Teaching of Astronomy in Asian-Pacific Region

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Designing and Fabricating a Sidereal Clock

Atsushi Matsuo
Yamaguchi Museum, 8-2 Kasuga-cho, Yamaguchi 753, Japan

and

Takeshi Nemoto*
Hachioji Science Center, 9-13 Ooyoko-cho, Hachioji, Tokyo 193, Japan

1. Introduction

A sidereal clock is an essential requirement for operating astronomical telescopes. Sidereal clocks are not commercially available in Japan. One would need to pay a high price if such a clock were to be made by a clock manufacturer to order. So we have designed and fabricated a high-precision sidereal clock inexpensively. In this papar we report it briefly.

Our sidereal clock has the following advantages:

(1) It provides sidereal time using a commercially available quartz oscillator, without the need for any special components.

(2) It digitally displays local sidereal time to the minute and Japanese standard time to the second.

(3) Since a single oscillator drives both sidereal time and solar time, we can tell if the sidereal time is fast or slow by checking the solar time (Japanese standard time).

2. Obtaining the sidereal time

When we make a digital clock based on mean solar time (hereafter

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*Present address : Micon Keisoku Kougyo Co., Ltd., 6432 Mizuko, Fujimi, Saitama 354, Japan.

solar time), it requires a signal corresponding to 1 Hz (a single pulse per second of solar time) in order to indicate the time up to the second. This is commonly achieved using a quartz oscillator with a frequency of 32.768 kHz, which is counted down to 1 Hz using 1/2 frequency dividers arranged in 15 stages.

$$32{,}768 \times (1/2)^{15} = 1$$

A large variety of inexpensive single-chip ICs for clocks is commercially available. The single-chip IC for clocks is an integrated circuit having nearly all the necessary circuits for digital clocks other than the display and the quartz oscillator. It is easy to make up a digital clock for solar time with this single-chip IC.

A sidereal clock requires a signal corresponding to a single pulse per second of mean sidereal time (hereafter sidereal time). As evident from equations (1) and (2), such a signal corresponds to one pulse per 0.99726957 seconds of solar time, which is equal to 1.00273791 Hz.

$$1 \text{ mean sidereal day} = 0.99726957 \text{ mean solar days} \qquad (1)$$

$$1 \text{ mean solar day} = 1.00273791 \text{ mean sidereal days} \qquad (2)$$

In the case of the solar time clock, 1 Hz is obtained by dividing the 32.768 kHz frequency of the quartz oscillator 2^{15} times with a single-chip IC for clocks. As evident from equation (3), for the sidereal clock, we should use a quartz oscillator having a frequency of 32.858 kHz, when we attempt to employ a single-chip IC for clocks.

$$1.00273791 \times 2^{15} = 32858 \qquad (3)$$

Oscillators having such a frequency are not marketed, since they are not in demand. If such an oscillator is to be made to order, it would cost a tremendous amount of money. So we make random logic circuitry using a commercially available quartz oscillator to fabricate a sidereal clock at a low cost.

3. Outline of the circuitry

(1) Oscillation unit

A quartz oscillator TCO-703A is chosen because of its good temperature characteristics, price, and other factors. This oscillator provides a frequency of 12.8 MHz, and a final frequency of 100 kHz is obtained using seven stages of 1/2 frequency dividers 74HC4020. The 100 kHz signal is further divided by 10^5 by a divider SPG8640B to obtain a frequency of 1 Hz, a signal corresponding to 1 second of solar time. This 100 kHz signal is also divided by 5,983,617 to obtain a frequency of 0.016712299 Hz, a signal corresponding to 1 minute of sidereal time, using 7 stages of binary coded decimal counters 74HC390. The deviation of this value from correct 1 sidereal minute is only 0.07 ppm.

(2) Counters and time adjustment

This sidereal clock employs two 1/60 dividers and a 1/24 divider to count the seconds, minutes and hours of solar time respectively. And also it has a 1/60 divider and a 1/24 divider to count the minutes and hours of sidereal time.

This clock has time adjusting switches for resetting the seconds and incrementing the minutes and the hours for both solar time and sidereal time.

(3) Display of time

We use LEDs for displaying time. The LEDs repeat on and off operations very quickly to minimize power consumption (dynamic LED activation). The display would look brighter as a whole if the "on" time is increased and the "off" time is decreased. The sidereal clock has a 74HC123 and a compact semi-fixed resistor to regulate the brightness.

(4) Backup during power failure

Although power failures rarely happen today, backup power is necessary when the sidereal clock is being transported from one place to another. Since the time display, which consumes more electricity than the other components of the clock, is not necessary during transportation, only the oscillation unit and the counter unit are supported by a battery-based backup. The backup electricity is supplied by alkaline batteries.

(5) Power supply

The entire circuit is driven by 5V DC. A standard fixed voltage regulator is used for the display circuit, while a CMOS-type fixed voltage regulator is used for the circuit supported by the battery backup. Electricity is normally supplied to both these fixed voltage regulators from an AC adaptor which provides 9V DC. In the case of a power failure, a 6V direct current is supplied by the batteries to only the CMOS-type fixed voltage regulator. Switching is accomplished with diodes.

4. Outline of fabrication

Two universal boards are employed, one for the clock circuits and the other for the LED display. Wires are soldered by hand. The two boards are stacked, divided by a spacer. Small tact switches are employed for adjusting the time.

