Proc. of the International Symposium on the NAOJ Museum
September 2015 in Tokyo, Japan

Gunma Astronomical Observatory, a Public Observatory with a Large Telescope

Osamu HASHIMOTO[1], Satoru YAMANO[1] and Akihito IGARASHI[1]
1 Gunma Astronomical Observatory. osamu@astron.pref.gunma.jp, yamano@astron.pref.gunma.jp, Igarashi-a@pref.gunma.lg.jp

Gunma Astronomical Observatory (GAO) is a public observatory equipped with a 150-cm reflector as its main telescope. It is one of the largest telescopes in the world used for the public star gazing, while it is used for scientific researches as well by professional astronomers and university students. The 150-cm reflector with its scientific instruments such as a high resolution spectrograph also plays a role as an exhibition item for the daytime visitors. GAO works as a museum of astronomy and astrophysics for the public. There are some exhibition items including a solar telescope and outside monuments of historical astronomical instruments.

1. Introduction

Gunma Astronomical Observatory (GAO) is a public observatory located in Gunma about 120 km north-west of Tokyo, being operated by Gunma prefecture local government. It can be regarded as a pioneer of the public observatories with a large telescope of full scientific capability. Its main telescope is a 150-cm reflector, which was the largest telescope in the world applicable to the public stargazing when it was built in 1999. The 150-cm reflector with its powerful scientific instruments (Fig. 1) also has an important function as an exhibition item for the daytime visitors. It is not only for the star gazing activities in the weekend evenings that GAO is working for the public, but it works as a sort of science museum for astronomy and astrophysics with various exhibition items in addition to the main telescope.

2. Telescopes of GAO

The 150-cm telescope has a full capability for the scientific observations of high standard, equipped with powerful instruments such as a high resolution Echelle spectrograph [1], [2] and a wide field near infrared camera [3]. Nevertheless its eyepiece optics at a Nasmyth focus provides chances of star gazing through such a large telescope for the visitors of all kinds. Photons gathered by the large aperture can show some interesting aspects of astrophysics in the stellar light in addition to the beautiful image of stars. For example, differences of colors from star to star, and a various characteristics of stellar spectra can be directly seen through the eyepiece. An eyepiece spectrograph (Fig. 2) has been developed recently, as it can provide a direct image and a spectrum of a star at the same time at two viewing points.

Usually star gazing programs for the public are carried out in the evenings of weekends and holidays. Schools and various kinds of groups are accepted in the weekday evenings. In daytime, the 150-cm reflector plays another role as the most important exhibition item in the museum function of GAO.

