Teaching of Astronomy in Asian-Pacific Region

Bulletin No. 3

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Mitaka Tokyo Japan
1990.4.28 -- 500 --

Preface

We start to publish our Bulletin of "Teaching of Astronomy in Asian-Pacific Region" of the International Astronomical Union (IAU) by this issue of February 1990. A Working Committee (WC) of astronomical education in the Asian-Pacific (AP) region of the IAU was settled during the A-P regional meeting of the IAU held in Beijing in October 1987, to discuss our efforts for activation of astronomical education in the AP region. After exchanging some numbers of letters within members of the WC, the chairman of the WC made proporsals on our activities: 1) to promote exchange of materials and techniques for astronomical education, 2) to promote activation in teaching of astronomy at some AP countries having no professional astronomers, 3) to promote exchange of school teachers and their ideas, and 4) to start a regular (semi-annual at the begining) publication of this Bulletin. These proporsals were approved at the WC meeting in Baltimore, USA during the IAU General Assembly in August 1988.
The Chairman of the WC hopes this Bulletin will support activities of astronomical education in the AP countries and will develop much.

February 26, 1990

Syuzo Isobe
Chairman of the WC

TEACHING SETI: WHERE THE SCIENCE OF ASTRONOMY MEETS THE SCIENCE OF SOCIETY

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At first glance there would appear to be no connection between astronomy and the social sciences. Our first impression, however, may be in error. In reality, social science was born out of the physical sciences.

One of the premier figures in the social sciences was Auguste Comte (1798-1857). This Frenchman was a mathematician with a deep interest in astronomy and physics. Comte is looked upon by many as being the figure that most cogently argued for the development of a social science based on the positivistic model of the natural sciences. Comte argued for the establishment of a discipline of study he called "social physics." Later, he coined the term "sociology," and it was this term rather than "social physics" which survived.

In the view of Comte, human social systems were similar to the solar system in that both were subject to invariable natural laws. When Comte wrote, some 150 years ago, astronomy was already a predictive science. Comte insisted that some day human historical events could be understood and predicted just as surely as astronomical events. Sociology would some day be as precise as astronomy.

The first 150 years of existence of sociology has not given us much hope that Comte's dream will ever be realized. Sociology, as well as a number of other social and behavioral sciences have developed, but they are still what we call the "soft sciences." In the social sciences concepts are often ill defined, methodology is weak, and the power of prediction is poor. Progress has been made in many areas, however, and the situation is not without hope. It has taken other sciences several centuries to develop sophisticated procedures of investigation, so perhaps the social sciences, being young, will, in time, mature.

One very encouraging development in the social and behavioral sciences has been brought about by their interaction with related fields of study. Physiological psychology has been enriched by advancements in biochemistry. Sociology and psychology have, through combined efforts, produced a rich field of information called social psychology. Sociology has recently been given a whole new paradigm of investigation based on genetic biology. The field of sociobiology appears to be a most promising intellectual adventure.

Sciences are much like flowers, they need cross pollenization to develop. The richest areas of intellectual investigation lie at the juncture between bodies of knowledge. Some bodies of knowledge lie so far apart it may be difficult to see a link between them. Astronomy and the social sciences might seem to have this problem. But, is it possible that the social sciences and astronomy could be connected? I believe that the answer is "Yes."

In the last 30 years there has been a growing interest on the part of the astronomical community in SETI (The Search for Extraterrestrial Intelligence). The use of radio astronomy to search for evidence of extraterrestrial civilizations was first suggested in 1959 by Guiseppe Cocconi and Philip Morrison. In their classic article in Nature, entitled "Searching for Interstellar Communication," they focused the astronomical community's attention on this new and exciting challenge.[1]

In 1960, American astronomer Frank Drake used the 85-foot-diameter dish at the Green Bank, West Virginia, National Radio Astronomy Observatory for a brief set of observations. This came to be known as project "Ozma." Since project Ozma, several thousand hours of observation time at various telescopes around the world have sought the elusive signal that would indicate we are not alone in our galaxy. As of yet we have not confirmed evidence that can argue for the existence of intelligence other than our own.

During the 1970s and 1980s attempts were made to interest national governments in the search for extraterrestrial intelligence. Although some minor funds were made available in several countries, no comprehensive and systematic search was approved by any government. The Soviet Union has conducted several interesting searches dating from Kardashev and Sholomitskii's initial work in 1964. In the United States, after many years of struggle, proponents of SETI received a commitment from Congress to fund a 10-year, $90 million program. After beginning funding in 1989, an initial vote in the House of Representatives killed the program entirely. Vigorous efforts by the California based SETI Institute and others, led to a reversal of this vote by the full Congress. NASA's SETI program was fully funded and fully protected. Specific language in the legislation assured that the program would be protected from internal NASA shifts that could threaten allocations.

In part, because of the slowness with which governments have moved on this matter, the Planetary Society, a space interest group headed by Carl Sagan, Louis Friedman, and a number of distinguished writers, scientists, and public citizens, has privately funded its own search. Private searches of a reasonably sophisticated magnitude are made possible by the development of advanced super-computer technology. The 1970s and 80s saw major developments in data processing capabilities at prices that made them affordable by privately funded agencies. Responding to this opportunity, the Planetary Society, in 1985, launched a project called META (Megachannel Extraterrestrial Assay). META I, headed by Paul Horowitz, operates at Harvard's Oak Ridge Observatory in Massachusetts. META II, headed by Raul Colomb, opened October 12, 1990 at the Argentine Institute of Radio Astronomy near Buenos Aires. META II has the capability of observing the southern skies, giving the META project complete sky coverage. Each of these systems is equipped with an 8.4 million channel receiver. A META III project is now being considered by the Planetary Society. Although no final decisions have been made, it appears likely that such a project might be located in the Soviet Union.

Now that NASA search has been funded, it promises to be immensely more powerful than all other searches combined. NASA's Michael Klein and Jill Tarter have calculated that during the first minute of the proposed NASA search, more data would be collected than during the entire 30 years of observation that preceded it. Progress is being made in the advancement of SETI, but as this brief history indicates, it has been a slow, painful, and sometimes stumbling progress.

Whatever the rate of progress, the age of sophisticated SETI searches has arrived. No one knows if they will be successful. Whether or not the search is successful, its mere existence provides for an exceptional array of research and teaching opportunities. SETI had the capability of stimulating multidisciplinary teaching and research, extending even into the social science disciplines. This is a rare opportunity to enjoy the richness of intellectual interaction that invariably occurs when "alien" fields of investigation have contact.

From a research standpoint, several social scientists have been working on various issues related to circumstances that might surround possible contact. Experts in international relations, working with social scientists, legal consultants, and radio astronomers have drafted a

Protocol Agreement aimed at defining appropriate professional response that would follow the first suspected ETI signal.[2] In addition, extensive social survey research has been conducted to ascertain the opinions of SETI community on the possible design of a contact verification committee that would function to seek maximum possible certainty that no false signal or hoax is given the scientific stamp of approval.[3] Surveys have also been conducted to explore the opinions of the international media with regard to possible impacts of an announced discovery.[4] These surveys have also suggested some points of critical importance for the effective interaction of the astronomy community and the media, should such an event occur.

Many other areas of research between the radio-astronomy community and the social science community are available and will be developed over the next few years. Although research opportunities are abundant, the opportunities for teachers of astronomy are perhaps even greater.