The clock is housed in an aluminum case which is partially cut out to enable viewing of the LED display. The opening is covered with a smoked acrylic panel. A power connector is mounted on the side of the case for connecting the AC adaptor.

The clock measures 150 mm (h) by 200 mm (w) by 42 mm (d), and it is produced at a cost of ¥15,000 - 25,000 (US$100 - 200).

5. Concluding remarks

The sidereal clock was completed three years ago. It has been put to actual use in Yamaguchi Museum. The deviation is only 2.4 seconds per month, maintaining a sufficiently high accuracy compared to a deviation of about 15 seconds per month for ordinary quartz clocks for home use.

This kind of sidereal clock can be fabricated at a very low cost while achieving a high level of precision. These clocks will prove to be very useful in schools, museums, science centers and other educational facilities, as well as for amateur astronomers employing medium-sized telescopes.

Users of 20 cm-class refractors would require a sidereal clock that indicates sidereal time up to 0.1 minutes or 1 second because their hour circle normally reads up to about 0.1 minutes. In such a case, the display of solar time would be to 0.1 minutes or 1 minute due to restriction on the number of IC outputs. This should not present a major inconvenience because the user can rely on commercially available clocks for solar time.

Circuit diagrams and other details are omitted. More information is available from the authors, on request.

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TEACHING OF ASTRONOMY IN BRAZIL: FROM THE ELEMENTARY SCHOOL TO THE UNIVERSITY

Walter J. Maciel
Instituto Astronômico e Geofísico da USP
Av. Miguel Stefano 4200
04301 São Paulo SP – Brazil

I INTRODUCTION

The teaching structure in Brazil comprises basically four levels, as shown below:

"Primeiro Grau"	1	2	3	4	Grade
(elementary)	7	8	9	10	age
"Primeiro Grau"	5	6	7	8	Grade
(elementary)	11	12	13	14	age
"Segundo Grau"	1	2	3		Grade
(secondary)	15	16	17		age
"Terceiro Grau"	1	2	3	4	Grade
(university)	18	19	20	21	age
"Quarto Grau"	2/4	years:	MSc		
(post-graduate)	3/6	years:	DSc		

In principle, all children over 7 years old are expected to attend the elementary school up to Grade 8, but many students do not complete it, especially in the poorest regions of the country. As a result, government authorities have had problems in keeping the illiteracy rate under 25%. On the other hand, university teaching is very selective, especially at the best, state operated universities, where admission is in practice often restricted to middle class students.

II ASTRONOMY TEACHING AT THE ELEMENTARY SCHOOL

(a) "Primeiro Grau" 1, 2, 3, 4

At the elementary school, Astronomy is not taught as an independent subject, but instead is part of the introductory courses on Geography and Natural Science

(Maciel, 1991). The first ideas are presented at Grade 3 (children of about 9 years old), and include a description of the Earth as a planet and a comparison of its properties with those of the remaining planets of the Solar System. The layers that comprise the Earth and its atmosphere are described. The force of gravity, motions of the Earth and travels to the Moon are discussed, and also the duration of the day and night, the years, seasons and eclipses. A connection is made between the Sun and the energy necessary for life on Earth, although in a very simple way. In many cases, the astronomical concepts are not well presented, and most teachers just transmit what they read in the textbooks, often without a clear understanding of it. Also, most science books at this level have mistakes, misconceptions and inconsistencies.

At Grade 4, these concepts are repeated, but in greater depth. A description is given of the planets, the Moon, asteroids and comets. Some properties are discussed, such as distances, dimensions and velocities (duration of the translation motion). Here one discusses astronomical instruments, from binoculars to large telescopes. This normally includes optical instruments only, sometimes with a brief description of radiotelescopes. In many cases the distinction between reflectors and refractors is not made. In fact, many teachers think that the largest telescopes have lenses, instead of mirrors.

The Sun is presented as a star, and its main atmospheric layers (photosphere, chromosphere and corona) are described. Sunspots and prominences are mentioned. Sometimes, a connection is made between the solar energy and nuclear reactions. A general description of Astronomy is made, which may extend to the Galaxy and the location of the Solar System in it. However, the approach is purely descriptive; no effort is made to describe the physical processes ocurring in the astronomical objects or to connect them with physical principles. The study of Astronomy concludes with a discussion of time and its measure. In some schools students are asked to build a sundial.

(b) "Primeiro Grau" 5, 6, 7, 8

During the last four years of the elementary school, the main goals are:

- To introduce the children to fundamental scientific knowledge;
- To teach the main processes of scientific investigation;
- To develop a scientific mind.

Science is characterized as a process involving observation, elaboration of concepts and hypotheses, experimentation, interpretation e a new elaboration of concepts.

During these last years, practically nothing is taught about the celestial objects, and here, probably, some innovations could be made. At the Geography course at Grade 5 one again studies the Earth and the Universe, but the astronomical concepts have now a "local", or geographic point of view. Some emphasis is placed on the location on Earth and orientation by te Sun and stars. The distinction between the hemispheres is not always clear and one often talks about the "polar" star, which cannot be seen from most of the country.

The first concepts of Physics and Chemistry are also given at Grade 5, which begins with a study of the atmospheric pressure, and especially at Grade 8, where the basic principles are studied.

