

The study of age and distance of open cluster by using H-R diagram

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Abstract

The study of age and distance of the open cluster using the H-R diagram. The purpose of this study were to determine age and distance of the cluster used by Main sequence turn off point and Main sequence fitting methods. The instruments used were PROMPT 8 Telescope of the CTIO. Using photos of open clusters; M11, M6, M23 and IC4651 in B and V filters. The results of this study were M11 was 2300 million years old, at a distance 2,308 pc; IC4651 was 3088 million years old, at a distance 476 pc; M23 was 2439 million years old, at a distance 42 pc; and M6 was 3622 million years old, at a distance of 163 pc.

Key words: Main sequence turn off point, Main sequence fitting

Introduction

The age of the star cluster can be obtained from the lifespan of a star that was turning off the main sequence. The age of the star cluster that estimates of the lifespan of a star which is evolved into red giant. This is referred to that point, the Main sequence turn off point. Moreover, we can use H-R Diagram to find the distance between Earth and the star clusters that are based on the Distance Modulus, which will use the color index (B-V) compared to the absolute magnitude of main sequence stars from stellar classification table and bring out the absolute magnitude to obtain the distance of open star clusters.

Materials and Methods

1. The photographs of open star clusters M6, M23, M11 and IC 4651 taken by PROMPT 8 Telescope in B and V filters
2. The magnitude of each star in each star cluster calculated. And we used the magnitude of reference stars from NOMAD and USNO A2.0 database.
3. H-R diagram created by the X-axis is the B - V and Y axis is the apparent magnitude of stars in the V filter.
4. Find the main sequence turn off point, then bring out B-V value to determine the absolute magnitude and get the mass of the star in solar mass unit from stellar classification table.
5. Substitute the mass of star to the equation $T_{ms} = 10^{10} \left[\frac{M}{M_{sun}} \right]^{-2.5}$ and obtained the age of a star cluster from lifespan of stars that turn off the main sequence.
6. Substitute the absolute magnitude and apparent magnitude in V filter to the equation $m - M = 5 \log d - 5$ to determine the distance of the star cluster.

Results and Discussion

The analysis of age and distance of each open star clusters found that the distance and age of open clusters is different. And the age and distance of the cluster using the Main sequence turn off point and the Main sequence fitting, respectively, may be a discrepancy. This is because the selection of the stars along the main sequence is very fragmented. Thus, the age and distance of the cluster was calculated is quite different from the database.

The figures showed the H-R diagram of open star clusters that used in this study. The circles are show the estimated main sequence turn off point. The stars in the circle were chosen to find the age of the star cluster

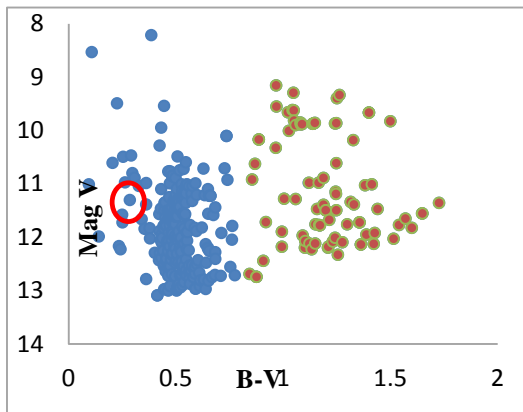


Figure 1: H-R diagram of IC 4651

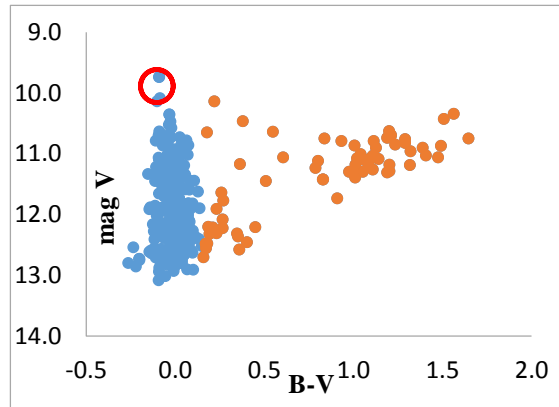


Figure 2: H-R diagram of M11

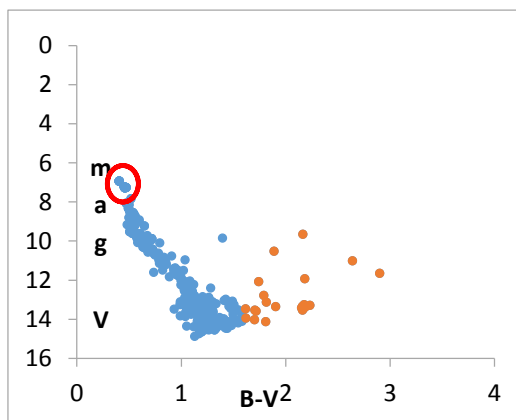


Figure 3: H-R diagram of M6

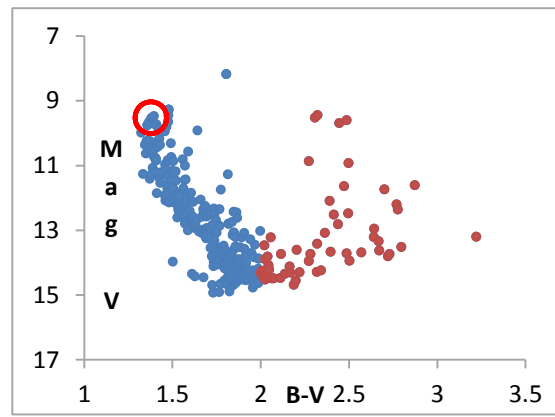


Figure 4: H-R diagram of M23

Conclusions

A study of the age and distance of the open star cluster using the H-R Diagram by the Main sequence turn off point and Main sequence fitting method found that, M11 was 2300 million years old, at a distance 2,308 pc; IC4651 was 3088 million years old, at a distance 476 pc; M23 was 2439 million years old, at a distance 42 pc; and M6 was 3622 million years old, at a distance of 163 pc.

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