From an educational point of view, it matters not whether evidence of the extraterrestrial use of radio technology is found--what matters is that we systematically think about and explore the questions that the search itself presents. Perhaps the best way to do this is to examine the famous Drake equation, originated by Frank Drake, Project "Ozma" pioneer.[5]

The Drake equation calculates the number of intelligent civilizations in the cosmos by designing an equation with seven basic variables. These variables, when multiplied together, give an estimate of the number of communicating civilizations in the galaxy.

$$N = N_{*} \times f_p \times n_e \times f_l \times f_i \times f_c \times f_L$$

- N = Number of communicating civilizations in the galaxy.
- N_{*} = Number of stars in the galaxy.
- f_p = Number of planets around stars.
- N_e = Number of planets suitable for life as we know it.
- f_l = Number of planets upon which life does arise.
- f_i = Number of planets on which intelligence arises.
- f_c = Number of planets on which a civilization capable of communication arises.
- f_l = The length of life of the average planetary civilization.

Examination of this equation reveals some interesting characteristics. First, although all figures assigned to the units in the equation are estimates, as we go deeper into the equation the estimates become more speculative. Reasonably good estimates of the number of stars in the galaxy are available. We are nearing the time when final confirmation of the existence of planets around other stars will be available. The number of planets suitable for life will for a very long time remain a matter of crude estimation. From this point on in the equation the estimates become almost total guess work.

The second interesting factor about the Drake equation is that as we move deeper into it, the variables we are considering lie more clearly within the life sciences. Beginning with f_1 (the number of planets upon which life does arise), the equation leads us into assumptions about the biochemical basis of the origins of life. At this point in the equation biophysics and biochemistry phase into broader biological and ecological questions. It is here that we find the essence of the field of bioastronomy, the search for extraterrestrial life (not just extraterrestrial intelligence). Bioastronomy is a relatively new field, first defined by SETI pioneer Michael Papagiannis in the 1980s. The field now enjoys official recognition under the auspices of Commission #51 of the International Astronomical Union.

Finally, the latter part of the Drake equation clearly involves psychology and the social sciences. The variable f_i (the number of planets on which intelligence arises), bring us into the psycho-physiological definition of intelligence and the theoretical question of what variation in forms might it take. Variables f_c (the number of planets on which a civilization capable of communication arises), and f_1 (the length of life of the average planetary civilization), get us into questions of sociological, anthropological, and historical content. Although estimates of these variables are extremely speculative, useful analogies can be drawn from our own experience on this planet. On our planet, a number of different civilizations have followed various paths of social evolution based on their environmental and historical circumstances. Here, anthropologists, sociologists, and historians can have the rare opportunity of joining astronomers, evolutionary biologists, biochemists, and psychologists in the attempt to bring full expression to this equation.

Virtually all fields of human knowledge would be enriched by a SETI discovery. In the social and psychological sciences, the impact could be particularly great. The mere confirmation of civilizations other than our own would rescue cultural anthropology from a fate that is slowly forcing its discipline toward comparative historical analysis. As human civilizations become more and more homogeneous under the impact of global communication and transportation, cultural anthropology is faced with a loss of subject matter. The confirmation of even one extraterrestrial civilization would instantly create a vital new area of extraterrestrial anthropology that would completely revitalize this dying discipline. Likewise, comparative planetary psychology might be made possible by interstellar communication. Sociologists could review their paradigms of social organization and social evolution with fresh new insights and speculations. As anthropologist Ben Finney has suggested, a complete new field called "xenosociology" or "astrosociology" might develop.[6] Historians, would have the history of a whole new planet to begin to record and analyze.

In the event of a SETI discovery, human knowledge, from astrophysics to philosophy, would receive perhaps the strongest stimulation since the invention of writing. We must remember, however, that such a discovery may take years, decades, or even centuries if it comes at all. Yet, the teachers of astronomy, biology, anthropology, sociology, and the many other disciplines involved in the total SETI enterprise can, with leaps of imagination, now begin to enrich their courses with speculations about the possible existence of extraterrestrial life and social systems.

As stated at the beginning of the essay, it was the French astronomer-philosopher Auguste Comte who launched the enterprise of social science. Comte correctly foresaw the development of the social sciences. He could not, however, foresee the development of SETI. He confidently, but wrongly, stated that following about celestial objects:

> "We see how we may determine their forms, their distances, their bulk, their motions, but we can never know anything of their chemical or mineralogical structure; and much less, that of organized beings living upon their surface..."

To the contrary, SETI could produce exactly that type knowledge. Perhaps a much wiser statement was made by Chinese scholar Hu Shin, when he remarked:

> "Contact with strange civilizations brings new standards of value, with which the native culture is re-examined and conscious reformation and regeneration are the natural outcome."[8]

Radio astronomy now brings us this possibility on an interplanetary scale.

REFERENCES

1. Giuseppe Cocconi, and Philip Morrison. "Searching for Interstellar Communications," Nature, Vol. 184, 1959, pp. 844-846.

2. See, "Approved Protocol," Part VI, Acta Astronautica, Special Issue, "SETI Post Detection Protocol," Jill C. Tarter and Michael A. G. Michaud (Eds.), Vol. 21, No. 2, February, 1990.

3. See Frank White, The SETI Factor, New York: Walker and Company, 1990, pp. 208-209.

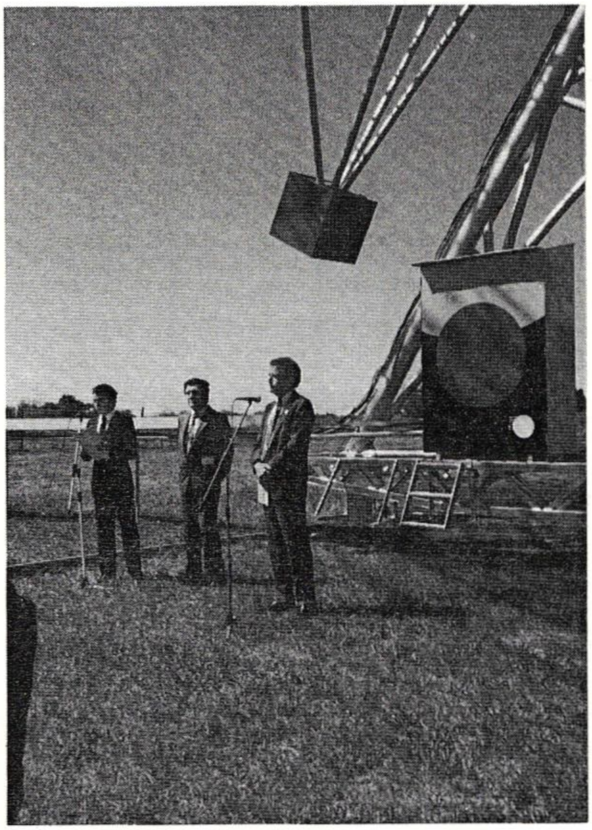
4. See the following: A. G. Franknoi, "What if We Succeed?: A Media Viewpoint," in G. Marx (Ed.), Bioastronomy -- The Next Steps, Kluwer Acedemic Publishers, 1988, pp. 417-424. Donald E. Tarter. "SETI and the Media: Views from Inside and Out," 40th Congress of the International Astronautical Federation, Malaga, Spain, and Donald E. Tarter and Walter G. Peacock, "The Consequences of Contact: Views of the Scientific Community and the Science Media," Proceedings of the Third International Bioastronomy Symposium, Val Cenis, France, June 1990.