The main concepts include: Matter and Energy, Atomic Structure, Motion, Forces, Work, Simple Machines, Heat and Temperature, Waves and Sound, Optics and Light, and Electricity and Magnetism. However, one does not try, in general, to include any astrophysical concepts with the basic concepts of Physics, although that could easily be done. Some examples are:

- Motions → Motion of the Earth, planets, double stars.
- Heat and temperature → Stars with different atmospheric temperatures.
- Optics and light → Dispersion, solar and stellar spectra; mirrors and telescopes.
- Matter and energy → The Sun, energy production.
- Energy transfer → Conduction, convection and radiation in stars. Energy transfer from the Sun to the Earth.

III ASTRONOMY TEACHING AT THE SECONDARY SCHOOL

At the secondary school a more detailed study is made of Mathematics, Physics, Chemistry and Biology. Here, unfortunately, very little Astronomy is given. The astronomical objects are studied only during the first year of the Physics course, with the study of gravitation in Mechanics. Kepler laws are given, and the motion of the Earth and satellites are described, that is, the same that is studied at the "Primeiro Grau" (elementary school), but with higher mathematical rigour. Astrophysics is almost completely ignored. Probably the same sugestions made for Grade 8 could be applied here, with the advantage that the students are now more mature and could understand better the applicaton of the physical concepts to astronomical situations. This could be achieved with the *improvement of the teachers* of secondary schools (see section IV). Unfortunately, education does not seem to have a high priority for the government, and few teachers can dedicate to the improvement of their activities.

IV UNIVERSITY TEACHING

(a) Astronomy for Physics students

A few universities include optional Astronomy courses for Physics students, lasting one or two semesters. As an example, at the São Paulo University (USP) there are two general courses: "Astronomy and Astrophysics I" and "Astronomy and Astrophysics II", apart from "Cosmology", "Astrochemistry" for Chemistry students, and "General Astronomy" for students of other areas.

Some of the Physics students plan to start a career in Astronomy, after finishing the Physics course. These normally engage in a undergraduate program called "Scientific Initiation" under the supervision of a professional astronomer, often with a scholarship from the National Research Council (CNPq) or other institution.

(b) Astronomy as a main subject

There is only one university in Brazil where a BSc degree can be obtained in Astronomy, independent of any post-graduate work. Most astronomers do not believe that this is the best way to prepare young students for a scientific career in Astronomy, basically due to two reasons:

– Modern Astronomy is essencially an application of Mathematical and Physical principles to astronomical situations, so that astronomers must have a good formation in both of these sciences. In Brazil, this can be achieved with a good Physics (or Mathematics) university course.

– Physics bachelors are able to engage in a career in any of the areas of Physics, such as Solid State Physics, Nuclear Physics or Cosmology, apart from Classical Astronomy or Astrophysics. However, Astronomy bachelors have stronger job limitations, which is especially important considering the difficult economical situation of the country in the last several years.

(c) The IAG/USP summer Astronomy course

In 1977, the Astronomy Department of the Institute of Astronomy and Geophysics of the São Paulo University (IAG/USP) started organizing a summer course in Astronomy, directed to Physics students and elementary school teachers. The course originally lasted about 10 days, but since 1989 it has been dismembered into two different courses, lasting about one week each.

The first course is called *Astronomy: a general view*, and is especially dedicated to elementary and secondary school teachers. As has been stressed before, it is important that elementary school teachers are well prepared to include in a couple of weeks all the astronomical knowledge that can be assimilated by the students.

The second course is called *Astronomy and Astrophysics*, and is basically aimed at young physicists and Physics students, emphasizing a more complete education and also providing the seeds for new astronomical research groups.

The summer courses are organized typically by 3 faculty members. Announcements are sent to planetariums, universities, municipal teaching committees, etc. Since a preference is given to students from places other than São Paulo, an effort is made to provide free or low cost lodging, food and transportation. No fees are charged. A certificate is given to those that attend a minimum of 70% of the classes and pass a written examination at the end of the course. Faculty members have put a considerable effort in the writing of lecture notes that could be made available to the students. This is particularly important in a country where virtually no astronomical literature exists, apart from general texts (often translations) addressed to the layman. A two-volume set has been published by the institute in 1977, supplemented by new material in draft form. A new version of the text is expected to be published by the end of 1991.

In the past 15 years, approximately 1,000 students have successfully completed the courses. The total number of inscriptions is roughly 40% higher than this figure, and an average of 15% leave the course before its end. The number of students that fail the course is very small, less than 5%. No more than 60 students can be accepted for each course, due to space limitations at the institute.

The first course grew as an answer to the need for an elementary astronomy course directed to teachers without a strong mathematical background, but anyone with a university degree can attend it. It lasts typically 32 hours, 16 of which in the form of theoretical classes, 4 hours in seminars, and 12 hours of practical activities. The program can be roughly outlined as:

- Components of the Universe: stars, planets, comets, asteroids, meteoroids, the Milky Way, galaxies.
- The Solar System: components, structure, distances, the Earth, motions, the Earth-Moon system.
- Stars: structure and evolution, small and large scale associations.
- Galaxies: our Galaxy: structure, components, other galaxies, types, distances, peculiar galaxies.
- Cosmology: models of the Universe, the Big Bang, chemical elements.

The second course requires some mathematical knowledge including calculus, and lasts longer (40 hours) than the first one. It contains typically 24 hours of theoretical classes, 8 hours in seminars, 2 hours of practical activities and 6 hours in other activities such as a visit to an observatory or a planetarium. The contents are:

- Fundamentals of Astronomy
- Kinematics and dynamics of the Solar System
- Stellar structure and evolution
- Galactic and extragalactic astronomy
- Cosmology
- Instrumentation for Astronomy

This course has been successfully offered since 1977, and has proved to be important in the selection of Astronomy as a career for Physics students. In fact, several students have engaged in a "Scientific Initiation" project after taking the course. As experience has showed, this kind of work is the best way to select promising students for future MSc or DSc work.

