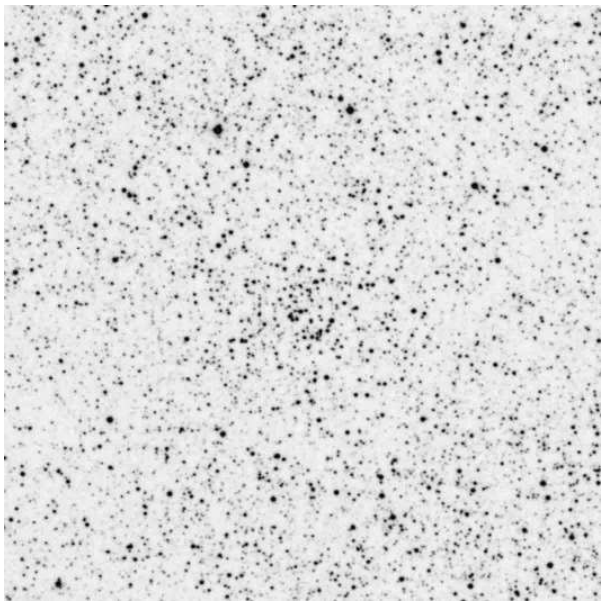

Fig. 3. The $15' \times 15'$ field of Berkeley 44 from the Palomar Observatory Sky Survey red image of the field. The image is centered on 2000 co-ordinates: 19:17:16, +19:33:00, the cluster center identified visually.

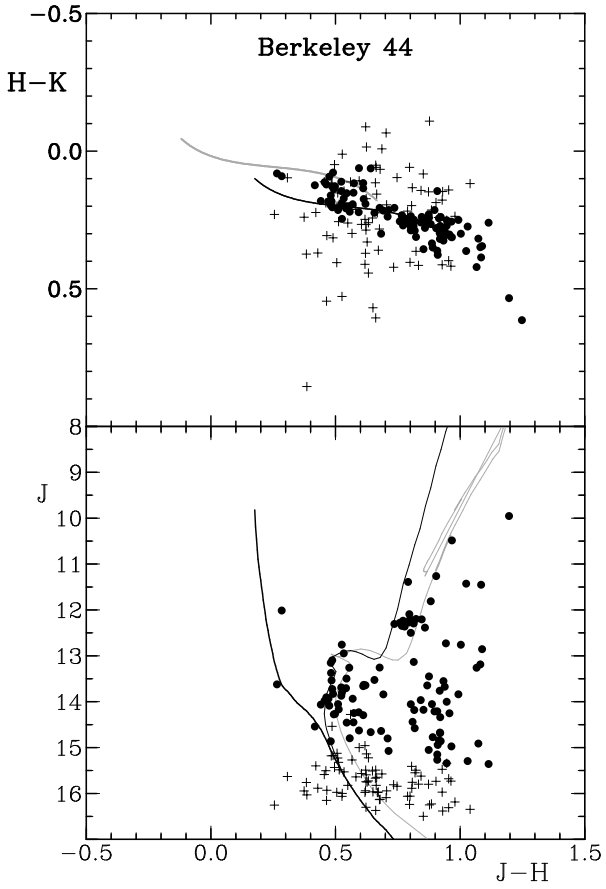


Fig. 4. $JHK_s$ photometry for stars within $2'$ of the center of Berkeley 44 with magnitude uncertainties smaller than $\pm 0.05$ (points) as well as with larger uncertainties (plus signs). The intrinsic color-color relation is depicted in gray (upper), while the intrinsic relations for $E(J–H) = 0.295$ ($E(B–V) = 1.00$) and $J–M_J = 12.1$ ($V_0–M_V = 11.38$) are shown as black lines. The thin black curve is an isochrone for $\log t = 9.3$ adapted from Meynet et al. (1993), the thin gray curve an isochrone of identical age from Bonatto et al. (2004).

with some question about its reality because of ambiguities in the star counts and the similarity of its color-magnitude diagram to that of stars in the surrounding reference field. The published co-ordinates for the cluster by Dias et al. (2002) and Carraro et al. (2006) do not match the optical density peak visible on the Palomar Observatory Sky Survey, and an alternate cluster center (Figure 3) was adopted here. The group lies more than 3° from the Galactic plane, so contamination by foreground early-type stars should be relatively low. However, the extreme faintness of cluster stars makes it necessary to consider both high quality and low quality 2MASS data for the field, with uncertainties of $\pm 0^{\rm m}.05$ representing the demarcation.

The 2MASS $JHK_s$ data for Berkeley 44 (Figure 4) confirm that it is an old open cluster. The cluster color-color diagram is devoid of early-type stars lying within $2'$ of the adopted cluster center, most cluster members being cooler late-type stars. A few stars of inferred spectral types G and K appear to be essentially unreddened, with most stars of spectral types F or later reddened by similar amounts. The cluster color-magnitude diagram reveals a well-defined clump of red giants at $J \simeq 12.2$ with implied spectral types of early K, so the identification of this cluster as an old cluster is confirmed. The optimum fit by eye to the $JHK_s$ observations yields a reddening of $E(J–H) = 0.295 \pm 0.02$ ($E(B–V) = 1.00 \pm 0.07$) and a distance modulus of $J–M_J = 12.1 \pm 0.1$ ($V_0 - M_V = 11.38 \pm 0.24$), corresponding to a distance of $d = 1.89 \pm 0.21$ kpc. The uncertainty in the intrinsic distance modulus includes the uncertainty in interstellar extinction towards the cluster. The ZAMS fit is tied to low quality $JHK_s$ observations at the faint end, so may be less well-established than the formal uncertainty suggests, although the implied distance agrees closely with the value of 1.8 kpc derived by Carraro et al. (2006). The implied cluster reddening is significantly smaller than the value of $E(B–V) = 1.40 \pm 0.10$ obtained by Carraro et al. (2006), which in any case is