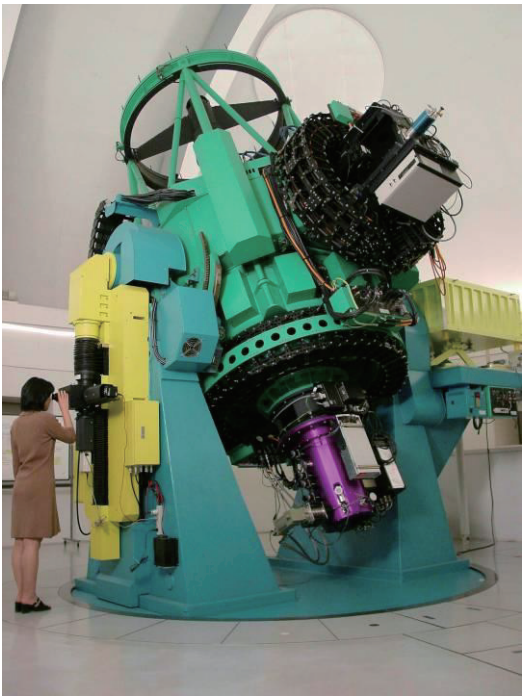


Fig. 1 The 150-cm reflector of GAO

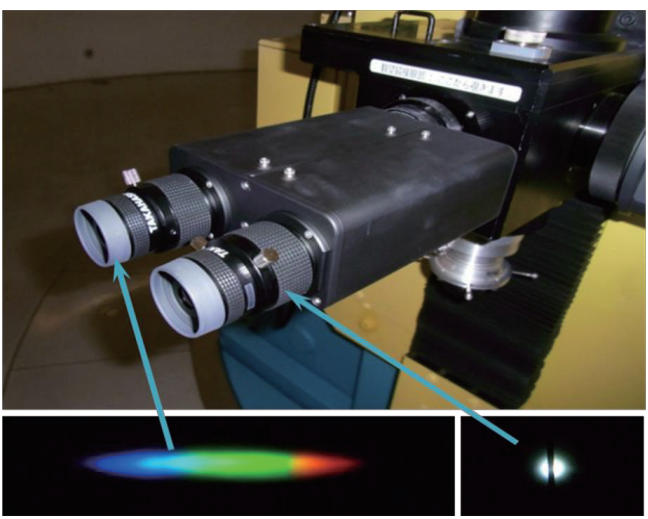


Fig. 2 The eyepiece spectrograph for the GAO 150-cm reflector. A stellar spectrum (left) and direct image (right) can be seen simultaneously.

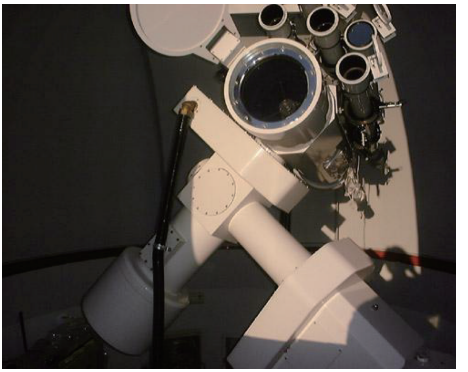



Fig. 3 The 30-cm solar telescope (left) and real-time solar images and spectrum in the exhibition area for the visitors (right)

There are smaller telescopes in addition to the main telescope. A 65-cm reflector on an equatorial mount, 25-30 cm reflectors and some portable telescopes are used for the star gazing programs. They are also used by amateur astronomers for their observations on weekends. In the daytime of clear sky, a 30-cm solar telescope on the roof provides a high resolution spectrum and a direct image as large as one meter in diameter on the screens in the exhibition area simultaneously (Figs. 3 and 4). There are additional video screens which show white and H-alpha monochromatic solar images at the same time. Those real time solar exhibitions tend to be more attractive and popular for the daytime visitors than other telescopes.

3. Exhibition

There are several exhibits of various kinds in the exhibition area of GAO (Fig. 5). Most of them are designed as visitors can study for themselves. A scale model of the 150-cm reflector and its real size dummy weight of primary mirror (Figs. 6 and 7) explain how a large telescope works. Comparison of two telescopes with different aperture sizes (Fig. 8) shows why larger telescopes are required for the astronomical observations. Some exhibition items (Fig. 9) present the basic principles of observations from a point of view of astrophysics. One exhibit shows the difference of spectra between a filament lamp and a fluorescent lamp (Fig. 10), while both lamps look quite similar for human eyes. Visitors can learn how the spectroscopic observation works in order to determine the physical properties of distant objects without touching them. A number of PCs and video tools are used for various sorts of explanations. Explanations of individual stars and many kinds of data and stories of them are provided. Also there are some exhibition boards of classical manner, which explain basic astrophysics of stellar evolution.

4. Outside Monuments

GAO looks like a park surrounded by natural woods in the mountain area. There are two monuments recalling astronomical instruments of ancient (Fig. 11). One is a scale model of Jantar Mantar, which was originally built and used in India of 18^{th} century. It consists of a number of measuring graduators. The other is a stone circle, which is coming from an idea inspired by Stonehenge in England.

