Identification and Determining The Pseudo Magnitude Of Meissa Star Based on Observation Data From The Eastern Sky In The Mentigen Hills of The Pseudo Magnitude of Meissa Star Based on Observation Data From The Eastern Sky

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Abstract. Mentigen Hill, Mount Bromo is a tourist area located at an altitude of 2,392 meters above sea level. As a tourist destination in Peak Bromo, the sky at night has almost no light pollution, it will be very good for observing celestial bodies. For this reason, identification and measurements of the pseudo magnitude of star observations are made using a camera. Meissa star is a blue giant star type O which is included in the Lambda Orionis. The rate at which a star is observed from Earth is called its apparent magnitude. Analysis of the identification and measurement of the pseudo magnitude of the stars can be done using the Iris 5.59 software. Based on the results of the analysis in the Iris 5.59 software, it was concluded that the Missa Star was identified and the apparent magnitude measurement was (3.87 ± 1.10) with an error of 2.39%. It is suggested by the results of this study to develop astronomical tourism.

1. Introduction
A clear night sky can show the beauty of a radiating celestial body. Seen from the earth with the naked human eye, there are many celestial bodies with different levels of brightness. Humans see the existence of a variety of material organizations in the form of various celestial bodies in the universe. Examples of celestial bodies such as the earth, solar system, planets, satelites, nebulae, asteroids, meteoroids, comets, space dust, black holes, galaxies and various stars. All celestial bodies appear through light that can be detected with the naked human eye or by using optical binoculars¹. The light that is detected is not all emitted from the celestial body itself. Some of the celestial bodies receive light reflection from other celestial bodies².

Stars are one of the celestial bodies that emit light in the universe³. The number of stars is very large, but there are some of the largest stars in this universe such as Aldebaran, Rigel, Betelgeuse, and Antares and so on. The stars do not spread evenly in the universe, but cluster together to form constellations. Meissa star is included in the Orionis lambda which is one of the stars in the Orion constellation. This star is a blue giant type O (blue giant type O) and is part of the cylinder 69 star group. Meissa or Heka comes from Arabic "Al-Maisan" which means "shining one". Heka also comes from Arabic, "Al Hakah", which means "white dot" comes from the additional dim light from the smaller φ1 and yang2 in the background.⁴ The star Meissa has a magnitude of 3.33 and a distance of 1098.18 light years. This star has coordinates + 83°58'43,7 "/ - 13°22'00,7" on Friday, November 1 2019 at 23:16 WIB on the Mentigen Hill, Mount Bromo. Mount Bromo is a good location for stargazing because it is far from cities and settlements so that light pollution disturbances that may occur are very small⁶.
The brightness of the stars can be captured using a telescope and an 8 MP digital camera. The brightness level of a star is its magnitude. The magnitude scale is the distance between the earth and the star. The magnitude of a star that can be observed from the earth is called the apparent magnitude. The apparent magnitude of a star can be determined from calculations in the Iris 5.59 software.

2. Method
The method in this observational, descriptive study uses quantitative methods to determine the magnitude of a star using the Iris 5.59 software which refers to the Stellarium software as the reference sky map. The magnitude of the star mesa can be seen from the star Betelgeuse as the reference star. Data collection for this research was carried out using a digital camera which was conducted at Mentigen Hill, Mount Bromo on Friday, November 1, 2019 at 23:16 WIB. The procedures carried out in this study are as follows:

1. Preparing and setting up tools, namely digital cameras.
2. Mounting a tripod along with a Nikon D5500 camera.
3. Check the quality of the sky that will be observed with a sky quality meter.
4. Determine the cardinal directions using a compass.
5. Pointing the camera at the part of the sky that is observed.
6. Set the camera to infinity focus, focal length 70.0 mm, diaphragm 5.6, shutter speed 13 "and ISO 16000.
7. Then press the shutter button to take a picture of the stars on Mentigen Hill.
8. Record the information obtained in the camera.
9. Information includes photo, name, exit data, time and part of the sky observed.
10. Analysis with Stellarium software and Iris 5.59 software.