V POST-GRADUATE TEACHING

The largest progress regarding Astronomy teaching in Brazil in the last 10 years ocurred in the University teaching in post-graduate level. The total number of qualified astronomers (holding a PhD degree or equivalent) is now about a hundred, which is ten times more than it was 15 years ago. This is still a factor of 10 behind the situation in the developed countries, as our population is of 160 million. However, the sharp increase is a reflection of the work done in a few institutes and universities, namely USP (Maciel, 1988, 1990), the National Observatory (ON), the Institute for Space Sciences (INPE), and the federal universities of Rio Grande do Sul (UFRGS) and Minas Gerais (UFMG).

The MSc degree can be obtained ideally after 2 years of post-graduate work. A few one term courses are necessary (4 – 6) plus a final dissertation. The main results are often published in scientific journals. In order to obtain the DSc degree, a few more courses are needed (2 – 3), but the thesis must be completely original, and its main results should be published in international scientific journals in paper form.

VI TEACHING THE GENERAL PUBLIC

There are several oportunities of Astronomy teaching to the general public, but they are almost always concentrated to the largest cities of the country. They include planetariums, Astronomy schools for amateurs, exhibits developed by the "Science Station" (São Paulo) and the Astronomy Museum (MAST) in Rio. The MAST organizes the "Quartas astronômicas" (astronomical Wednesdays), which are talks on Astronomy delivered at the first wednesday of each month. Three times a week one can visit the Museum in the evening and make some observations. The same is being made since 1990 by the IAG/USP, holding a public visit every friday evening, when an astronomer and two graduate students talk to the public and organize observations. The success of this activity is confirmed by the large waiting lists, which can extend to several months.

Another very interesting initiative on Science teaching is being taken by the brazilian society for the advancement of science (SBPC). Since 1982, it publishes the science magazine "Ciência Hoje" (Science Today), addressed to the general public, and from March, 1987 the society started the regular publication of a companion supplement, *Ciência Hoje das Crianças* (Children's Science Today), especially written for children under 14 years old. Up to now, 20 issues have been published, and since September, 1990 the original supplement evolved to a bimonthly independent magazine.

The first issues as an independent magazine have been distributed to public schools under a contract with a state foundation, amounting to 200,000 copies. Presently, about 30,000 copies are published, 20% of which are from subscriptions, and 80% distributed and sold in newsstands.

Before *Ciência Hoje das Crianças* was launched as an independent publication, the project has been analysed by specialists in children literature, teachers, and 1,600 elementary school students. As a consequence, it became clear that the main goal of the magazine should be to introduce children to science, experiments and culture altogether.

As a non-profit organization, the SBPC developed from the beginning a non-commercial approach in both magazines. In particular, most articles are written by scientists active in the particular field treated, assisted by a professional journalist. This warrants a scientific accuracy often lacking in similar publications, however maintaining the light and clear style characteristic of good journalism.

Most science articles in newspapers and commercial publications stress the *informative* aspects of science only. Another interesting feature of the new magazine is a special effort to present articles that excite the child's curiosity, provoking it to supplement the reading with some additional activity. This may be some further reading, a group discussion, or an actual experiment. In doing so, some care is taken not to assume a "classroom" approach, stressing instead the fun that can (and should) exist in a scientific experiment. As an example, the last issue suggested the construction of a kaleidoscope.

The last published issue includes two articles on Astronomy. In fact, together with Ecology, Astronomy is probably the science with greater appeal to children of ages 6 – 13 (and adults as well!). The first article describes the final stages of stellar evolution, stressing the changes that occur in stars, which may seem surprising in the apparently "fixed" sky. The next article is about the Space Telescope, which obtained a considerable amount of space in the press at the time of its launching. The text emphasizes the effects of the atmospheric turbulence, which poses the need for a space telescope, and comments on the mirror problem.

Past Astronomy related articles featured the Sun, shapes and contents of galaxies (incuding our own), the Earth, and artificial satellites. Future scheduled articles include a child's view of an image processing laboratory for astronomical purposes and of a night at the country's largest optical observatory.

The first issues of *Ciência Hoje das Crianças* as a companion magazine to "Ciência Hoje" included a poster, often displayed on walls in public schools. As the magazine evolved, the posters were reduced to the central pages, and presently show brazilian animals on the verge of extinction.

Apart from the main articles, the magazine has fixed sections, such as letters, reading or video suggestions, and games, especially addressed to younger children. As a general science magazine, it also features articles on the Humanities, which may include poetry and short stories.

Since the first few issues were published, the magazine collected several positive reviews in the press. Also, the contact with the public either from letters or directly in schools demonstrated a warm acceptance of the publication. More recently, the country's extremely difficult economical situation forced a drastic reduction of costs, especially in the parent magazine. Also, the large size of the country (Brazil is the fifth largest country in the world, after the USSR, Canada, China and the USA) makes distribution a difficult problem. However, it has been proved that there is a need for a magazine of this kind, and that popular science can be both accurate and accessible enough to be attractive to school children.

