IAU Symposium 211: Brown Dwarfs
ASP Conference Series, Vol. 000, 2002
E.L. Martin, ed.

A search for brown dwarfs in the Alpha Persei cluster

Nicolas Lodieu & Mark McCaughrean

Astrophysikalisches Institut Potsdam, An der Sternwarte 16, D–14482 Potsdam, Germany

Jérôme Bouvier

Laboratoire d'Astrophysique de Grenoble, Université Joseph Fourier, BP 53, F–38041 Grenoble Cedex 09, France

David Barrado y Navascués

Laboratorio de Astrofísica Espacial y Física Fundamental, INTA, P.O. Box 50727, E–28080 Madrid, Spain

John R. Stauffer

IPAC, California Institute of Technology, Pasadena, CA 91125, USA

Abstract. We present preliminary results from a deep near-infrared survey of a ~ 1 square degree area in the young open cluster Alpha Persei using the wide-field Omega-Prime camera on the Calar Alto 3.5m telescope, yielding a list of new low-mass cluster members, including brown dwarf candidates.

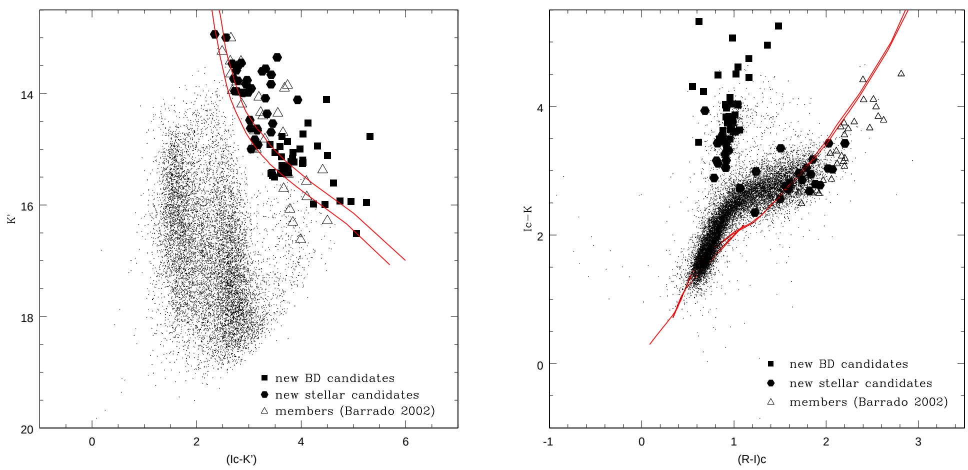
1. Previous results for the α Per cluster

Interest in low-mass stars and brown dwarfs in young clusters has increased dramatically during the last few years. The Pleiades, σ Orionis, Trapezium, and ρ Ophiuchi clusters, as well as the Taurus low-mass dark cloud, have been studied intensively in order to detect brown dwarfs and derive a mass function in the substellar regime. Our work focuses on the relatively young (90 Myr), nearby (180 pc) open cluster Alpha Persei, located at low galactic latitude with negligible internal extinction. Brown dwarfs are predicted to lie at K magnitudes in the range 15–18. Stauffer et al. (1999, ApJ, 527, 219) surveyed ~ 3 square degrees of the cluster in the R and I bands using the wide-field MOSA camera on Kitt Peak, making an accurate age determination via the lithium method, and obtaining a list of new candidate members, including two brown dwarfs. Recently, Barrado et al. (2002, A&A, in press) extended this list by combining deep optical and infrared photometry, and derived a mass function to a detection limit of 0.035 $M_{\odot}$. With a slope of α=0.74$\pm$0.05 in the mass spectrum $\phi \propto M^{-\alpha}$, the mass function for α Per is similar to that of Pleiades, although the shape is uncertain below 0.050 $M_{\odot}$ due to background star contamination.

2. Infrared survey of the α Per cluster

Five of thirteen optical fields-of-view (each $35.4' \times 35.4'$) have been imaged in the K'-band with the wide-field Omega-Prime camera on the Calar Alto 3.5m telescope. Using theoretical isochrones (Baraffe et al. 1998, ApJ, 337, 403) for 50 and 100 Myr, bracketing the age of the cluster, we derived a list of new stellar and substellar member candidates from the (K', $I_c - K'$) colour-magnitude and ($I_c - K'$, $(R - I)_c$) colour-colour diagrams shown in the figure below. Open triangles are probable candidates from the optical study (Barrado et al. 2002), filled hexagons and squares are new member candidates above and below the substellar limit, respectively. Our main conclusions from these data are:

1. Our ability to detect low-mass objects in the cluster is limited by the optical data, not the infrared
2. New low-mass members of the cluster, including brown dwarf candidates, have been located by the optical/infrared study
3. Many of the new brown dwarf candidates in fact appear to be giants judging from the colour-colour diagram



3. Future work

Two-thirds of the optical survey remains to be followed up in the infrared, to increase the statistics for low-mass objects across the stellar/substellar divide. Furthermore, optical/infrared selected member candidates will be observed spectroscopically to confirm their membership and better constrain the age of the cluster. The ultimate goal is to disentangle cluster members from background stars in order to derive a true mass function for this low galactic latitude cluster combining optical and infrared photometry, spectroscopy, and proper motion measurements.

Acknowledgments. This work was supported by the European Research Training Network "The Formation and Evolution of Young Stellar Clusters" (HPRN-CT-2000-00155).