Emission Line Identification of 66 Oph

Kanpatom Kasonsuwan[1], Hasan Al Banna[2], Rukman Nugraha[2], Luthfiandari[3] and Apurba Pandey[4]

[1]Department of Physics, Faculty of Science, Naresuan University, Phitsanulok Thailand 65000

[2]Institut Teknologi Bandung, Bandung Indonesia 40132

[3]Indonesia University of Education, Bandung Indonesia 40154

[4] National Association of Nanotechnology and Ultra-science, Nepal 21267

*Corresponding Author: ISYA2013

Abstract

In this paper we analyzed identification spectra of 66 Oph using spectroscopy technique. The observation was done in the clear night sky of 4th September 2013 at National Institute of Public Administration, Jatinangor, West Java, Indonesia (S 06° 54', E 107° 45'). We detected H-α absorption line, λ= 6567.5 ± 7. 9 Å in the spectra of 66 Oph which is typically seen in normal B-type star. Halpha emission profile cannot be seen during our observation, suggesting that 66 Oph is in a Be-shell star status instead of an active Be star status.

Introduction

Be star is a non-supergiant B star which showed emission in one Balmer line (H-α) at least once (Jascheck and Egret, 1982). One example of this type star is 66 Oph, which it's emission profile was first identified by Meril and Burewll in 1933. It has spectral type B2Ve (Lesh, 1968), which e here means emission, and 4.64 magnitude in V-band (Kozok,1985). This star also has projected rotational velocity (V sin *i*) 280 $\pm$ 15 km/s (Floquet et al., 2002).

Floquet et al., (2002) argue that 66 Oph has long-term variability in H-α emission. They also predicted that Hα would disapear in the near future from 2002. Miroshnichenko et al., (2011) predicted that after Hα emission of 66 Oph disapeared in 2010, it will return in a few years. Martin (2013) report that 66 Oph is on the verge of resuming an active Be status.

Method

Spectroscopy Observation of 66 Oph

We observed 66 Oph by using DSS-7 spectograph + CCD ST-7 attached on Celestron C-8 (F/10). DSS-7 spectograph has Wavelength range 4000 – 8000 Å, Grating : 300 grooves/mm blazed at 550 nm fixed position,

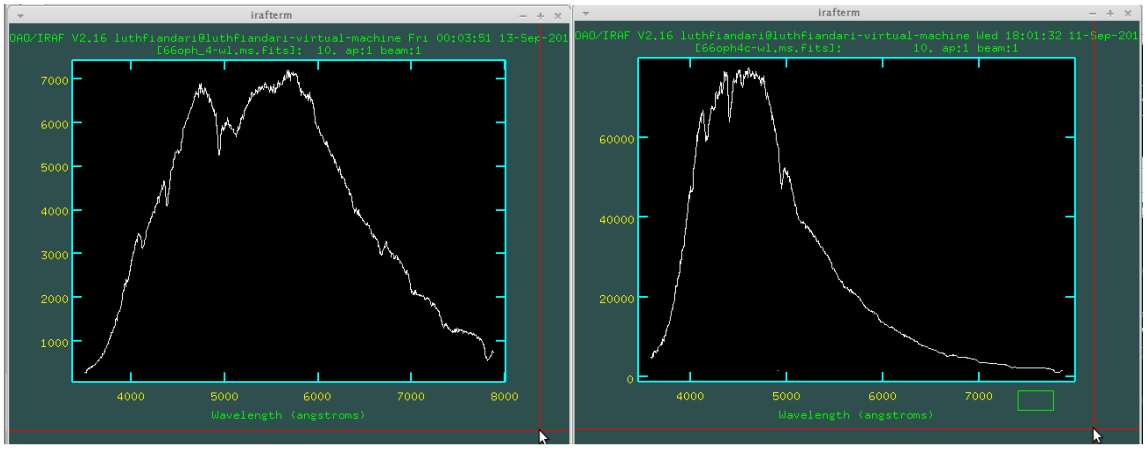
f/D input : 10.0, and Slit Widths : 50, 100, 200 and 400 microns. When combined with CCF ST-7, it has linier dispersion : 5.4 Å / pixel, resolution : 400, and wavelength coverage : 4139 Å. In our project, we use 50 slit width. We also use Phillips Geniewarm as calibrating spectrum. Observation was done in the clear night sky of 4th September 2013 at National Institute of Public Administration, Jatinangor, West Java, Indonesia (S 06^{o} 54', E 107^{o} 45').

In observation, we used Vega and Antares to calibrate telescope pointing and tracking. Telescope was pointed to Rasalhague first before pointed to 66 Oph. After compared with star chart, we was convinced that the star we observed was 66 Oph.

In process, we took Bias 1x, 66 Oph with exposure time 10 second 5 x, Dark for target star with exposure time 10 second 5x, and Comparison lamp with exposure time 5 second. Unfortunately we did not take dark for comparison lamp. Flat was taken by other group and then they shared to us.