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Physics Teachers from all the World gather in Copernicus Native Town

Cecylia Iwaniszewska
Institute of Astronomy, Nicolaus Copernicus University
87-100 TORUN, Poland

As I have told in my previous paper in Bulletin No.3, an international conference "Teaching about Reference Frames: from Copernicus to Einstein" - the bi-annual meeting of the International Research Group on Physics Education - GIREP, has been organized in Toruń, the birthplace of Nicolaus Copernicus, on August 19-25,1991. About 200 participants, school and university physics teachers from all over the world gathered at the Nicolaus Copernicus University campus. They came from South and North America: Brasil, Venezuela, Mexico, USA, Canada; from New Zealand; from Asia: Japan, China, India, Pakistan, Israel; from Africa: Botswana, Guinea, Egypt, and from nearly all European countries. They were accompanied by their spouses, daughters, mothers, sisters, fiancées, brothers-in-law, who came all here to get a look at a foreign country during their summer vacations.

The programme consisted of morning invited lectures, twelve in all; of workshops with short presentation of papers and discussions; of poster sessions as well as of experiments and computer simulations. Evenings have been spent at special receptions, a concert, public lectures, an administrative GIREP meeting. Sight-seeing tours for accompanying persons consisted of visits to the Old City and its museums including the house where Nicolaus Copernicus has been born on February 19, 1473; of trips to neighbouring sites, a medieval town, a health resort, a renaissance castle, and, last but not least, the Astronomical and Radioastronomical Observatories at Piwnice, 12 kms from Toruń.

The opening lecture has been that of prof.Wilhelmina Iwanowska, emeritus professor of astrophysics and former Director of the Institute of Astronomy of N.Copernicus University. The topic was the Universe of Nicolaus Copernicus, the Universe which has been limited by the sphere of fixed stars forming "the location of the universe, to which the motion and position of all the remaining stars is referred " (De Revolutionibus, Book One). Prof. Marek Demiański from Warsaw University told about the history of the ideas on the structure of the Universe, from Ptolemy to our times, prof.Jon Ogborn from London spoke about the role of the general and special relativity theory, while reference frames in the introductory physics course and discussions with students' ideas have been the topics of lectures of prof.Clifford Swartz of New York and prof. Edwin Taylor of Cambridge, USA, respectively.

The workshops have been devoted to the following themes:

- historical and philosophical aspects in teaching on reference frames,
- introducing elements of special and general theory of relativity,
- research on understanding of basic concepts concerning refer.frames,
- high school and university experiments concerning reference frames,
- computer simulations in teaching about reference frames,
- other teaching technologies devoted to teaching about refer.frames.

Many interesting experiments have been shown at these meetings. Some of them have been computer simulations, but there have been also some low-cost specially constructed devices to illustrate physical phenomena.

Astronomical themes have been introduced at this conference through posters, two of them have been connected with observations on the astronomers basic plane, the HORIZON. Rosa Maria Ros from Barcelona, Spain, is already known to the readers /see Bulletin No.3 /. Now she has shown her experiments with secondary school students, taking photographs of sunset from the same place on the first day of each of the four seasons. From these photographs one may easily calculate the obliquity of the ecliptic when the geographic latitude of the observer is known. The second poster has been a series of photographs of Nicoleta Lanciano from Roma, Italy, showing her experiments with groups of quite young children, looking for cardinal directions, determining their local horizon, observing the daily motion of the Sun.

Another poster of Rosa Maria Ros told about planet observations with a telescope made by secondary school students of 16-17 yrs. Taking photographs of Jupiter during one month, studying them carefully provided material for the calculation of the periods of rotation and the orbital radius of the four Galilean satellites, also the determination of Jupiter mass. My own poster was devoted to teaching on different scales of distance, showing the importance of popularizing the relation between sizes and distances of celestial bodies. Two Solar System models have been tabulated and shown on drawings, similar to that I have mentioned on pg.21 of Bulletin No.3 .

At the experiments session another astronomical theme was presented by Roland Szostak from Münster, Germany, who has been showing his thermal method for describing the seasons. A sphere like a tennis ball covered with a special thermally sensitive material that looks yellow at room temperature, and turns reversible red at about 40°C is the main device. When exposed to a heater - the sphere turns red at the heated place, and a rotating sphere when heated - gets a red ring. By tilting the axis of the sphere one obtains the effect of getting red rings on both hemispheres if the rotating sphere goes round the heater, representing the Sun. One can repeat the whole procedure many times, every child having thus a possibility of making its own experiment.

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Didactic publications. Since I have been mentioning above experiments connected with the horizon, I want to tell here about another country, about other teaching aids, also connected with this fundamental notion. The French association,called Committee of Liaison of Teachers and Astronomers, CLEA, publishes a quarterly magazine "Les Cahiers Clairaut", various bruchures on didactic topics, self-made teaching devices, astronomical slides, etc.Just before the GIREP meeting I have received a set of slides and a didactic publication on astronomy at elementary school. The latter consists of sheets for separate lessons showing how to introduce elementary notions, such as: shadows; meridian and horizon ; day-night and seasonal changes ; solar and local time, time zones ; solar trajectory during one day; sundials ; phases of the Moon; a model of Solar System; the constellations ; space investigations. Each lesson is divided into sections: the aim of a given lesson, the means to introduce the problem, questions to be asked of children, their activities, easy exercises, experiments and bibliography.

