RevMexAA (Serie de Conferencias), **16**, 261–262 (2003)

Science with the GTC 10-m Telescope (Granada, España, 5-8 febrero 2002)
Editors: José Miguel Rodríguez Espinosa, Francisco Garzón López & Verónica Melo Martín

LOW MASS STARS AND BROWN DWARFS IN OPEN CLUSTERS

David Barrado y Navascués

Laboratorio de Astrofísica Espacial y Física Fundamental, LAEFF-INTA, Apdo. 50727, E-28080 Madrid, Spain

We have carried out photometric searches in the optical in several nearby, young open clusters. The goal was to obtain a census of the stellar and substellar population for all of them. Near-infrared photometry and low–medium resolution spectroscopic were collected. Mass functions and ages based on the lithium depletion boundary were derived. We discuss the new age scale based on this new technique.

1. INTRODUCTION

Over the last few years, we have conducted several deep, extended surveys devoted to the search of low mass stars and brown dwarfs in young, nearby open clusters, down to $I_c \sim 24$. Our targets include the Trapezium, IC 2391 (Barrado y Navascués et al. 1999, 2001a), Alpha Persei (Stauffer et al. 1999), the Pleiades (Bouvier et al. 1998; Stauffer et al. 1998; Martín et al. 2000), NGC 2516, and M35 (Barrado y Navascués et al. 2001b). The final aim is to create a complete census in these associations in order to study different properties of the stellar and substellar components. One of the goals is to compute the mass function in each cluster and to compare them. This comparison can provide important insights regarding the influence of the environment on the stellar formation and the dynamics of the clusters.

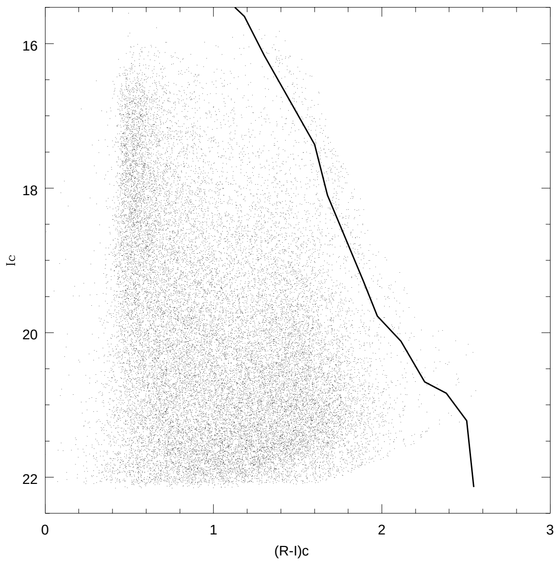

Fig. 1. Optical color–magnitude diagram in the NGC 2516 field of view. An empirical zero age main sequence is superimposed. Diagrams like this one have been used to select candidate members in several open clusters.

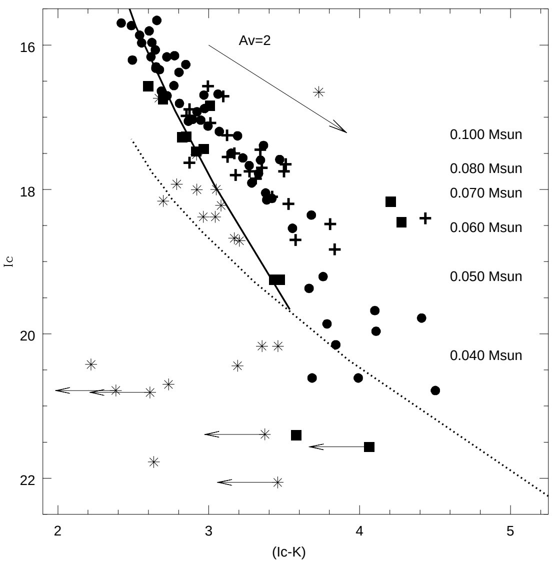

Fig. 2. Alpha Persei: Solid symbols and crosses correspond to probable and possible members of the cluster; asterisks represent interlopers.