5. A more elaborate discussion of the Drake equation can be found in Thomas R. McDonough, The Search for Extraterrestrial Intelligence: Listening for Life in the Cosmos, New York: John Wiley & Sons, 1987.

6. Ben Finney, "The Impact of Contact," in Part III. Acta Astronautica, Special Issue (See #2, above).

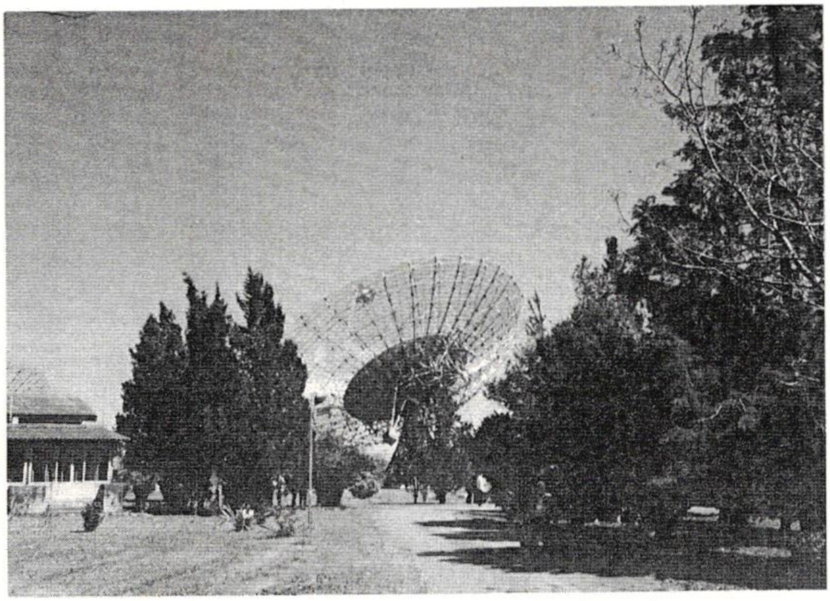
7. As quoted in Arthur C. Clarke, Profiles of the Future, New York: Harper & Row, 1958, p. 13.

8. Ibid. p. 91.



Planetary Society Executive Director, Dr. Louis Friedman (right) and Director of the Argentina Institute of Radio Astronomy, Dr. Raul Colomb (center) dedicate META II in formt of The Flag of Earth (October 12, 1990)

The META II Radio Telescope Argentina Institute of Radio-Astronomy



Astronomy careers in Australia

Astronomy has always been one of the more popular sciences. It costs nothing to go out at night and watch our galaxy march across the sky, but to observe the nature and movement of the stars in more detail requires the most advanced instruments devised for scientific research, like the Australia Telescope array at Narrabri. The technologies developed to build such an instrument have numerous advantages for man's progress, whereas the astronomical knowledge appears to have fewer immediate applications.

There are very few positions available for astronomers, and these few are fiercely contested by our best scientific achievers when they become available. The basic education for an astronomer requires eight years at university, four years for an honours degree in science (or a pass degree and masters degree), and then four more years on average for a Ph.D. degree. The universities supporting astronomy studies can be seen in the extra sheet called 'Studies for a Career in Astronomy'.

An astronomical institute not only employs research scientists, but requires a support staff with many other specialised skills like Engineering, Computing, Photography, Publishing, Metal Trades and Carpentry. People with training in these skills and an interest in astronomy may have the opportunity to compete for jobs in their speciality when they become available. See the diagram on the extra sheet called 'Alternate Careers in Astronomy' showing the education requirements for many of the support positions. Once a position in a particular field is gained in an astronomical institute, there are often opportunities to progress to another field after further part-time studies e.g. Metal Trades to Engineering or Computing to Scientist.

To find out more about a career in astronomy you may be able to ask a representative from a research organisation, like the Australia Telescope National facility and the Division of Radiophysics, CSIRO, about the current status of employment in astronomy at one of the 'careers market' days that are held regularly in major centres throughout the state.

To see further the day-to-day requirements of filling a position in astronomy, interested students should consider doing their 'work experience' in years 10 or 11 at an institute that can show how a scientist works and the skills required to survive in the job beyond the more obvious educational requirements. The Parkes Telescope takes three or four work experience students a year, the Australia Telescope National Facility and the Division of Radiophysics take quite a few more. Students interested in careers in engineering, computing, photography as applied to astronomy can see these careers in action at the Radiophysics laboratory at Marsfield (Epping).

If you miss out on the few work experience opportunities available, keep an eye out for the 'Open Days' held every few years or encourage your school to organise a visit to your nearest observatory or laboratory. The Anglo-Australian Observatory at Marsfield (Epping) and the Mount Stromlo and Siding Spring Observatories in Canberra and Coonabarrabran occasionally take students at their sites, and are well worth investigating. Dr. Dave Allen from the A.A.O. Marsfield has written an interesting article 'A career in astronomy' in Phys Educ. Vol 17 1982, pp.178-182.

Because astronomers are a small population and are very dependant on each other for exchange of information, it becomes essential for them to travel to other Astronomy centres for conferences and workshops. They need to use other instruments designed to observe in different configurations or with different frequency specifications to the observatories where they usually work and they usually have to contribute themselves to the cost of the travel. Once students have completed the long years of study, they often find it necessary to move to these overseas centres to pursue the area of interest they may have developed in their studies, or because there is no positions available at the time. A list here shows a small portion of the International Institutes in the index of the IAU (International Astronomical Union).

For those of you still interested, I wish you the best of luck, because plenty of luck will be needed, along with stamina, good health, tremendous motivation and the innovative powers to make something of the information coming you way. Most of the people working in astronomy think it well worth the effort because it is a most inspiring and rewarding field, and looks more into tomorrow than any other scientific endeavour.

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Experimental Scientist
Australia Telescope National Facility
Parkes Observaory.

STUDIES FOR A CAREER IN ASTRONOMY

Higher School Certificate subjects (University entrance)

English most important for writing skills
Mathematics a basic requirement for any science subjects
Physics > important but can be caught up at tertiary level
Chemistry > as for physics
Design, Drawing and Computer science are useful

Under-Graduate Degree

A science degree in physics or mathematics
Engineering degree in electronics

First Year	physics, mathematics, chemistry and computer science
Second year	perhaps leave out chemistry
Third year	physics and mathematics
Fourth year	honours year of physics or mathematics

Electrical Engineering covers science studies and 'hardware' skills with an option of taking a year out to complete a B.Sc.

Post -Graduate Courses
The Ph.D. requires 4-5 years slave work at one of these graduate schools.

Monash University Theoretical Astrophysics in the Mathematics Dept.
Galacto-chemistry in the Chemistry Dept.
Astronomy on variable stars in the Physics Dept.

University of Tasmania Radio, Optical, Cosmic-ray, X-ray Astronomy in the Dept of Physics using the Observatories at Mt. Pleasant and Parkes.

University of Adelaide Gamma-ray Astronomy in the Dept. of Physics

Australian National University, Canberra
Optical Astronomy is done at Mount Stromlo, and Siding Springs.
and Radio astronomy is done in conjunction with the Australia Telescope.