The set of slides "Stars are also rising" presents pictures of sunrise taken at monthly intervals during one whole year at the same place, pictures of rising planets and brighter stars also from the same place. It is in fact a didactic tool, it can be used in the case of a teacher who has no possibility of making in class the same experiments as Rosa M.Ros or Nicoleta Lanciano. There are also some data to be used for exercises to be conducted with children during respective lessons, using the set of coloured slides.

So now we can see how enthusiastic teachers try to introduce to their students the basic astrononomical notions, the frames of reference undispensable for observation - in three neighbouring European countries: Spain, France and Italy. Would it be very difficult to do it also elsewhere ?

Astronomical Educational Materials in Japan

Syuzo ISOBE
NATIONAL ASTRONOMICAL OBSERVATORY
MITAKA, TOKYO, JAPAN

Currently, informations on astronomical educational materials in the world have been published in the Newsletter of IAU Commission 46, Teaching of Astronomy. However, it was decided at the General Assembly in Baltimore in 1988 that informations on astronomical educational materials will be published only for English, Spanish, French, and Russian but not for the other languages.

In the most Asian countries, astronomical educational materials are written in their native language but not in English. Those informations are not published in the Newsletter. However, it is useful for the Asian-Pacific countries to have ideas what atronomical educational materials are published in each countries. I decide to put those information from Japan in this Bulletin. I would like to encourage each Asian-Pacific country to show their information of astronomical educational materials in this Bulletin.

A list of astronomical books in 1987 published in Japan.

No.	Title	Author(s)/ Editor(s)/Translator(s)	Publisher	Size	Page	Price(yen)
1	Catching the Halley comet	Astron. Soc. Japan	U. of Tokyo Press	B4	182	2800yen
2	Hop-up universe	H. Couper & D. Derum / K. Saijo	Maruzen K. K.	25x25	12	3800
3	Howking's Universe	J. Bozlow / K. Suzuki	Chijin-Shokan	B6	188	1500
4	Universe observed in X-ray	M. Matsuoka	Kyoritsu-Shuppan K. K.	B6	208	1500
5	History of Japanese astronomy in modern preiod(I)	T. Watanabe	Koseisha-Koseikaku	A5	450	8500
6	Building a radio telescope	T. Kaifu	Otsuki-Shoten	B6	221	1200
7	Present Topics in solar system and universe	K. Itoh et al	Kyoritsu-Shuppan K. K.	B6	158	1500
8	Near future programms in space development	R. Akiba	Iwanami-Shoten	B6	142	1000
9	What is an extension of our universe	G. Hori		B6	159	1600

10	Encyclopedia of space and astronomy	M. Oda	Maruzen K. K.	B5	530	15000
11	What is the big bang	S. Obi	Daiamondo K. K.	4x6	220	1200
12	Instruction hand book of annual astronomical phenomena		Seibundo-Shinkosha	B6	126	980
13	Star chart (2000.0) for meteor observations	Astron. Soc. of Japan	Koseisha-Koseikaku	A4	80	1500
14	Histry of Chinese constellation	S. Osaki	Yuzankaku	B5	370	15000
15	Supernovae	D. H. Clarke / H. Okamura	Kaimeisha	B6	216	1800
16	Fundamental astronomy	M. Takeuchi & A. Uesugi	Koseisha-Koseikaku	A5	190	1900
17	Technics for astronomical photograph		Seibundo-Shinkosha	B5	176	1900
18	Wondering of constellation (new)	H. Nojiri	Seibundo-Shinkosha	B6	328	1800
19	Effort to recover Yamazaki mirror		Kinamino-Kaze	B6	238	1200
20	A trip to the end of our universe	S. Isobe	Iwasaki-Shoten	B5	64	1800

A list of astronomical books in 1989 published in Japan.

No.	Title	Author(s)/ Editor(s)/Translator(s)	Publisher	Size	Page	Price(yen)
1	Guide of constellation : autumn	A.Fujii	Seibundo-Shinkosha	B6	100	950yen
2	Large molecular coulds and extermination of dinosaur	S. Yabushita	Chijin-Shokan	4x5		1800
3	Telescope optics : reflector	S.Yoshida	Seibundo-Shinkosha	A5		1800
4	Introduction to astronomical photograph	A. Fujii	Seibundo-Shinkosha	B6	100	950
5	Naozo Ichinoe	S. Nakayama	Rproboard	B6		1400
6	A book of Hoei Nojiri	G. Ishida	Chikuma-Shobo	4x6		2500
7	Guide of constellation : spring	A. fujii	Seibundo-Shinkosha	B6	100	950
8	Explanation of modern astronomy	K.Sakurai	Kyoritsu-Shuppan	A5		1900
9	Astronomical graphity : galaxies	T. Furuta	Seibundo-Shinkosha	B6	342	3090
10	Astronomical graphity : nebulae and clusters	T. Furuta	Seibundo-Shinkosha	B6	238	2260
11	Ancient astronomy by computer	K. Saito	Koseisha-Koseikaku	A5		2600
12	Astronomy class by Hidemi	K. Suzuki and H. Naito	Chijin-Shokan	B6		1545
13	A trip by Voyager I and II	N. Nakatomi	Shinchosha	A6		480

