A Study of Nuclear Reaction of Hypergiant Stars Based on Their Photographed Spectral Lines

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Abstract

This study aimed to discover the elements of hypergiant stars and their ratio of hydrogen and helium abundances based on their spectral lines which were photographed by the telescope at the observatory in Nakhon Ratchsima. The results showed that O-, B-, A-, F-, G-, and M-type stars had the same elements including H, Na, Fe and He. However, Mg could be found only on the surface of A-, F-, K- and M-type stars. Moreover, it was found that the ratio of hydrogen and helium abundances of O-, B-, A- and F-type stars was more than 1. Among those stars, A-type stars had the highest of that ratio which was 2.97. Unlike those stars, the ratio of hydrogen and helium abundances of K- and M-type stars was less than 1 and K-type star had the least of that ratio which was 0.83.

Introduction

The stars are classified according to their spectral lines into 7 types: O, B, A, F, G, K and M [1]. In addition, luminosity classes of stars are subdivided into 8 classes: Hypergiant, Supergiant, Bright giant, Giant, Subgiant, Main sequence, Subdwarf and White dwarf [2]. In this study, the elements of all types of stars whose luminosities were within the hypergiant class were studied and chosen using the purposive sampling technique.

Materials and Method

1. The spectral lines of the hypergiant stars which had been chosen by the telescope at the observatory in Nakhon Ratchsima were photographed.

2. The photographs were processed and their noise was reduced using ISIS software. Then, the processed photographs were analyzed using Visual Spec in order to explore the stars' elements and their ratio of hydrogen and helium abundances. After that, the elements of those stars were compared.

Results and Discussion

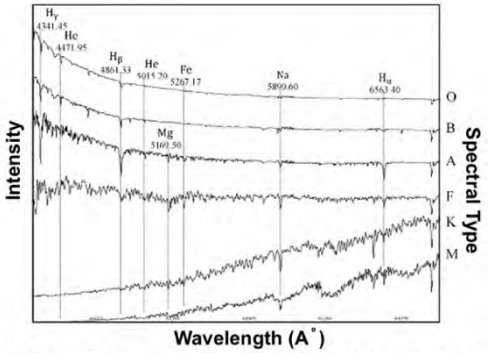

Figure 1: The relation between the intensity and wavelength of each type of stars

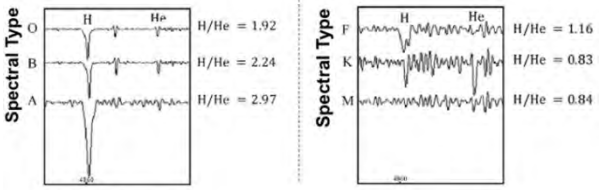

Figure 2: The position of hydrogen and helium absorption lines and the ratio of hydrogen and helium abundances of each type of stars

Figure 1 shows that there are eight wavelength positions of absorption features gained by using Visual Spec which calculated wavelengths in Angstroms. The wavelength positions included H_α (6563.40 A^O), Na (5890.60 A^O), Fe (5267.17 A^O), Mg (5169.50 A^O), He (5015.20 A^O), H_β (4861.33 A^O), He (4471.95 A^O), and H_γ(4341.45A^O). Among those, the six wavelength positions of absorption features including H_α (6563.40 A^O), Na (5890.60 A^O), Fe (5267.17 A^O), He (5015.20 A^O), H_β (4861.33 A^O), and He (4471.95 A^O) can be found in spectral lines of all types of stars. However, the wavelength position H_γ (4341.45 A^O) can be found only in the spectral lines of O-, B- and F-type stars. Furthermore, the wavelength position Mg (5169.50 A^O) can be found only in the spectral lines of A-, F-, K- and M-type stars.

According to Figure 2, the full width at half maximum (FWHM) ratio of hydrogen and helium abundances of O-, B-, A- and F-type stars was more than 1. Among those stars, A-type stars had the highest of that ratio which was 2.97. Unlike those stars, the ratio of hydrogen and helium abundances of K- and M-type stars was less than 1 and K-type star had the least of that ratio which was 0.83.

Conclusions

The study revealed that O-, B-, A-, F-, G-, and M-type stars had the same elements including H, Na, Fe and He. Moreover, Mg could be found only on the surface of A-, F-, K- and M-type stars. This finding was in accordance with a study conducted by Aurora Y. et al. who studied the spectral lines of diffent types of stars. Ragarding their study, it was found that Mg was the element of A-, F-, G-, K- and M-type stars only. It also showed that the ratio of hydrogen and helium abundances of O-, B-, A-, and F-type stars was more than 1. Unlike those stars, the ratio of hydrogen and helium abundances of K- and M-type stars was less than 1.

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[1] Wikipedia. (2018). Stellar classification. Retrieved December 24, 2019, from https://simple.wikipedia.org/wiki/Stellar_classification

[2] LESA. (2017). stars. Retrieved December 24, 2019, from http://www.lesa.biz/astronomy/star/starbirth