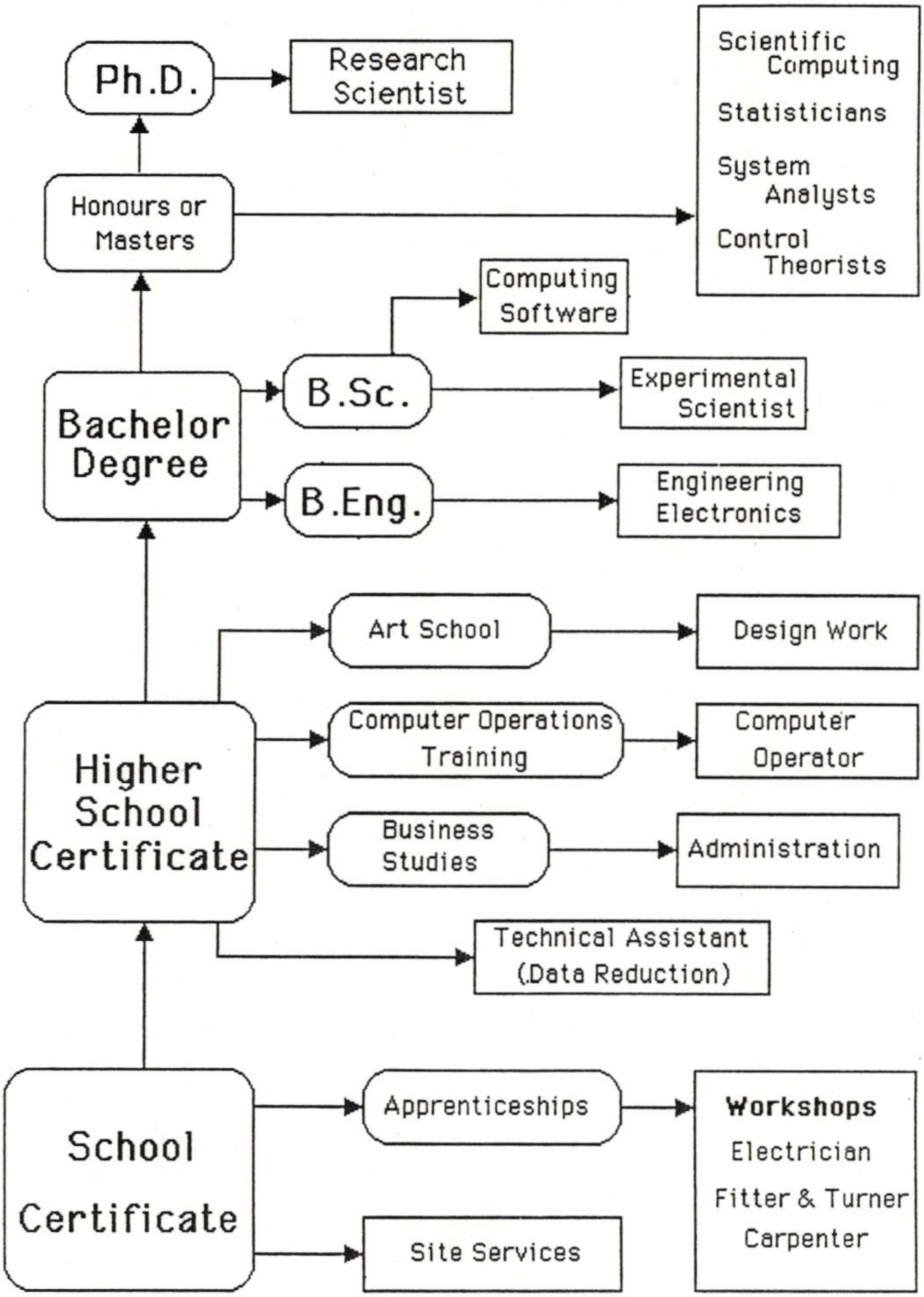
Sydney University Dept. of Physics does radio astronomy at Molongolo, Stellar astronomy at Narrabri, and other optical astronomy activities.

University of N.S.W. Dept of Physics, infrared, optical, and radio astronomy.

University of Wollongong Dept. of Physics.

Australian Institutions employing Astronomers

Universities mentioned above (and some others) in Academic roles.
Anglo-Australian Observatory at Marsfield.
CSIRO Australia Telescope National Facility, Marsfield N.S.W.



Alternative Career Options

There are over 500 institutions listed in the International Astronomical Union Index that employ astronomers, over half in North America, and many of them controlling several Observatories. Here are some of the major entries.

- U.S.A., Canada and Mexico
  - Algonquin Radio Observatory, Ontario, Canada
  - Arecibo Observatory, Puerto Rico
  - Cornell University, Ithaca, New York
  - Dominion Astrophysical Observatory, Victoria, BC, Canada
  - Dominion Radio Astrophysical Observatory, Penticton, Canada
  - Five College Radio Astronomy Observatory, Massachusetts
  - High Altitude Observatory, Boulder, Colorado
  - Instituto de Astronomia, Mexico City, Mexico
  - Jet Propulsion Laboratory, Pasadena, California
  - John Hopkins Laboratory, Baltimore, MD
  - Kitt Peak National Observatory, Arizona
  - Massachusetts Institute of Technology, Cambridge, Massachusetts
  - Mauna Kea Observatories, Hawaii
  - McDonald Observatory, Fort Davis, Texas
  - Mount Wilson Observatory, Pasadena, California
  - N.A.S.A. Washington, DC
  - National Radio Astronomy Observatory
    - Greenbank, West Virginia
    - V.L.A., Socorro, New Mexico
  - Owens Valley Radio Observatory, California
  - Palomar Mountain Observatory, Pasadena, California
  - Smithsonian Astrophysical Observatory, Cambridge, MA
  - Space Telescope Science Institute, Baltimore
- Argentina
  - San Juan Observatorio Astronomico Nacional, Cordoba
- Australia
  - Anglo-Australian Telescope, Coonabarabran
  - Parkes Radio Telescope, Parkes
  - Mt. Stromlo and Siding Spring Observatories, ACT
  - Mt. Pleasant Observatory, Tasmania
  - Molongolo Observatory Synthesis Telescope, Molongolo, NSW
  - Deep Space Tracking Station, Tidbinbilla, ACT
  - Australia Telescope, Narrabri
- Belgium
  - Observatoire Royal Bruxelles
- Brazil
  - CNPq-Observatorio Nacional, Rio de Janeiro
- Chile
  - Cerro Tololo Inter-American Observatory, La Serena
  - Las Campanas Observatory, La Serena
  - European Southern Observatory, La Cilla
- China
  - Beijing Astronomical Observatory, Zong-guan-cun, Beijing
  - Observatory ZO-Se, Shanghai
  - Purple Mountain Observatory, Nanjing
  - Yunnan Observatory, Kunming
- Germany
  - European Southern Observatory, Munich
  - European Space Operations Centre, Darmstadt
  - Max-Planck-Institut fur Radioastronomie, Bonn
- Finland
  - University of Helsinki Observatory, Helsinki
- France
  - Groupe d'Astrophysique, Grenoble
  - Institut de Radio Astronomie Millimetrique
    - Observatoire du Plateau de Bure, St. Etienne en Devoluy
  - Observatoire de Nice, Nice
  - Stellar Data Centre, Strasbourg
- Greece
  - National Observatory of Athens, Athens
- Hungary
  - Konkoly Observatory of the Hungarian Academy of Science, Budapest

India
- Raman Research Institute, Bangalore
- Tata Institute of Fundamental Research, Bombay
- Uttar Pradesh State Observatory, Naini Tal