14	A diagram of cosmic evolution	S. Ikeuchi	Otsuki-Shoten	B6		1340
15	Astronomical objects drawn by computer	Y. Sofue	Koseisha-Koseikaku	B5		3914
16	Einstein's universe		Hakuyosha	A5		2000
17	Fundamental knowledge of astronomy and stars		Kodansha	B6		1100
18	Modern astronomy		Kakushu-Kenkyosha	B6		1010
19	A trip to beginninf of time	H. Percel / S. Kurohoshi	Chijin-Shokan	4x6		2575
20	Howking explains our universe	W. Howking / H. Hayashi	Hayakawa-Shobo	A5		1600
21	Encyclopedia of sky watching	S. Obi	Asahi-Shinbunsha	A5		2200
22	Miss-understanding of relativity	A. Asimov / S. Yamakoshi	Chijin-Shokan	A5		1854
23	A descovery of our star	Y. Kushida	Popurasha	4x5		910
24	Guide book of astronomical telescope	Y. Saijo and K. Watanabe	Seibundo-Shinkosha	A5	204	1900
25	General guide of star charts and star catalogue	Astron. Soc. of Japan	Seibundo-Shinkosha	B5	142	2000
26	Astronomical data book	N. Owaki, S. Isobe, K. Saito, G. Hori	U. of Tokyo Press	B5		3296
27	A trip to Nobeyama through universe	M. Morimoto	Maruzen K. K.	A5		1300
28	Star chart for observation by binocular	S. Nakano	Hoshinotechosha			1860

A list of astronomical books in 1988 published in Japan.

No.	Title	Author(s)/ Editor(s)/Translator(s)	Publisher	Size	Page	Price(yen)
1	General descriptions of modern astronomy	K. Utsumi, K. Tanabe, K. Yoshioka	Asakura-Shoten	A5	164	2400yen
2	A trip to 20 billion year universe	M. Morimoto	Iwanami-Shoten	B6	146	1000
3	Illustrative view of lunar surface	G. Shirao, S. Sato	Rippu-Shobo	B5	152	1900
4	Encyclopedia of astronomy	K. Kodaira, E. Hiei, G. Hori	Heibonsha	B6	758	5500
5	How are planetary rings formed?	J. Elliott, R. Kerr / T. Nakamura, M. Soma	Iwanami-Shoten	B6	300	3000
6	Invitation to cosmology	F. Sato	Iwanami-Shoten	A6	214	480
7	History of the Japanese amateur astronomy		Koseisha-Koseikaku	A5	410	4800
8	At the time of formation of our universe	Torefinell / Y. Suzuki	Chijin-Shokan	B6	352	2300
9	Measuring stellar distances	M. Yoneyama	Somei-Shobo	B6	182	1500
10	Guide book to stellar night sky	S. Isobe	Maruzen K. K.	B6	200	1800
11	Guide of night sky	A. fujii	Seibundo-Shinkosha	B6	100	950
12	View to the universe	R. Robinson / A .Okazaki, T. Mikami	Chijin-Shokan	B6	254	1800

13	Exercise of astronomy	T. Yokoo	Koseisha-Koseikaku	B5	222	3200
14	Supernovae explosion	A. Nomoto	Iwanami-Shoten	B6	208	1300
15	Meteorite at Kokubunji		Kokubunji-Town	A5	141	---
16	Workbook for experimental astronomy	R. B. Culbee / T. Hasegawa	Koseisha-Koseikaku	B5	124	1200
17	Essense of calcuration of orbital motion	D. Tatersfield / H. Ohnishi	Chijin-Shokan	B5	182	1800
18	Four forces in the universe	P. C. W. Davis / K. Kiguchi	Chijin-Shokan	B6	438	2500
19	Cosmic radio astronomy	K. Akabane, N. Kaifu, H. Tabara	Kyoritu-Shuppan	A5	986	6800
20	Cosmic large scale structure and galaxies	S. Ikeuchi	Maruzen K. K.	B6	152	1300
21	How was our universe formed?	J. Gribin / A. Nomoto	TBS Britanica	B6	424	2800
22	A life as an astronomer	G. Ishida	Chikuma-Shobo	B6	254	1600
23	Gallileo saw Neptune	T. Cowal / W. Tanaka	Iwanami-Shoten	A4	82	1400
24	An introduction of space development	N. Nagatomo	Nippon-Keizai-Shinbun	B6	176	850
25	What made human living on the earth possible	W. S. Brocker / K. Saito	Kodansha	A6	319	780
26	Looking back to the end of our universe	S. Isobe	Kodansha	A6	223	600

Activities of Teaching of Astronomy in the Asian-Pacific Region of the IAU

Syuzo Isobe

National Astronomical Observatory
Mitaka, Tokyo, Japan

After establishment of our working group at the 4th Asian-Pacific regional meeting of the IAU held in Beijing in 1987, two main activities were carried out.

The first one is this Bulletin which have been published so far (February 1990, September 1990, and March 1991), with this volume in November 1991. I planed originally to publish every half year. However, this schedule has been delayed because of shortage of papers at the time for printing. I will ask your contribution.

The second one is a meeting on Teaching of Astronomy during the Asian-Pacific Regional meeting of the IAU held on 18 July 1990 in Australia. The proceedings was published in Proceedings of Astronomical Society of Australia, Volume 9, Number 1, 1991.

We have a plan to have another meeting of Teaching of Astronomy in October 1992 in Beijing. About this point, please contact with Mrs. Tong Jianhua at Beijing Observatory.

A MEETING ON ADVERSE ENVIRONMENTAL IMPACTS ON ASTRONOMY

This meeting will be held in Paris from June 30 to July 2, 1992. The following is an information given by Dr. Derek McNally, past general secretary of the IAU. I expect you will distribute this information to people working not only in astronomical field but also in political and other fields.

