Introduction to E-maya Observatory

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Abstract. Located at the coordinates of 107°47′39″BT and -6°24′15″ LS, E-maya observatory is an observatory that close to the center of astronomical studies in Indonesia i.e., Bosscha Observatory and astronomy study program ITB, as well as Planetarium Jakarta, which is known as the first Planetarium in Indonesia. The E-maya observatory can facilitate education and training program. The observatory is a private observatory and it requires injection of knowledge and motivation. It is managed by people with modest astronomical background and therefore it requires hard work so that the observatory can still functioning properly. The E-maya observatory was established in 2013. At the beginning, it was aimed at providing helpers for the Rukyatul Hilal executors only. This coincide with the E-maya founder’s goals that is to participate in the development of the Indonesian Nation and to establish harmony between people of Indonesia. The founder believes that by providing a place for Rukyat Hilal, he can contribute to people and state. Beside Rukyatul Hilal activities, other activities are also carried out at E-maya observatory, for example photometry research by using a modest telescope, ZWO 120MM camera and DSLR; training activities in astronomy for students and teachers who are members of the Science and Physics MGMP; Hisab and Rukayatul training for Islamic organizations or foundations in collaboration with the Ministry of Religion and the Province; also services to measure Qibla direction.

1. Introduction
The E-maya observatory has similarities with other observatories. But, compared to the other observatories, E-maya observatory has indecent equipment and funding which is not as much as other observatories. Currently, E-maya observatory has limited human resources. The staff member needs to do considerable work, such as managerial task, practical work as technician, visitor guide, also maintenance for the observatory at the same time. Despite the challenges and limited resources, the founder of E-maya observatory and staff member commit to continuously improving the observatory and even adding more instrument in the future like radio telescope.

Basically, the location of E-maya observatory is suitable for Rukyatul Hilal. It is surrounded by rice field, has adequate horizon view, low light pollution, and accessible. Therefore, the founder built the observatory in the current location. As a matter of fact, E-maya observatory is one of the eight observation points for Rukyatul Hilal in West Java. The Regional Office and Ministry of Religion representative at West Java Province who had visited the observatory during the 1st Dzulhijjah 1439 H determination mentioned that E-maya observatory together with Sukabumi would be the iconic places for Rukyatul Hilal in West Java. In contrast to E-maya observatory, Sukabumi is a coastal district which facing the sea (or has sea horizon view). In addition, Sukabumi received enough financial support up to 3.5 billion rupiah from the Sukabumi government and the Center Office so that it can be used as the
representative place for Rukyat Hilal. Other activities in religious terms are rukyat reckoning training in cooperation with the ministry of Religion in Subang district and provincial.

Gradually, other activities (other than Rukyat Hilal) have been developed at the E-maya observatory, such as modest research on variable star based on photometry data. The research activities have been carried out and making good progress and still ongoing today. Photometry observation has been persistently performed at the observatory, therefore the staf member plan to continue the work by observing more variable stars, not only the short period variable stars but also the long period ones. The variable star observation was established as the long-term project and will be improved continuously, especially with the increase of human resource and in collaboration with astronomers from other observatories, i.e. Bosscha Observatory ITB.

E-maya observatory staf member also hold astronomical training for high school students to use astronomical devices and to try scientific activities, such as observing variable stars using DSLR camera and performing the analysis. Also, E-maya observatory provide training for junior and senior high school teachers who are members of the Subang Middle School Science MGMP and Subang Physics MGMP in developing astronomical learning devices for students in their respective schools.

2. The owned equipment
The E-maya observatory has a 3.5 m diameter dome and William optics telescope with a focus length of 477.9 mm and diameter of 81 mm inside the dome. The telescope is equipped with 1200D DSLR camera that has resolution of 5202 pixels x 3465 pixels, pixel width 14.9 mm x 22.3 mm and the pixel size is 4.29μm as the detector. In addition, there are other instruments, such as David H levy telescope with a diameter of 152 mm and a focal length of 729.6 mm, and ZWO 120MM camera with a resolution of 1280 pixels x 960 pixels, pixel width of 4.8 mm x 3.6 mm and the pixel size of 3.75 μm. Digital cameras have several advantages. Among the advantages it has linear photon response to reach saturation. The retrieval, processing, and testing the data of the response chip linearity (intensity) to the time of integration (exposure time) was same as the technique used in the photon-transfer curve plot. As for tested the validity level of the data obtained, the saturation value of the attached camera for photometry was quite sensitive with the count limit till approached 15303 as shown in the figure below.