2. THE OPTICAL–INFRARED PHOTOMETRY

We have used the Cousins RI filters, in order to obtain color–magnitude diagrams and to select possible cluster members (Figure 1). In some cases, we also used Johnson V and Z at ∼1 micron. For each cluster, we have collected additional infrared (JK) photometry in order to reject spurious members (mostly field stars, see Figure 2). The final lists of bona fide members have been used to derived the mass function in each cluster (Figure 3).

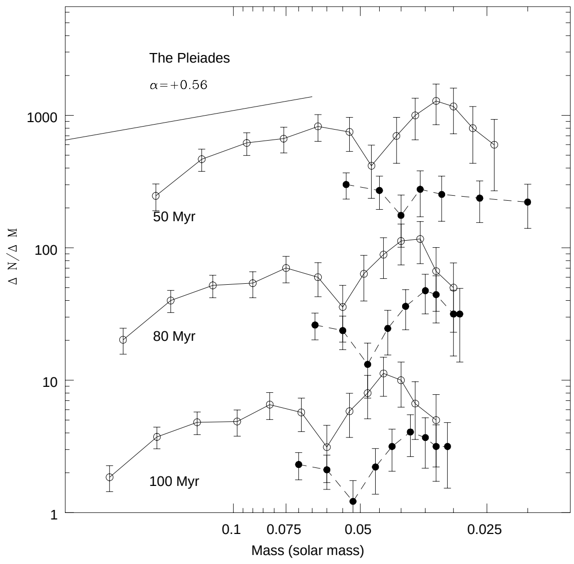

Fig. 3. Mass function of Alpha Persei. Open and solid symbols correspond to calculations done with different models and ages.

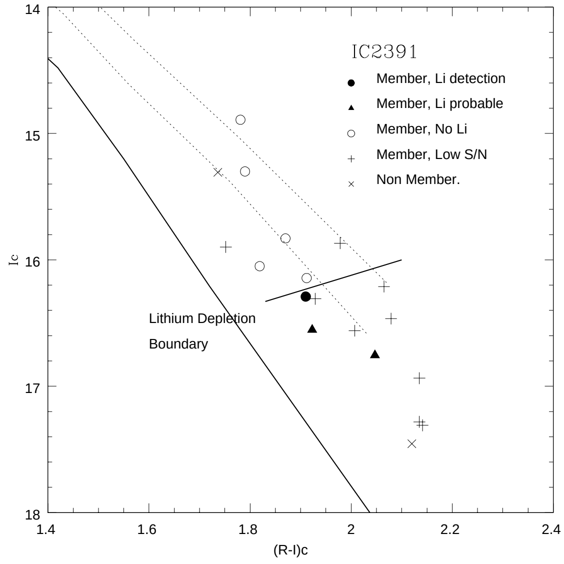

Fig. 4. Lithium depletion boundary in IC 2391.

3. CONFIRMATION AND PROPERTIES: SPECTROSCOPY

Low–medium resolution spectroscopy is used to derived spectral types. Additionally, these spectra contain features which are sensitive to the gravity, $T_{\rm eff}$, and age. Most of our cluster candidate members are very faint; this step can only taken by using large telescopes such as Keck, VLT, and GTC.

Lithium is destroyed at low temperatures (2.5 million degrees). Since low mass stars and brown dwarfs are fully convective, this element can be used to estimate the age of the cluster. This process has been carried out in IC 2391, Alpha Persei, and the Pleiades. The new ages are ∼50% older than those obtained using the upper main sequence (turn-over ages). Based on these data, Barrado y Navascués et al. (1998) have defined a new age scale. Both age scales agree with each other if a moderate core overshooting is introduced in the theoretical models.

REFERENCES

Barrado y Navascués, D., et al. 1998, ApSS, 263, 239
Barrado y Navascués, D., et al. 1999, ApJ, 522, L53
Barrado y Navascués, D., et al. 2001a, ApJS, 134, 103
Barrado y Navascués, D., et al. 2001b, ApJ, 546, 1006
Bouvier et al. 1998, A&A, 336, 490
Martín, E. L., et al. 2000, ApJ, 543, 299
Stauffer, J. R., et al. 1998, ApJ 504, 805
Stauffer, J. R., et al. 1999, ApJ 527, 219

Science with the GTC 10-m Telescope (Granada, España, 5-8 febrero 2002)
Editors: José Miguel Rodríguez Espinosa, Francisco Garzón López & Verónica Melo Martín