To make it easier to understand the research carried out, it is illustrated by the following diagram:

Figure 1. Research Flow Diagram

| Prepare the camera including tripod |
|------------------------------------|
| Observing the sky                  |
| Take a picture of sky              |
| Analyzing and discussion           |
| Conclusion                         |
From the research results obtained data, such as the table below:

| No. | Format                  | Information                        |
|-----|-------------------------|------------------------------------|
| 1   | File Type               | JPEG                               |
| 2   | Sky Quality             | 20.79 mags / Ac sec²               |
| 3   | Time                    | Friday, November 1, 2019, at 23:16 WIB |
| 4   | Location                | Mentigen Hill, Mount Bromo, East Java, Indonesia |
| 5   | Location Coordinates    | 7 ° 55’39” S 112 ° 58’09” E       |
| 6   | Camera                  | Nikon D5500                        |
| 7   | Focal Length            | 70.00 mm                           |
| 8   | Diaphragm               | 5.6                                |
| 9   | Shutter Time            | 13 ”                               |
| 10  | ISO                     | ISO16000                            |

Figure 2. Observation Result Data
3. Discussion

### Figure 3. Betelgeuse Star Information From Stellarium

**Betelgeuse (Al Mankib - Betelgeux - Martial Star - Mirzam)**

- **Type:** Red supergiant
- **Distance:** 676 light years
- **Color:** Red
- **Size:** 0.00624 of the Sun
- **Image:** [View Image]

![Betelgeuse Star Information From Stellarium](image)

**Figure 4. Meissa Star Information From Stellarium**

**Meissa (Heka)**

- **Type:** B Main Sequence Star
- **Distance:** 28.14 light years
- **Color:** Blue
- **Size:** 1.03 of the Sun
- **Image:** [View Image]

![Meissa Star Information From Stellarium](image)

#### 3.1 Determining the Magnitude of the Star Betelgeuse

Based on the information from Stellarium, it is known that the magnitude value of the Betelgeuse star is 0.45. This obtained magnitude is used as a calibration in determining the comparative magnitude constant between the results of the apparent magnitude analysis of the Betelgeuse star on Iris 5.59 software and the information obtained from Stellarium. To determine the magnitude constant of the Betelgeuse star, it is necessary to calibrate the measuring instrument in the Iris 5.59 software by determining the radius of the circle on the photometric aperture setting using two digital rings with a ratio of 1: 6. This radius ratio affects the intensity value of the Meissa star on the inner ring and the intensity of the surrounding sky on the outer ring. Then click on the Betelgeuse star which is at coordinates (359,244). Then set the magnitude constant value to 0 in the Iris 5.59 software (as shown in Figure 4) so that it can be adjusted to the apparent magnitude of the Betelgeuse star on the Stellarium of 0.45 as a reference. The apparent magnitude constant value of the Betelgeuse star in the Iris 5.59 software is 7,997 obtained from calculations using the formula:

\[
\text{Magnitude Constant} = \frac{\text{Apparent Magnitude of Betelgeuse on Stellarium}}{\text{Radius Ratio}}
\]
Where

\( Y \) : magnitude pseudo-star Betelgeuse on the Stellarium

\( x \) : Big Betelgeuse star apparent magnitude constant in Iris 5.59 software

\( c \) : Big Betelgeuse star apparent magnitude constant in Iris 5.59 software when the magnitude is constant 0

\[ y = x + c \]  

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**Figure 5.** Iris Settings For Determining Betelgeuse Star Magnitude

**Figure 6.** Iris Arrangements To Determine The Magnitudo Star Meissa
Table 2. The Value Of Meissa Star Magnitude

| No. | Coordinate | Pseudo magnitude |
|-----|------------|------------------|
| 1   | 252, 294   | 3,281            |
| 2   | 255, 290   | 3,864            |
| 3   | 256, 292   | 2,579            |
| 4   | 257, 293   | 3,570            |
| 5   | 254, 297   | 2,679            |
| 6   | 253, 293   | 2,874            |

To determine the apparent magnitude of the Meissa star, an analysis was carried out by determining several points for which the magnitude value would be known by placing the radius of the circle of the photometric aperture. Using the reference to the magnitude constant obtained previously from the standard star. After obtaining several apparent magnitudes from different points on the Meissa star as in the table above, the mean value of the apparent magnitude can be calculated. 3.144167. Then the standard deviation is also searched using equation 8 which gives the result of 0.511972. The apparent magnitude analysis result value of Iris 5.59 software is compared with the apparent magnitude value of Stellarium so it can be seen the level of measurement error. So that the apparent magnitude value of the Meissa star is (3.14 ± 0.51) with an error of 2.60% (less than 5%). From the results obtained, it is known that the apparent magnitude value obtained from the calculation is almost close to the magnitude value of Stellarium.

4. Conclusions

Based on research sky, which is conducted On the Mount Bromo Mentigen hill, data is obtained in the form of a picture of the night sky on Friday, November 1, 2019 at 23:16 WIB. The apparent magnitude value of the star Meissa is (3.87 ± 1.10) with an error of 2.39% (less than 5%) with the reference value for the magnitude of Stellarium. The value resulting from the analysis is not that far off. This can prove that determining the apparent magnitude of a star can be done through calibrated using the Iris software.

Reference

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