Ireland
- Dunsink Observatory, Dublin

Israel
- Wise Observatory, Tel Aviv

Italy
- Istituto de Astrofisica Spaziale, Frascati, Rome
- Istituto di Radioastronomia C.N.R. Bologna

Japan
- Kiso Observatory, Nagano
- Nagoya University Physics Department, Nagoya
- Nobeyama Radio Observatory, Nakano
- Tokyo Astronomical Observatory, Mitaka-shi, Tokyo

Korea
- Korean National Observatory, Yoksam-Dong, Seoul
- National Astronomical Observatory, Daejon,Chungnam

Netherlands
- Kapteyn Astronomical Institute, Groningen
  - Kapteyn Observatory, Roden
- Radiosterrewacht Dwingeloo, Dwingeloo
- Sterrewacht Leiden, Leiden

New Zealand
- Black Birch Observatory, Blenheim
- Carter Observatory, Wellington
- Mount John University Observatory, Lake Tekapo

Poland
- University Jagiellonskiego Astronomical Observatory, Krakow
- Warsar University Astronomical Observatory, Warszawa
- Wroclaw University Observatory, Wroclaw

South Africa
- Boyden Observatory, Bloemfontein
- South African Astronomical Observatory, Hoartebesthouk

Spain
- Instituto de Astrofisica de Andalucia, Granada
- Instituto de Astrofisica de Canarias, Islas Canarias
- Instituto de Radioastronomia Milimetrica, Pico Velata
- Observatorio Astronomico, Madrid

Sweden
- Lund Observatory, Lund
- Onsala Space Observatory, Onsala
- Stockholm Observatory, Saltsjobaden
- Uppsala Astronomical Observatory, Uppsala

Switzerland
- Observatoire de Geneve, Sauverny
- Observatoire de Lausanne, Lausanne

Turkey
- Ege University Observatory, Izmar
- University Observatory, Istanbul

United Kingdom
- Armagh Observatory, Northern Ireland
- Nuffield Radio Astronomy Laboratories, Jodrell Bank, Cheshire
- Mullard Radio Astronomy Observatory, Cambridge
- Royal Greenwich Observatory, Hailsham, East Sussex
- Royal Observatory, Edinburgh
- St. Andrews University Observatory, St. Andrews, Fife

USSR
- Abastumani Astrophysical Observatory, Mount Kanobili, Georgia
- Crimea Astrophysical Observatory, Crimea
- Pulkovo Observatory, Leningrad
- Radioastrophysical Observatory, Riga, Latvia
- Shemakha Astrophysical Observatory, Shemakha, Azerbaijan
- Sternberg State Astrophysical Observatory, Moscow
- Ukrainian SSR Academy Observatory, Kiev, Goloseevo

Vatican City State
- Specola Vaticana, Citta del Vatticano

Planetariums in Japan - An Overview

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1. Planetarium Environment

Most planetariums in Japan have been constructed by local autonomys and operated by them or affiliated organizations, for public/school educational purposes. According to an survey made in 1990 (all data referred to are from Ref. 1 unless otherwise stated) of non school-owned planetariums of 5-m or larger , 59.0% were founded for the purposes of social education and 21.0% for school educational use; however 96% of the total are visited by school groups for school programs on weekdays.

Most school teachers had not experienced astronomy education, even introductory courses, in universities, because a small percentage of universities in Japan provide astronomy courses. School teachers feel it difficult to guide night observations due to their unfamiliarity with constellations and due to special homework circumstances: weather, light pollution, safety and others.

These accounts for a great demand for school use of planetariums, where planetarium staff usually teach pupils instead of school teachers. As a result, school teachers further depend on planetariums for astronomy education.

School groups usually visit planetariums on weekdays; while on holidays, lots of families, couples, and other groups or individuals crowd there.

Public interest in social education have increased markedly as a result of the improved living standard and the expanded availability of leisure time. To meet this growing demand for social education, various learning opportunities are offered by local governments, such as lifetime education seminars, adult university courses, and open seminars at some universities; and the authority is improving and expanding cultural facilities such as art museums, libraries, sports center and parks.

The living standard of the Japanese people has reached a level comparable to that of the West in terms of average income, as a result of the rapid expansion of the Japanese economy. Now the emphasis on citizen's life is shifting from materials affluence to the quality of living, especially the culture aspect of life.

With such a social background, planetariums has been built rapidly at the rate of about 10 a year since the first manned lunar landing (Ref. 2 and 3) and when the Japanese economy still continued on a course of high growth. According to the 1990 survey, planetariums, excepting ones at some schools, amount to 217.

2. Planetarium Dome

Domes in diameter from 5.0 to 9.9-m account for 26.1% of the total number of planetariums in Japan. This is followed by 10.0 - 14.9-m domes with 27.8%, 15.0 - 19.9-m with 8.8% and 20.0 - 24.9-m with 13.6%.

The current tendency is building big domes, sometimes tilted ones, which has come to be known as the "Space Theater" : 10.7% planetariums in Japan already have tilted domes.

Even in "flat domes," uni-directional seating has come to be used widely, 58.9%. This matter show that lots of visual productions such as slides, video tapes, laser disks and movies are frequently used.

About 96% planetariums are made by two domestic manufacturers (Ref. 3).
Most planetariums own their telescopes and hold public observing sessions on regular basis.

3. Personnel

About 60% planetariums have a full-time staff of one or two persons only. Even though there is also part-time staff, it is usually one at most.

Most planetariums are not only understaffed but suffered personnel change once a few years as a rule of government officials. Furthermore, planetariums staffer is not always one with astronomy literacy. In the worst cases he/she must unwillingly learn everything required step by step.

As a matter of course, such planetariums cannot show enterprising spirit and programs with their own individual qualities.

About 20% planetariums do not suffer such a personnel loss; they can accumulate their technical and educational experience and knowledge for challenging works. But in cases where they are not creative, personnel change is must.

4. Programs

Most planetariums aiming school education only provide no public programs, while other ones show school and public programs according to their show schedules.

Lack of staff should not lead to in house productions. In cases of public programs, 53.8% planetariums entrust with a part of or whole production and installation to software producers, often affiliated with planetarium manufacturers; 39.5% for school programs.

Planetariums where no staff can write public program scripts account for 31.9% ; 24.3% for school programs.

Thus manufactured "show packages" without no live lectures are widely marketed; 36.9% planetariums use such a taped show for public programs and 16.1% for school programs.

5. Conclusion

The quality gap between creative planetariums and "canned" ones will be still wider in future.

Planetariums are visited by about two millions of persons, 1.7% of the total population of Japan, annually (Ref. 4). This means that planetariums are one of big key media for astronomy education in Japan.

The biggest problem will be breaking the staff-overcutting trend. If the administration is aiming to establish planetariums appreciated by all the citizens, taking expertise for planetarium educator into account, they must look out for educators with astronomy literacy, and may find helpful candidates among young researchers with much interest in sharing astronomical experiences with the public and young people.

On one side, if an university with interest in astronomy education can use a nearby public planetarium, the student will be willing to offer help to public program planning, making and operating; such a activity itself can be a part of a curriculum of the university; and planetarium-aided instruction at university will be fit to attract high school students' attention.

This interdependent relationship between local autonomous bodies and universities will bring a big advance in astronomy education in Japan, if realized.

