Estimating the age of open cluster M18 using H-R Diagram

Nunthapong Nunthasin
Adviser Mrs. Jiraporn Kakaew
Pua school Nan Thailand
E-mail: fifafifa6@icloud.com

Abstract

This research calculates the age of the M18 open clusters. A photo is taken form PORMPT 5 in filter B and V for 60 seconds per image. After that we measure Magnitude and color index. Then the age is found by plotting the H-R Diagram and finding the main sequence turn-off point. Based on the main sequence turn-off point, we have estimated that the age of M18 cluster is no greater than 4.3 billion years.

Introduction

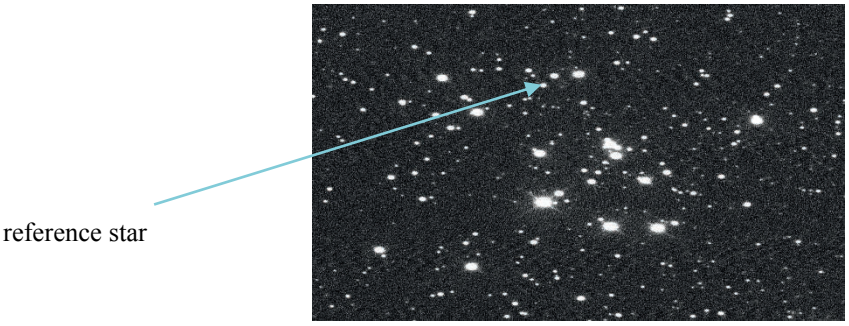
An open Cluster is a groups of fixed stars created by the collapse of a nebula. Each fixed star is attracted to surrounding other fixed stars, creating clusters.

The principal source of energy for each fixed star is a series of reactions called nuclear fusion, occurring in the center of the star. The reaction rate is more or less dependent on the mass of the fixed star such as fixed star with a lot of mass have a higher reaction rate than fixed star with less mass.

H-R Diagrams show the physical properties of fixed stars. The arrangement of many stars seen in an H-R Diagram is called a main sequence. The point where the main sequence line of a cluster began to diverge to become red giant is called the Main Sequence Turn-off point.

Materials and Methods

First, we find the apparent Magnitude by using Aperture Photometry with photos taken from PORMPT 5 in filter B and V. Then we find the Absolute Magnitude of a reference star in filter B and V from the Aladin database. After that we find the Magnitude constant by finding the difference of apparent Magnitude and Absolute Magnitude of a reference star. Then we find Absolute Magnitude of all the stars in the photo by subtracting the Magnitude constant form the Appear Magnitude.



Afterwards we find the color index by subtracting the Absolute Magnitude in filter V form the Absolute Magnitude in filter B. Then plot the H-R Diagram. The Y-axis is apparent Magnitude in filter V and the X-axis is the color index. When we have a H-R Diagram of M18 open clusters, we find the Main Sequence Turn-Off Point. We use the color index of the Main Sequence Turn-Off point to calculate the age of M18 open clusters by using the color index to find the class of the fixed star in order to find the approximate mass and then use the following equation to find the lifetime of a main sequence star:

$$\tau MS \approx 10^{10} x [\frac{m}{m\odot}]^{-2.5}$$

τMS is limit of life of fixed star in main sequence.

m is mass of fixed star.

m⊙ is mass of the sun.

Results and Discussion

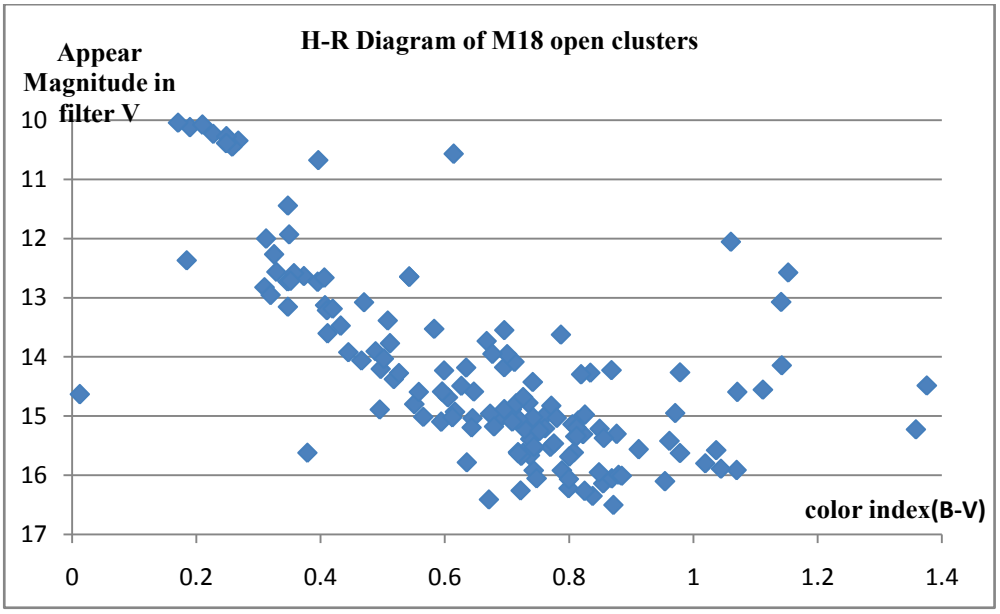


Photo 1 : H-R Diagram of M18 open clusters

From the H-R Diagram, we will find that the Main Sequence Turn-Off Point has a color index 0.3. Then we will know the mass of the fixed star is 1.4 the mass of the sun. When we calculate the age of the M18 open clusters we find that the age of M18 cluster must not be older than 4.3 billion years.

Conclusions

When we plotted the H-R Diagram, we found the Main Sequence Turn-Off Point at the fixed star is RA 274.97381 Dec -17.13573. It has a color index 0.3. Then we calculated the age of the M18 open cluster and find the age of the M18 open cluster is 4.3 billion years. Age is specific to this main sequence turn-off point. When we change the main sequence turn-off point, age will change. Because of the graph doesn't explicitly show the main sequence turn-off point, the upper limit for the age is about 4.3 billion years.

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References

2013. "The Star Color Index". (online).
Available http://domeofthesky.com/clicks/bv.html (30 October 2013)

2013. "Stellar classification". (online).
Available http://en.wikipedia.org/wiki/Stellar_classification (30 October 2013)

2013. "basic query result". (online).
Available http://simbad.u-strasbg.fr/simbad/ (9 October 2013)