THE HYADES: DISTANCE, STRUCTURE AND DYNAMICS

A.G.A. BROWN
Sterrewacht Leiden, Postbus 9513, 2300 RA Leiden, The Netherlands

AND

M.A.C. PERRYMAN
Astrophysics Division, European Space Agency, ESTEC, Noordwijk 2200AG, The Netherlands

The Hipparcos parallaxes and proper motions together provide a consistent picture of the Hyades distance, structure and dynamics. They yield a cluster convergent point motion consistent with the individual trigonometric parallaxes, and together explain the large distance modulus derived from the most recent ground-based proper motion investigations as originating from differences in the space velocity and small systematic effects in the ground-based proper motions. Conversely, the smaller distance modulus generally derived from a variety of ground-based trigonometric parallax programmes originates from systematically larger values of the ground-based parallaxes. Although recent distance determinations to individual objects in the cluster, most notably the results of Torres et al. (1997a,b,c), are in excellent agreement with the Hipparcos trigonometric parallaxes, extrapolation to a mean cluster distance is again affected by systematic effects in the ground-based proper motion studies.

The combination of the Hipparcos astrometry with radial velocity measurements from ground-based programmes provides three-dimensional velocities allowing candidate membership selection to be based on 3-dimensional positional and kinematical criteria. A number of new cluster members have been found within 20 pc of the cluster centre. No evidence for systematic internal velocity structure is found; rather, the results are fully consistent with a uniform cluster space motion with an internal velocity dispersion of about 0.3 km s^{-1}. Spatial distribution, mass segregation, and binary distributions are consistent with N-body simulations.

The cluster has a tidal radius of $\sim$ 10 pc. Outside this region, the stellar distribution is elongated along the direction of the Galactic centre and anti-centre, and is slightly flattened in the direction perpendicular to the Galactic plane. Inside this sphere, the cluster has spherical symmetry with a core radius of $r_c \simeq 2.7$ pc, and a half-mass radius of $\sim$ 6 pc. The presence of objects closely linked kinematically with the cluster core, but well beyond the tidal radius, probably originates from dynamical interactions in the centre combined with diffusion beyond the Lagrangian points.

With the caveat that the importance of the Hipparcos results is to provide individual distances to cluster members, rather than a mean cluster centre of mass (a concept meaningful only in the restricted context of the cluster members contained in the Hipparcos Catalogue), our estimated distance to the observed centre of mass for the objects within 10 pc of the cluster centre is 46.34 ± 0.27 pc, corresponding to a distance modulus $m - M = 3.33 \pm 0.01$ mag. This mean distance is only marginally modified (by about 0.4 pc) for the derived centre of mass for Hipparcos objects within $r < 20$ pc of the cluster centre. A possible bias in the cluster distance due to the Lutz-Kelker effect is small and of the same size as the error in the mean distance.

For full details on these results we refer to Perryman *et al.* (1997).

References

Perryman, M.A.C., Brown, A.G.A., Lebreton, Y., Gómez, A., Turon, C., Cayrel, G., Mermilliod, J.-C., Robichon, N., Kovalevsky, J., Crifo, F., 1997, *Astron. & Astroph.*, in press
Torres, G., Stefanik, R.P., Latham, D.W., 1997a, *Astroph. Journ.* **474**, 256
Torres, G., Stefanik, R.P., Latham, D.W., 1997b, *Astroph. Journ.* **479**, 268
Torres, G., Stefanik, R.P., Latham, D.W., 1997c, *Astroph. Journ.* **485**, 167

J. Andersen (ed.), Highlights of Astronomy, Volume 11A, 578.
© 1998 *IAU. Printed in the Netherlands.*

https://doi.org/10.1017/S153929960002236X Published online by Cambridge University Press