6. References

(1) Takabatake, N. and Yamamoto, S. (1990): Proc. the 4th conf. of the Society of Teaching and Popularization of Astronomy, 87- (complete report available from the authors; both in Japanese)

(2) Itoh, S. (1987): Proc. the first conf. of the Society of Teaching and Popularization of Astronomy, 64- (in Japanese)

(3) Kitazawa, J. (1987): Planetarium Research, 4, 23- (in Japanese)

(4) Isobe, S., Sasaki, G, and Shinohara, N. (1986): Proc. the GIREP conf., 313-

ASTRO BBS
"T H E   S P A C E   B O A R D"

For the dissemination of free software and information of interest to astronomers/observers/astronom educators and astronomy buffs, Yokohama Science Popularizing Association for Youth is operating a free astronomy electronic bulletin board system at Yokohama Science Center, Isogo-ku, Yokohama. It runs 24 hours a day, 7 days a week except for occasional system maintenance.

To access this free service you will need a computer and modem.
This system called THE SPACE BOARD is accessible through a dialup modem at 300/1200/2400 baud (8 bits, 1 stop, no parity). The phone number is 045-832-1177. International users can call it through a public packet switch network such as TELENET and DATAPAC. The DTE address is 440881406100.

The system is menu-driven, offers a bulletin board, private e-mail services, free software, and various text files.

INTRODUCING ASTRONOMICAL ELEMENTS IN SECONDARY SCHOOLS IN POLAND

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The organization of education of young people in Poland may be presented as follows:

Age	Type of education
0 - 2 years	at home, or infant's nursery, creche,
3 - 5	nursery school, kindergarten,
6	class "zero", either at kindergarten, or at school,
7 - 14	eight class elementary school,
15 - 18	four class secondary school, lyce, or five class technical school,
18 or 19	secondary school certificate,
19 - 24	five years of university studies, ending with Master's Degree.

Astronomical elements are introduced in the elementary school while teaching geography and physics. Geography in the 5-th class comprizes a chapter on the "Earth as a Planet" explaining the shape and size of the Earth, the rotation and the revolution of the Earth and their consequences, the terrestrial orientation.

While teaching physics in the 6-th class one mentions the gravitational force on the Earth and on other celestial bodies in the chapter "force". In the 7-th class in "kinematics" one tells about the heliocentric and geocentric system, in "gravitation" - on motions of the Moon and of artificial satellites round the Earth, describing the Solar System, Copernicus work, Newton gravitational law, the importance of gravitation in the Universe. In the chapter on "optics" in the 8-th class the teacher introduces various optical instruments, the notion of difraction of light, the relation of colour and temperature of a body, determination of stellar surface temperatures, the solar spectrum.

In Polish secondary schools astronomy has been taught for many years as a separate subject, one hour per week in the last class. However, the introduction of school-free Saturdays a few years ago, caused a decrease of school hours, hence some subjects, among them astronomy, had to be cancelled from school programmes. Another way of introducing astronomical elements has been proposed: to teach not simply "physics", but to teach "physics with astronomy" as a new subject. In that manner in every type of secondary school some astronomical notions will have to be introduced together with physical elements.

There exist in Poland four types of lyce, where one of the following subject groups are taught in a more detailed way: mathematics + physics, biology + chemistry, general type, humanities + classics. In the first three types astronomy is introduced in the 2-nd class as "astronomy and gravitation", and in the 4-th class as "astrophysics and cosmologoy", but the number of hours given to these chapters may vary according to the school type. In the last type of lyce astronomy is introduced in the 1-st class in "origins of physics and astronomy" and in "classical mechanics", where one mentions Copernicus, Brahe, Galileo, Descartes, Newton, Kepler, space flights. The second part of astronomy, called " modern views on the Universe", is introduced in the 4-th class and deals with stars, galaxies, and the history of the Universe. The above programme has been introduced about three years ago, so that one has to wait some time to see the results.

Of course, teachers have to be specially prepared to cope with this new subject. Normal training of future physics teachers takes place in universities and higher pedagogical schools. For these who are already teaching physics, evening or extra-mural courses are being offered. In a few universities post-diploma recycling courses in modern physics and astrophysics are organized. Future geography teachers also get a training in astronomy during their university education. Some of the largest planetariums usually offer summer workshops for teachers.

Let me tell now about my own city. Nicolaus Copernicus has been born in Torun on February 19, 1473, the University bearing his name came into existence in 1945. About ten thousand students are learning at six faculties: humanities, exact sciences, biology and earth sciences, law, fine arts, econonomics. Torun has been the site of many international symposia and colloquia, the most important during the Copernican Anniversary-1973. Yet it will be for the first time that a meeting connected with research on teaching methods will be organized in 1991. This will be a conference on physics education, organized by the Internatnional Research Group on Physics Teaching, GIREP, on "Teaching about Reference Frames: from Copernicus to Einstein", to be held at the Nicolaus Copernicus University in Torun on August 19-24, 1991. The programme will consist of thirteen plenary lectures, six workshops, poster sessions and exhibitions. A preliminary registration form ought to be mailed back to Torun till December 1, 1990.

And, since we were talking of Copernicus, let's try to introduce to school-children an easy model of the Solar System, based on the local well-known highest building or tower. This should be taken as the solar diameter, and the resulting planetary sizes and orbits have to be projected on the map of the town, or of the country. For Torun I take usually the solar diameter equal to the height of the tower of St. John's Church / about 50m /. The Earth has then a diameter of 51cm, the Moon - 12cm, and all planetary orbits can be drawn on the map of Poland, the first in close vicinity of Torun, Neptune would be in Warsaw, Pluto still farther. Can you calculate your own models?

A DIFFICULTY IN TEACHING PLANETARY MOTION

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Persistence of Aristotelian ideas among students of various levels, including the university level, has been baffling educators for about 20 years and it is a global problem. Particularly, it has been observed that the uniform circular motion is the most difficult topic from mechanics. The first investigation[1] on u.c.m. is due to John Warren, who studied the patterns of thinking among students of engineering and observed that they had poor understanding of the subject. Subsequently, many educators carried out similar studies in many parts of the world and their findings substantiated the observation made by Warren. Therefore a restudy of teaching u.c.m. was undertaken, by the present author, which brought to the fore some drawbacks. These drawbacks were discussed[2] in the I.C.P.E. Tokyo C^nference in 1986 and it was argued that students are motivated to give wrong answers to some questions on u.c.m., because of these drawbacks. Also, an appeal was made to physicists and educators to devote a future conference for the logical restudy of physics itself[3] and to resolve these drawbacks <u>before</u> blaming students. The problem regarding the direction of motion is the most difficult one and it necessitates us to restudy the teaching of planetary motion, in the introductory class, because the u.c.m. forms the basis for the planetary motion. I would like to term that problem as the Anticlockwise / Clockwise Paradox i.e. A/C Paradox and comment on the teaching of planetary motion in view of this Paradox. Let me explain the A/C paradox first.

