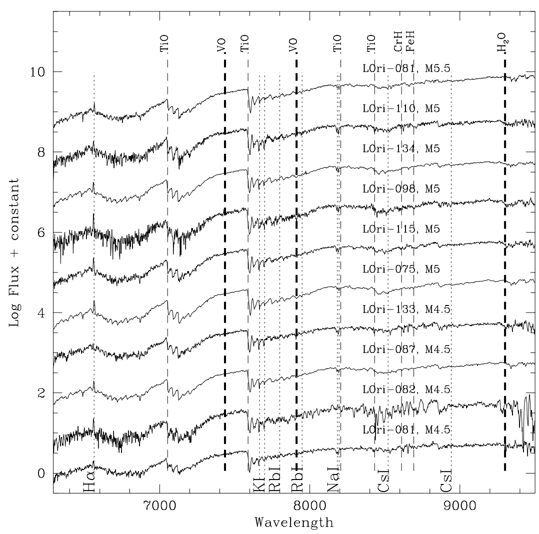

Fig. 3. A sample of our low resolution spectra.

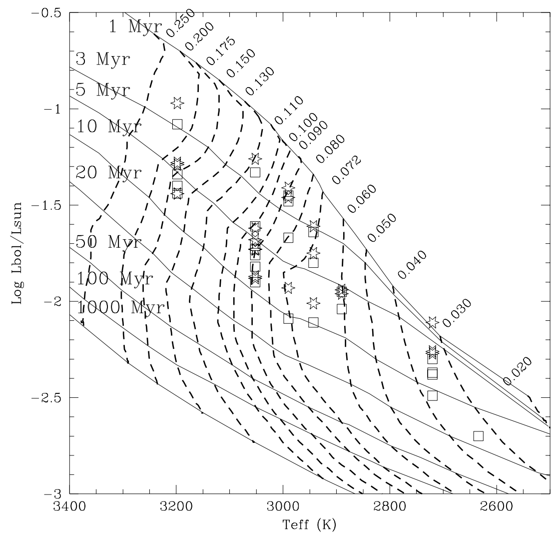

Fig. 4. HR diagram for the Lambda Orionis cluster (Collinder 69). The age can be estimated as 3-10 Myr.

of B35, B30 and Collinder 69 members, no depletion has taken place, since these stars and BDs are younger than 10 Myr. However, some Classical TTauri have a significant veiling, which reduced the measured W(Li) because the disk contribution to the spectral continuum.

The final lists of *bona fide* members have been used to derived the mass function in each cluster. Additional details can be found in Barrado y Navascués et al. (2004ab).

Future work

We are in the process of analyzing a large amount of photometry taken in two consecutive nights with INT/WFC, in an area close to the center of the Lambda Orionis cluster, in order to study the variability due to rotation. This area will be investigated with the XMM-Newton satellite, complementing the wealth of data already acquired with X-ray information. Moreover, the photometric dataset, once stacked together, will be used to look for very low mass members, two magnitudes fainter than our present data. We already have deep IR data for this area. The intrinsic faintness and reddeness of the prospective candidates will require the use of a IR spectrograph attached to a 10m class telescope, such as GTC/EMIR. Finally, we have a requested a SPITZER campaign to investigate the properties of the disks around these three clusters and search from faint members.

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