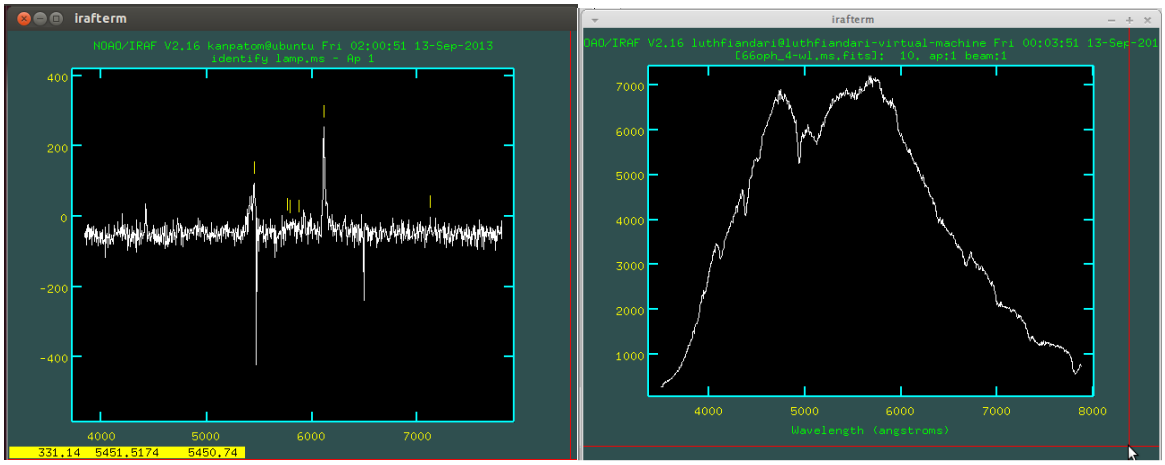
Data Analysis

Data were analysed by using IRAF. In preprocesing data step, after the target star image corrected to flat image, we got no H-α profile on 66 Oph spectrum. So that, we decided to not use the flat image in our data analysis. We only use Dark and Bias image in preprocessing step. Below are two spectrum of 66 Oph that uncorrected and corrected with flat image.



Picture 1. *Spectrum of 66 Oph that uncorrected (left) and corrected (right) with flat image*

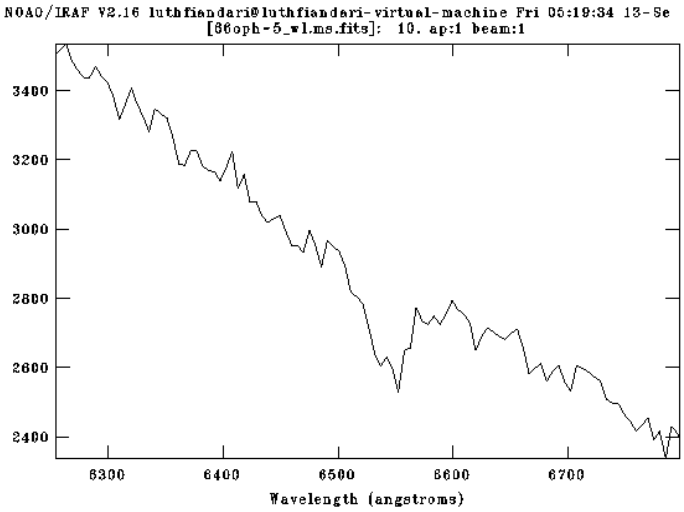
In order to calibrate the wavelength and identify the location of emission profile, spectrum of 66 Oph were corrected to comparison lamp spectrum. We identified the lines in lamp-line spectrum, especially wavelength at peak of the lamp (Philips Geniewarm). Its spectrum can be seen below in Picture 2 (left). Spectrum 66 Oph after calibrated to this lamp spectrum can be seen below in Picture 2 (right).



Picture 2. *Comparison Lamp spectrum (left) Spectrum 66 Oph after calibrated to comparison lamp spectrum (right)*

Result and discussion

To identify H-α profile, we zoomed 66 Oph spectrum around 6500 Å. As we can see in Picture 3, there is an H-α absorption line. The next step was finding the center of H-α profile and in this step we used Lorentzian method. After averaging the center in every image, we got the center wevelength of H-α was 6567.5 $\pm$ 7.9 Å.



Picture 3. *H-α profile of 66 Oph spectrum.*

The last step was finding emission sign of H-α profile. Unfortunately we can't identify emission profile of 66 Oph in H-α. We expect that it is because we did not use flux calibration in our project.

Conclusion

We can identify H-α profile from 66 Oph spectrum at 6567.5±7.9 Å. H-α emission profile cannot be seen during our observation. According to Martin (2013) that 66 Oph is on the verge of resuming an active Be status. Suggesting that 66 Oph is in a Be-shell star status instead of an active Be star status.

Acknowledgment

1. Mrs. Retno Dyah Hapsari , Our Mentorwho help us in this project
2. 35th International School for Young Astronomers (ISYA2013)
3. Dr. Amornrat Aungwerojwit for more information

References

1. Floquet, M., Neiner, C., Janot-Pacheco, E., Hubert, A. M., et al., 2002, A&A, 394, 137
2. Jascheck, M. & Egret, D. A Catalogue of Be-Stars, in Jaschek, M., & Groth, H.-G., eds. 1982, IAU Symp. 98, Be Stars, (Dordrecht: Reidel)
3. Kozok, J.R. 1985, A&AS, 61, 387.
4. Lesh, J.R. 1968, ApJS, 17, 371.
5. Martin, J., 2013, JAVSO, 41, 151.
6. Miroshnichenko, A.S., Zharikov, S.V., Fabregat, J., Reichart, D.E., et al., 2011, Be Star Newsl., 40, 42.