The u.c.m. is characterised by two parameters, viz.
i) the magnitude of velocity and ii) the direction of motion. The present knowledge asserts that the u.c.m. is due to the centripetal force acting on the body and therefore we can calculate the <u>magnitude</u> of velocity by using the eq. force, i.e. $F = mv^2/r$. But how to decide whether the body is moving anticlockwise or clock-

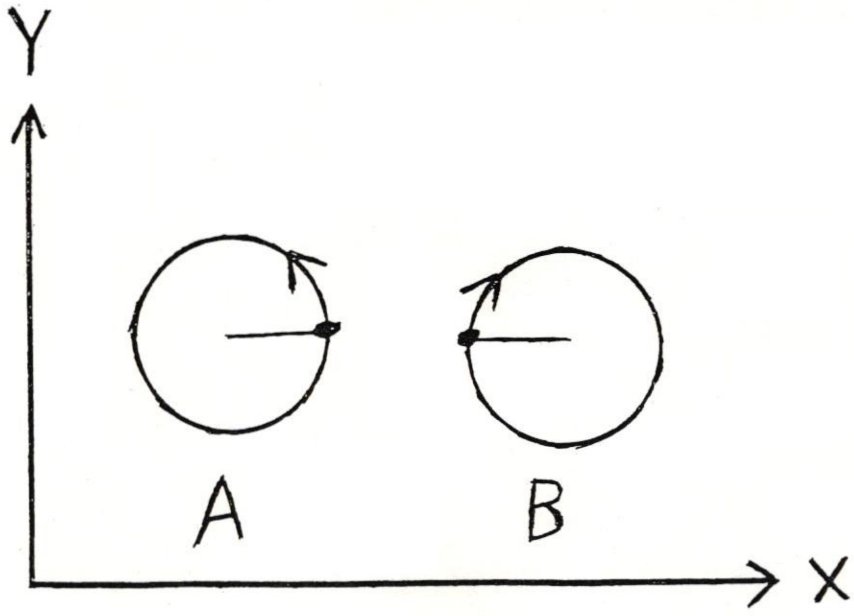
wise? If the u.c.m. is really due to the centripetal force, then it should be possible for us to decide the direction of motion on the basis of force only. For illustrating this paradox I used the following demonstration in the Tokyo conference. Two keys were tied to two strings and revolved in opposite directions, in front of the audience, as shown in figure 1. It was argued that the A/C paradox has missed our attention because we never use two objects while discussing the u.c.m., in the classroom and in the textbooks as well. Let us see how this paradox poses difficulty in teaching planetary motion.

While teaching the planetary motion in the introductoty class, we assume that the orbit is circular and the gravitational force provides the centripetal force for the planetary motion. This leads us to the eq. of velocity of planet, $v^2 = GM / r$. But the question is, if the gravitational force provides the centripetal force, how to decide the direction of motion by using the gravitational force? Unfortunately, all known planets are moving in the same direction and therefore we did not face this problem before. But in 1986 two Russian astronomers claimed the discovery[4] of the 10th planet and according to them it is moving in the opposite direction. In due course of time more observations will be made and their claim will be either supported or refuted. But can we do this theoretically, on the basis of the assumption stated above? We can do neither because there is no consideration to the direction of motion in the very basic treatment of the u.c.m. I hope that this difficulty will receive the careful attention of teachers to make the teaching of planetary motion more convincing than before.

REFERENCES:

1) Warren, J. W. (1971) Physics Education, 6, p.74
2) Sathe, D.V. (Aug. 1986) Proceedings of the I.C.P.E. Tokyo Conf., Part-II, p.72
3) Sathe, D.V. (Aug. 1986) i.b.i.d., p.258
4) News in Indian Express, dated: Feb. 7, 1986, p.1

Figure:1



Teaching of Astronomy in the Planetariums

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Abstract

From time immemorial men have been attracted to the beautiful starry sky, and people in ancient times desired to explore the celestial phenomena, and to discover the laws of Nature existing their seasonal changes. Scientists developed various kinds of tools, such as celestial globes to understand and explain them, easily. The emergence of planetariums gives us revolutionary changes in teaching astronomy to students and ordinary people. And planetariums have the possibility to be the core and centre of astronomy teaching in the communities.

In this paper the author discussed history and usages of planetariums. The distinct features of planetarium as a tool for astronomy education are also mentioned. Further, the typical planetarium programs for school education and for general public are refered to.

Planetariums are getting popular in our country year by year. Most local governments, however, are crazy enough to build planetariums furnished with modern, sophisticated, fully automated projectors and equipments with inadequate staff rather than traditional planetariums which seem more effective for astronomy education. There seem to be some problems concerning planetarium management in Japan. Last year Japanese planetarians decided to start some actual plans about the activation of planetariums. The author mentioned, finally, how to increase good planetariums which can function as effective facilities for teaching astronomy.

1. A Brief History of Planetariums

Since men first began to study the nature of the heavenly bodies about five thousand years ago, when the concept of zodiac or the twelve constellations of ecliptic was presumably established in Mesopotamia, they have attemted to explore the mystery of the universe and to understand its rules using instruments such as celestial globes and orreries.

In ancient Greece philosophers or scientists made celestial globes such as Aratus Globes on whose surfaces were drawn more than forty constellation figures and celestial coordinates. The most sophisticated was Ptolemy's with forty-eight constellations and many coordinates, and it showed precessional motion as well.

According to Cicero, the famous Roman poet and writer, Archimedes (287? - 212 B.C.) invented a geared machine which showed not only the accurate movement of the sun, the moon and the planets but also solar and lunar eclipses. It is obvious that such tools and devices were used in ancient times mainly for the sake of holoscopic astrology or as aids to understand calendars.

After the Renaissance, people felt the need of better celestial instruments for deeper scientific understanding of planetary motions and for picturing real night skies. Several clock workers contrived and improved upon such instruments and finally made what are called orreries and Copernican planetariums.

In 1923 the first projection planetarium was completed at the factory of Carl Zeiss in Jena, Germany. This project was proposed by Oscar von Miller, the founder of Deutsch Museum, Munich, as an exhibit in the astronomy section. Since then many planetariums have been opened all over the world, for they proved to be most suitable and powerful for teaching astronomy.

2. Their History in Japan

The first planetarium in Japan equipped with Zeiss Model II, which incidentally was the twenty-fifth to be established in the world, was opened at Ohsaka Municipal Electro-Science Museum in 1937. The second planetarium was installed in the Tokyo Nichi-nichi Shimbun Building next year, but it was destroyed near the end of the Second World War. A Zeiss Model IV was placed at

Gotoh Astronomical Museum, Tokyo, in 1962. At around the same time, Masanori Nobuoka and Seizoh Goto, the founder of Goto Optical Industry, succeeded, each on his own, in developing planetarium projectors called the Nobuoka type and M type respectively. The Nobulka type, made by Chiyoda Optical Company (renamed Minolta Camera Co.), was installed in a dome with a diameter of 20.5 m. at Hanshin Park, Ohsaka, in 1958. The first M type, which was similar to the projector at Morrison Planetarium in San Francisco, U.S.A., was exhibited at the International Trade Fair in Tokyo and was then placed in the Shinsekai Building, Tokyo, in 1959.

With the development of computer technology, the fully automated planetariums with high accuracy were developed by Goto and Minolta independently.

From 1971 on, we find remarkable increase of planetariums in Japan. New openings amounted to 16 in that one year, and 7 to 17 planetariums are opened every year. So, today we have more than 270 planetariums in Japan and they are getting more and more popular in our country. Most of the planetarium facilities are public and are therefore placed under the authority of the Boards of Education, Mayor's Offices or operating agencies of local governments.

3. Use of Planetariums as a Tool for Astronomy Education

Planetarium is a special room and it has three distinctive features as a tool for astronomy education.