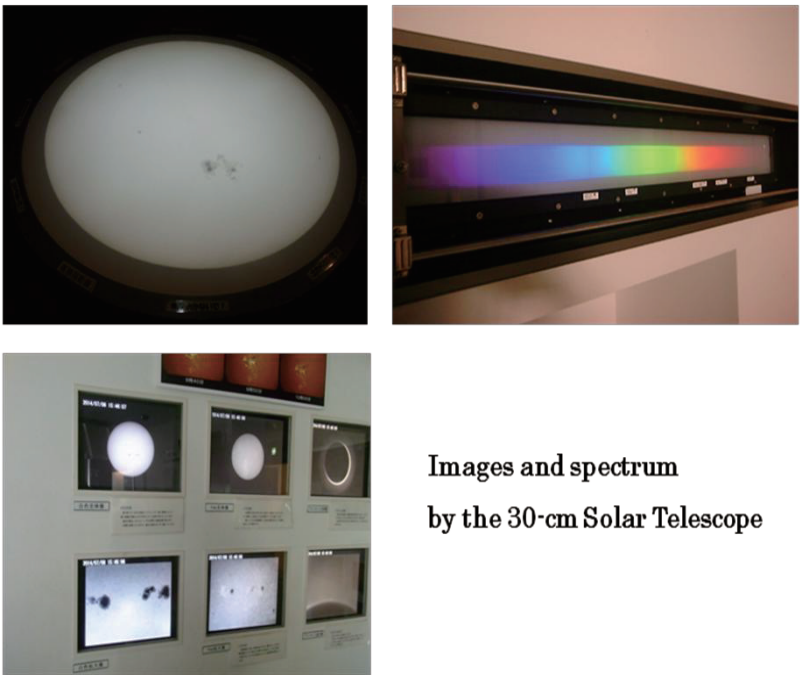


Fig. 4 Direct solar image (upper left), spectrum (upper right) and various images in white and H-alpha monochromatic lights in video screens (lower).

Fig. 5 Exhibition area of GAO

Fig. 6 Scale model of the 150-cm reflector

Fig. 7 Dummy mirror of the 150-cm reflector

Fig. 8 Effect of large aperture

Both are redesigned as they can be used for real astronomical observations at GAO. Visitors can enjoy historical feeling as well in addition to the most recent astronomy and astrophysics as a modern science.

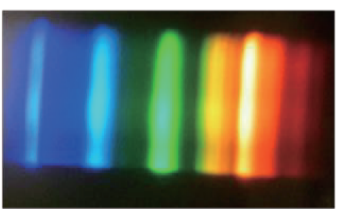
5. Summary

Gunma Astronomical Observatory (GAO) has a function as a kind of science museum for astronomy and astrophysics. Its 150-cm telescope plays an important role as the most popular exhibition item for the daytime visitors, while it is used as a powerful facility for scientific observations and star gazing activities for the visitors of various kinds. Daytime visitors can enjoy real time solar spectrum and images which are provided by the solar telescope. Exhibits and outdoor monuments are also welcoming visitors for their studies of both modern and ancient astronomy and astrophysics.

How infrared (IR) observation works

How spectrographs work

Fig. 9 Basic principles of astrophysics



fluorescent light

incandescent light

Fig. 10 Difference of spectra between fluorescent and filament lamps. Basic principles of spectroscopy.

Fig. 11 Outside monuments of GAO, Jantar Mantar and Stone Circle. The main building and three domes are seen in the lower photograph. The largest dome on the right side contains the 150-cm main telescope. The solar telescope is set in the smallest dome on the left side on the roof of the main building.

References

[1] Hashimoto, O., Kinugasa, K., et al. 2002, "Gunma Astronomical Observatory 1.5m telescope and its instruments", Proc. IAU 8th Asian-Pacific Regional Meeting, Vol.II, pp. 7–8.

[2] Hashimoto, O., Malasan, H.L., Taguchi, H., et al. 2007, "Gunma Astronomical Observatory Echelle Spectrograph (GAOES) in GAO-ITB collaboration", Proc. ITB-GAO Science Workshop, pp. 45–49.

[3] Takahashi, H., et al. 2007, "Gunma Infrared Camera and Spectrograph (GIRCS)", Proc. ITB-GAO Science Workshop, pp. 50–56.