Popularization and Education at Gunma Astronomical Observatory

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Abstract

The largest public observatory in Japan, *Gunma Astronomical Observatory* (GAO), is now under construction. The purposes of this observatory are popularization, education and research of astronomy and astrophysics. The main telescope is a 150-cm reflector equipped with a public-viewing eyepiece, a high-resolution spectroscope, a near-IR camera, and so on.

In this article, I will report an outline of the observatory and our plan for education and popularization of astronomy and astrophysics via the internet.

1. Introduction

There is a large number of public observatories in Japan. Almost all were established by local governments in the 1990's. Many local governments expected that these facilities would play a core role in promotion of local industry as a recreational facility attracting a lot of tourists, or as a means of popularization of astronomy such as by exhibiting stale scale models of the planets. These facilities were not expected to be used for education or research of astronomy. Many staff of these facilities have appealed to their governments that popularization and education are based on research activity, and to study astronomy and astrophysics under such circumstances is difficult.

However, some public observatories have education and research activities, for example, Nishi-Harima Observatory, Bisei Observatory and Misato Observatory. After seeing the profitable results, *e.g.*, after seeing that students looked lively and studied science with enthusiasm after learning science supported by real researchers, or after seeing that newspapers reported scientific results acquired at public observatories, some local governments began to recognize the importance of their activities.

Gunma Astronomical Observatory (GAO) is the largest public observatory

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under construction following the current of the times in Japan. The scale of this facility is next to that of the Okayama Astrophysical Observatory (OAO) which is the largest observatory in Japan, *i.e.*, GAO is the second largest observatory in the country. This facility is situated at a ridge of Mt. Komochi, 885m above sea level, at Takayama village about 120km northwest of the center of Tokyo.

The purposes of this observatory are: popularization of astronomy via star watching, lectures, and so on; support of school education and life-long education via training of teachers, remote teaching, and so on; research of astronomy and astrophysics. In this article, I describe only the plan for popularization and education via the internet, but these are a part of our activities, not all.

2. Telescopes, Equipment and Networks

In this section, the telescopes, equipment and networks in our observatory are introduced. Plans for popularization and education will be mentioned later.

There are several telescopes in GAO, a 150-cm reflector, a 60-cm reflector, small telescopes (6 sets of reflectors and refractors) and a solar telescope. There are also small telescopes and binoculars that can be taken out.

First, the 150-cm reflector (F12.2) has 5 focuses, and is equipped with a public-viewing eyepiece, a near-IR camera, a high-resolution spectrograph and a CCD camera. Second, the 60cm reflector (F12) has a cassegrain focus, and is equipped with a public-viewing eyepiece, a CCD camera, a photoelectric photometer and a low-intermediate spectrograph. It is planned that this telescope will be available for remote access.

Third, there are small telescopes consisting of 6 sets of 15-cm refractors and 25- to 30-cm reflectors, with 8-cm guide telescopes. The equipment attached to these telescopes are CCD cameras and a photoelectric photometer. It is planned that these telescopes will be available for synchronous operation and remote control.

Finally, the solar telescope is a 30-cm reflector with a vacuum tube assembly. A direct image of white light (diameter = 1.0 m) and a spectrum (length = 0.81 m) are to be displayed. Five images of H alpha, prominences (both in whole or in part) and white light in whole acquired by five 8-cm refractors attached to the main reflector are displayed on 5 TV displays simultaneously.

There are about 10 workstations and several tens of PCs which are connected by 100-base or light cables. This system is open to the internet and persons who want to use this system will be given their own account.

3. Popularization and Life-long Education

There are many people interested in the universe. Some amateur astronomers would like to study astronomy and to write articles, and some hope to use large or professional telescopes to take fine pictures.

We will present lectures on astronomy and astrophysics, given by ourselves or invited speakers. Astronomical classes for everyone who is interested in astronomy who wants to know more details about this field of science will be held. Also, seminars for persons who want to study astronomy such as graduate students and high-level amateurs will be held.

The internet star watching will be held a few times every year. People can request to see particular stars and can have conversations with us via the internet.

For amateur astronomers, the data which they have acquired by themselves in GAO can be analyzed by means of software on the WS and PCs connected via a LAN, and they can obtain the results of analysis and the raw data at home via the internet.

4. School Education

The internet is a highly effective means of education, for example, remote operation telescopes can be operated by the students themselves. Indeed, some telescopes can be operated from remote places and some classes using this function of telescopes were put into practice between Misato Observatory and the Branch School of Taisei High School, and between Bisei Observatory and Kamogata High School, in Japan.

I think that remote operation by the students themselves is important, but it is not essential to school education. When the students are operating a telescope via the internet, they interact with a machine not a man. It must offer motivation that makes them interested in studying science, but the most important thing is to interact with men such as scientists and/or educators directly.

Because the internet is a highly effective means of communication between remote places such as a school in the city and an observatory in the mountains, we are now planning to support school education from our observatory via the internet. Students in schools will be able to talk with us and to operate telescopes by themselves. They can ask many questions and soon receive answers or related questions from us. There will be live interaction between the students and researchers (educators) in GAO.

Teachers and researchers can collaborate in school education in such a way that researchers offer motivation to study sciences and teachers plan systematic classes for studying sciences. Because both are specialists in their own field, researchers can tell students the attraction of studying sciences, and teachers can teach them science systematically in a manner appropriate to the students' stage of mental development.

The experiences which a student has had in class at school are very important to him or her, because life-long education is based on school education. I would like to support school education from this point of view.

So far, I have described the plans for future activities in our observatory. It is hard to say how we will realize these plans because the facility is now under construction and the matter of how it will be managed is under discussion. I am really sorry, but, as the establishment of this facility is not yet completed, it is hard to provide exact details at the current stage.

IMPACT: Internet-Mediated Partnership between Colleges and Communities for Technology

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"If You Are Educated, You Can Solve Problems"
Awa Kone, resident of Tenemakana, Mali, Africa
Time Magazine, March 30, 1998, p. 44

The IMPACT Consortium will develop programs that will combine current and emerging Internet technologies with research-based educational programs. Undergraduate college science programs in astronomy and marine sciences will be integrated into K-12 curriculum. The IMPACT Consortium is building a national community of science learners and practitioners, that engages learners in grades K-12 through graduate studies and beyond, providing opportunities for science inquiry and research, and promoting curiosity and a lifelong interest in science.

A confluence of two major sources of change in K-12 curriculum is rapidly approaching in conjunction with the millenium. These are a need for major reform in K-12 science curricula and the development of information technologies. The potential for utilization of new technologies for curriculum reform and development are just beginning to be realized.

Early calls for curriculum reform were advocated by John Dewey, and also suggested by Harold Rugg and Ann Shumaker in *The Child-Centered School* (1928). More recently, the Third International Mathematics and Science Study (TIMMS) and the Secretary's Commission on Achieving Necessary Skills (SCANS) show that a pressing need exists for reform of K-12 science curricula. The American Association for the Advancement of Science has spent considerable effort developing a program — Project 2061 — whereby outcomes of curriculum necessary to enable students to become citizens fully capable of participating in the workplace of the 21st Century have been suggested. These outcomes are projected to address what the needs of the workplace will require at the next return

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