The Study of Stellar Population in Open Star Clusters

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Abstract

The purposes of this research to study the spectrum type ratio of star and Initial Mass Function (IMF) of open clusters. In this work, the databases were taken from SAOImageDS9 and SIMBAD Astronomical Database - CDS (Strasbourg). This data contains apparent magnitude in B and V filter. We create the color-magnitude diagram (CMD) to select only main-sequence stars. The relationship between the number of stars and the stellar masses in term of solar mass is described by power law. The results show that the ratio of stellar spectrum types of the open cluster in the view facing out the center of the galaxy has the ratio of F-type stars more than the other side. And from the analysis of the IMF shows that the open clusters in the view toward the center of the galaxy have more massive stars than the other side. This indicates that the Milky Way galaxy in the view facing its center is denser than the other side.

Introduction

The star cluster in the view facing means the cluster with galactic longitude coordinate in range $0^{\circ} - 90^{\circ}$ E and W. Likewise, the other view means the cluster with galactic longitude coordinate in range $90^{\circ} - 180^{\circ}$ E and W. We use the magnitude in V filter and color index to construct the CMD and find the stellar mass from the mass-luminosity relation. In this study, we are interested in studying the different population proportions of each type of stars and the initial mass function of the open clusters in each viewpoint.

Materials and Method

PART 1: The ratio of spectrum type

1. Grouping open clusters using the galaxy's longitude coordinate system and choosing which side of each clusters are.
2. Collecting information about apparent magnitude in B and V filter of the stars in each open cluster from SAOImageDS9 and SIMBAD Astronomical Database - CDS (Strasbourg).
3. Plotting CMD of each open cluster and selecting only main sequence stars.
4. Determine the mass of each stars in term of solar mass by using the criteria for classification of the spectra from the color index.

PART 2: Initial Mass Function

1. Calculating the stellar mass of each star using the mass-luminosity relation.
2. Dividing the mass into 7 equal periods.
3. Counting the number of stars in each period and calculating the average mass for each view.
4. Dividing the stellar mass in each period by the number of stars in that period.
5. Plotting the logarithm graph to find the relationship between the number of stars and the stellar masses in term of solar mass.

Result

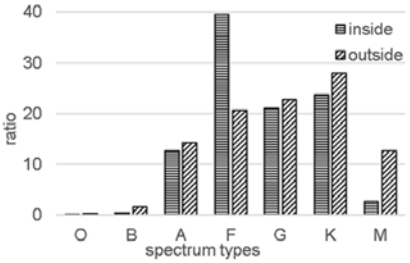

Figure 1: comparing the ratio of each spectrum type.

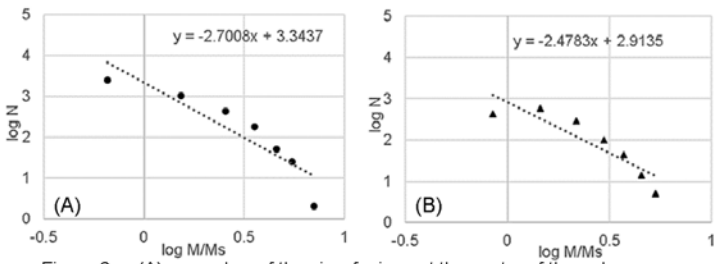

Figure 2: (A) power law of the view facing out the center of the galaxy.
(B) power law of the view facing the center of the galaxy

From the Figure 1, the open clusters in the view facing out the center of the galaxy has the ratio of F-type stars more than the other side. According to Figure 2, the equation of (A) is $y = -2.7008x + 3.3437$ and the equation of (B) is $y = -2.4783x + 2.9135$

Conclusions and Discussion

PART 1 The ratio of spectrum type

The star cluster in the view facing the center of the galaxy has the ratio of spectral type O B A F G K and M as follow 0.26, 1.51, 14.19, 20.68, 22.77, 27.93, and 12.59, respectively. And the other view has the ratio of spectral type as follow 0.07, 0.41, 12.57, 39.55, 21.05, 23.73, and 2.61, respectively. The ratio of spectrum types of the stars in the view facing out the center of the galaxy has the ratio of F-type stars more than the other side.

PART 2 Initial Mass Function

According to the analysis of the power law, the IMF of each side are obtained. From the graph in Figure 1, the IMF of the open clusters in the view facing out and in the center of the galaxy are $y = -2.7008x + 3.3437$ and $y = -2.4783x + 2.9135$, respectively. We get the relationship between the number of stars with mass M $(N(M))$ and the size of mass M as follow $N(M) = 940 \times M^{-2.4783}$ for the view facing the center of the galaxy and $N(M) = 2206 \times M^{-2.7008}$ for the view facing out the center of the galaxy. Consequently, the densities of the massive stars in the cluster in the view facing the galaxy is greater than the cluster in the view facing out the galaxy. This indicates that the open cluster in the view facing the center of the galaxy have more massive stars than the other side.

References

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