A MEETING ON ADVERSE ENVIRONMENTAL IMPACTS ON ASTRONOMY

1992 UNESCO HQ, PARIS

1. Precise date to be determined: suggest 1992 June 30-July 2. — accepted to UNESCO

No clash with any IAU Meeting so far accepted for 1992.

There is a need to avoid second half of August for the COSPAR/IAF World Space Congress.

2. Suggested format of meeting. A 3-day meeting is envisaged.

Day 1:	09.30-10.30	The Growing Points of Modern Astronomy: why they require observation of very faint objects.
	11.00-11.30	Astronomical Photography and the new generation of Astronomical Telescopes - active optics, adaptive optics, 10m and beyond
	11.30-12.00	New electronic detectors for Astronomy
	12.00-12.30	Demonstration of CCDs, IR detectors, optical noise, speckle interferometry
	14.00-14.30	Radio Detectors from m - mm
	14.30-15.00	Radio Interferometry
	15.00-15.30	Demonstration of radio detectors, radio noise
	16.00-17.00	Observations in Space for Astronomy and Geophysics: how they are affected and limited by human activity
Day 2:	09.30-10.30	Natural Background Radiation (Zodiacal light, atmospheric glow, scattered starlight, radio, X-ray, γ-ray backgrounds, 2.7°K background)

	11.00–11.30	Impact of Outdoor Lighting
	11.30–12.00	Spectroscopy of Outdoor Lighting
	12.00–12.30	Demonstrations of the Effects of Outdoor Lighting
	14.00–14.30	Man-made radio noise
	14.30–15.00	Impact of Telecommunications
	15.00–15.30	Demonstrations of radio noise
	16.00–17.00	Interstellar Chemistry, the formation of planets and th Evolution of living matter
Day 3:	09.30–10.30	The Protection of Observatory Sites Terrestrially and in Space
	11.00–11.30	Space Debris
	11.30–12.00	Commercial Exploitation of Space
	12.00–12.30	Terrestrial pollution of the nearby Solar System
	14.00–15.30	Division into 3 Interest Groups for question and answer sessions on AEI as they affect UV/Optical/IR, Radio and Space Astronomy
	16.00–17.00	Formal Plenary on Action to be Taken

a) Agreement on outdoor lighting (i) shielding, ii) hours of use, (iii) spectroscopic limitation;

b) Radio frequency allocation (i) rigorous defence of radio astronomy allocation, (ii) reduction of sideband and harmonics interference and prevention of frequenc; drift;

c) space policy (i) disposal of spent spacecraft, (ii) reserved use of space for science (like Antarctica), (iii) avoidance of further pollution of nearby solar systen from atmospheric and other activities.

3. Rationale for Meeting

The AEI Meeting is essential to inform governments and the public of the well nigl overwhelming problems being faced by astronomy. Because the meeting is to b‹ expository, the frontier activities of astronomy in all wavelength regions need to b‹ explained especially the intrinsic weakness of astronomical signals. The pressures or astronomy, e.g. telecommunications, are not necessarily obvious to the layman. There i: a need to make clear where astronomy is developing and to make clear visually anc aurally just how man-made noise impacts on astronomical observations, an enterprise madɛ difficult by the Earth's own atmosphere.

The audience is expected to be drawn from science advisers to governments anc science writers and other members of the public with concern for the preservation oi astronomical science.

It is intended to publish the proceedings as a UNESCO book which should be a visually appealing product - good astronomical photographs and colourful representation of e.m. interference. UNESCO will give the volume wide circulation through its own mailing list. A well illustrated book always has appeal and, if simply written, could be a substantial influence on the AEI problem.

4. Participation

The draft programme is only included to provide an initial framework - it is not prescriptive. What is essential is to assemble a worldwide set of good lecturers and demonstrators. It seems to me that good demonstrators can improve the impact of the presentations and it would be valuable if the demonstrations could be made available for hands-on experimentation during coffee breaks. The total number of lecturers needed is not large. There are five hour length lectures, 11 half hour lecture slots and four demonstrations. A maximum of 20 people is therefore involved. However, some of the demonstrations will no doubt be handled by the lecturers involved.

However, the primary need now is to establish a representative Programme Committee to seek lecturers of excellence.

It would also be the intention to seek the participation of COSPAR, IUCAF (already expressing interest), URSI, IUGG (already expressing interest), SCOSTEP, SCOR, in this meeting. The meeting itself could be seen as a contribution by these Unions and Inter-Union Committees to the International Space Year in 1992. The participatiion of NASA, ESA, ESO etc. would be most welcome.

I would welcome suggestions for programme and speakers and further offers of financial support.

Members of Scientific Organising Committee:

Dr S.J. Bauer (ESA, COSPAR)

Dr R. Costero (IAU)

Dr D. Crawford (IAU)

Professor Sir Francis Graham-Smith (IAU)

Dr T. Gergely (IAU)

Dr S Isobe (IAU)

Dr D.J. Kessler (NASA)

Dr J. Kovalevsky (IAU)

Dr D. McNally (IAU) - Chairman)

Dr P. Murdin (IAU)

Professor L. Perek (IAF, IAU)

Dr S. Raither (UNESCO)

Dr J.-P. Swings (IAU)

Dr. B. Robinson (IUCAF)

Professor M. Walker (IAU)