

DYNAMICAL AGE DETERMINATION OF OPEN CLUSTERS

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The radial mass distribution (obtained by counting stars in strips) of the real cluster is compared successively to the distribution functions of a simulated cluster of 100 stars, each of which corresponds to a certain dynamical age, T_{dyn} . The value of T_{dyn} belonging to the function most similar to the observed one is taken to be the dynamical age of the cluster. The radius is given in units of $R_{1/2}$ (sphere containing half of the total mass); this unit is nearly time-independent. The difference between the distribution functions is measured by the maximum Δ_{max} of the Kolmogorov-Smirnov test which is free from assumptions on the form of the distributions. The minimum in the plot Δ_{max} vs T_{dyn} indicates the age of the cluster. It is then converted into an absolute age, T_{abs} (in years), by

$$T_{\text{abs}} = 1.5 \cdot 10^7 \cdot T_{\text{dyn}} \sqrt{\frac{\bar{R}^3}{\bar{m}}} \cdot \frac{\ln(100/\sqrt{8}) \cdot \sqrt{N}}{\ln(N/\sqrt{8}) \cdot 10}$$

The error due to the dynamical theory (limited number of distribution functions, etc.) is estimated at 12%, the error due to the uncertainty of diameter and mass of the cluster is about 30%. Unreliable results were obtained in case of strongly inhomogeneous reddening of the cluster. As an example, the plot of the test values for NGC 457 is given in Figure 1.

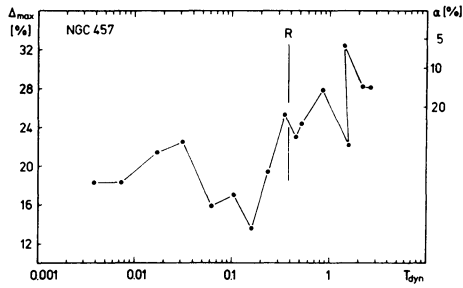


Figure 1. Δ_{max} versus T_{dyn} for NGC 457. The values at top right give the significance for a single point. Although all points lie outside the range of significance, the form of the curve allows a significant age determination.

The following ages (in units of 10^7 y) were determined (evolutionary ages in brackets)

NGC 457	-	1.5	(1.6)
NGC 663	-	0.8	(0.8)
NGC 869	-	1.3	(1.5)
NGC 884	-	0.8	(1.0)
NGC 7235	-	0.3	(0.5)