![Figure 1. Liniearity curve of integration time with the signal obtained.](image1)

![Figure 2. Linerity curve of saturation.](image2)

By considering the saturation level of 1200D DSLR camera, data can be collected and processed as needed. Table 1 show the obtained data.

In addition, other than dome and equipment, E-maya observatory has several rooms that can be used to support research and astronomy learning activities. Among of them are multimedia room that currently still being worked on, library and auditorium.
3. Result

Using the equipment that are available at the observatory, we had conducted research not only focused on rukyatul hilal, but also variable star photometry. For the photometry, we have performed some observations and data retrieval was still ongoing, namely beta Perseus star with a period of 2.86 days and has a delta magnitude of 1.27 and up to now the data collection has reached 65%, as shown in the table in below.

| Data   | TL             | UT             | JD     | JD0    | E     | fase  |
|--------|----------------|----------------|--------|--------|-------|-------|
| 2018090809 | 09092018time02.58 | 08092018time19:58:40 | 2458370.33241 | 2445641.5135 | 4439.298232 |
| frame 2 | 09092018time05.15 | 08092018time22:15:26 | 2458370.42738 | 2445641.5135 | 4439.331354 | 0.033122 |
| 2018090910 | 10092018time02.15 | 09092018time19:15:05 | 2458371.30214 | 2445641.5135 | 4439.636435 |
| frame 2 | 10092018time05.14 | 09092018time22:14:58 | 2458371.42706 | 2445641.5135 | 4439.680002 | 0.043567 |
| 2018091011 | 11092018time03.51 | 10092018time20:51:28 | 2458372.36907 | 2445641.5135 | 4440.008537 |
| frame 2 | 11092018time05.18 | 10092018time22:18:33 | 2458372.42955 | 2445641.5135 | 4440.029630 | 0.021093 |
| 2018091112 | 12092018time00.17 | 11092018time17:17:06 | 2458373.22021 | 2445641.5135 | 4440.305380 |
| frame 2 | 12092018time05.06 | 11092018time22:06:06 | 2458373.42090 | 2445641.5135 | 4440.375373 | 0.069993 |
| 2018091314 | 14092018time00.53 | 13092018time17:53:36 | 2458375.24556 | 2445641.5135 | 4441.011741 |
| frame 2 | 14092018time05.12 | 13092018time22:12:52 | 2458375.42560 | 2445641.5135 | 4441.074531 | 0.062791 |
| 2018091516 | 16092018time00.58 | 15092018time17:58:01 | 2458377.24556 | 2445641.5135 | 4441.710327 |
| frame 2 | 16092018time05.05 | 15092018time22:05:16 | 2458377.42032 | 2445641.5135 | 4441.770209 | 0.059882 |

4. Conclusion

The E-maya Observatory was one of the private observatories in Indonesia, which certainly has advantages and disadvantages both in terms of funding and equipment. But the shortcomings that were taken did not necessarily discourage the intention, vision and mission of the construction of this observatory, such as utilizing existing equipment and available funds.

The scopes that were offered by observatory are Rukyatul Hilal activities, acceptance of astronomical visits, as well as variable star photometry research. This scope was the long-term project of this observatory and will continue to be improved along with the increase of human resources and cooperation with other observatories, i.e., Bosscha Observatory ITB. Other scope that have been carried out is to hold astronomical training for students to use astronomical tools and to do scientific activities, such as observing variable stars by using DSLR cameras. Also, holding trainings for junior and senior high school teachers who are members of the Subang Middle School Science MGMP and Subang Physics MGMP to make astronomy learning devices for students in their respective schools.

References

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