(1) Sky Simulator

It is convenient for observing diurnal and annual motions of the sun, the moon, the planets and fixed stars at any latitude on the surface of the earth. Particularly, the phase changes of the moon, the planetary motions which include direct motion and retrograde motion and the precessional motion are among the special features of planetarium, though it usually shows us the scenes seen from the earth. Planetariums can show them in a short time. Morphologies of stellar distribution and our Milky Way Galaxy are also available on the machine.

Modern technology has brought us such an amazing revolution that we can watch the motion of celestial objects as seen from inter-planetary space in the space theatre equipped with space simulator model. It was made possible because the star projector and the planet projector are separately controlled by digital computer, unlike the traditional geared projectors combining star ball and planet cages. Furthermore, Degister, the computer graphics planetarium which was developed by Evans and Sutherland Computer Corporation, U.S.A., can simulate three-dimentional flight out to 200 parsecs through space. Proper motion can be applied to the stars or constellation stick figures. The motion of the stars can be shown for all time from one million years going back into the past up to one million years into the future.

(2) AV Presentation Room

Recently planetarium is furnished with many slide projectors, special effects projectors, movie projectors, and video projectors. So, we may say planetarium is an audio-visual room.

Many planetariums have a collection of a great number of slides of celestial objects. Video projectors are particularly very useful when they are linked with laser disc players. For example, the video disc entitled "Astronomy" issued by Optical Data Co., U.S.A., contains extraordinary number of astronomical photos and movies, and we can easily pick and show them to the audience with random access selection by computer control.

Video projectors of multi-scan type are more useful for their possibility as computer displays which are capable of many astronomical simulations. Planetarium is just a film library, computer room, and listening room for music. We can use these AV equipments effectively for teaching astronomy.

(3) Laboratory

A planetarium can be used as a laboratory. For example, we teach students in the planetarium how to take pictures of constellations, using a camera and a tripod just like under the real night sky. We have also given audience such exercises as spectral analysis, observation of electric discharge tubes containing some kinds of elements through simple spectroscope, and dopplar effect. Stellar photometry is also possible.

4. Classification of Planetariums

According to the use and purposes for which planetariums function, they may fall into three kinds. (1)Planetariums mainly for the general public, (2)those both for the public and for school education, and (3)those used exclusively for school education.

The 26 percent of total planetariums, placed in school buildings and of fairly small size, belong to category (3). It seems that there are only a few planetariums belonging to category (1). The rest are mostly of the type (2).

We can classify planetariums into three types by hard ware systems. (1)The planetariums with horizontal spring line, having manual control system for live performance, and (2)the planetariums with automated control system by means of a computer with taped narration. (3)The planetariums called space theatre with tilted dome, having automated control system and separate projection system with star ball and planet projectors.

5. Planetarium Programs

Now I'd like to introduce the trend of planetarium usages for school education and for the public.

(1) School Programs

The contents of school programs in Japan are laid down in the science curriculum edited by the Ministry of Education. On the level of 5th, 6th grades at elementary school, we treat the diurnal motions of the sun and the moon, the difference of brightness, colors and positions of stars, and the diurnal motion of stars. The constellations are also mentioned. At 7th grade (or the 1st grade of junior high school), we deal with the features of the sun, the moon and the earth, the rotation of the earth, the annual motions of celestial objects, and the solar system. At senior high school, we treat the earth as a planet, the sun and stars including the stellar radiation and the evolution of stars, and in advanced courses, we also treat Our galaxy with its structure and dynamics, Galactic morphology and the evolution of galaxies. In most school shows in the planetarium are treated the constellations and apparent celestial motions, for planetariums are originally meant for them.

We believe it is most effective for astronomy education to employ the programs of students' participation, using observational work sheets. We regard the planetarium both as a class room and as a laboratory. The students have to observe and memorize as under the real sky; they should not be mere passive listeners, they have to discover for themselves the rules regulating the behaviour of heavenly bodies. They say, "Easy come, easy go." In teaching constellations, for example, we give each student a star chart at the beginning and then explain how to use it. The first several minutes they are left to discover the constellations for themselves under the red lamps. Next they are allowed to discuss the results with friends . Finally the lecturer tells them the correct positions of constellations. Such proceedings may seem rather difficult at the middle or large sized planetariums, but we, at the Suginami Science Ed. Centre, do that in our dome, measuring 15 m. in diameter.

(2) Programs for the Public

More than 150 planetariums provide shows for the general public every day in whole Japan.

The shows or lectures for general public have a wide range of contents, from primitive stories of seasonal constellations to advanced ones about the evolution of stars and galaxies, and the creation of universe.

More and more audience tend to prefer the visual and dramatic programs that make use of many special effects projectors and panoramas. Apparently the planetariums which have only manual operation systems with live narration seem unable to meet their demand any more. The planetariums with fully automated projection systems, particularly the ones meant for general public, are winning more and more popularity. The space theatres which have not only projectors of space simulator (such as Goto's Model GSS or Minolta's Model Infinium), but also all sky movie projectors with tilted domes are typical examples. But recently, it seems to me that a slight change in the tendency is to be seen. People in big cities live in the din and bustle all day long, surrounded by artificial scenes and backgrounds. They cannot enjoy the beautiful night sky any longer. They may naturally wish to return to more natural life. They may want to see more steady shows with live lectures about astronomy. Evidently a lot of planetariums fail to meet audience's sundry desires. I believe they have to be provided with various kinds of shows which are not of one pattern. It is most important and desirable that every planetarium should make its own programs for itself whether they are live shows or automated ones with taped narration.

6. Some Problems and Activation of Planetariums in Japan

The teaching of astronomy is most effectively done in the planetariums and it saves school teachers time and trouble. Teachers who don't have enough knowledge of atronomy often depend too much on planetarium educators and sometimes they give up giving lessons in astronomy themselves. We have to find the ways which are really effective and satisfactory not only to students but to teachers as well.

There are two reasons why planetariums of entertainment type and space theatres with automatic operating systems are getting popular rather than traditional planetariums with domes of horizontal spring lines which are usually more convenient for astronomy education. One is that their programs are very exciting like the movie entitled "Star Wars". Another reason, for financial sake, is that managing directors believe that the planetariums with fully automated control system are by far economical in the long run. They can order whole show-programs from external producers, and so they don't have to employ a large staff that cost them much expenses. As a result, most planetariums in Japan which are furnished with sophisticated equipment and fully automated control system, are unfortunately in charge of a small, inadequate staff.

So, as I have mentioned at the conference of International Planetarium Society (Borlänge, Sweden, 1990), we have several problems concerning planerarium management in Japan. Most planetariums have a small staff consisting for the most part of non experts, and besides, they are often at short intervals transferred to other posts that have nothing to do with planetariums and the new comers at the planetariums are novices.

So, a large part of planetarians don't produce their own show programs nor can they develop their own projection systems, particularly in the latest, big planetariums with sophisticated projection systems. Consequently, in spite of the popularity planetariums have gained, the activities of Japanese planetarians on the whole are not on high level, except for those of a small number of planetarians who have had professional trainings. Therefore, more often than not, it is difficult to activate astronomy education in the planetariums as the central place, the core of astronomy education.

In order to increase good planetariums, we talked earnestly about the activation of our planetarium organization, Zenkoku Planetarium Renraku Kyougikai (the Japan Planetarium Society) at the annual conference held at Nagoya Science Museum in 1990. We discussed definite, practical plans, such as the publication of a journal, editing a planetarium handbook, and starting a planetarium techniques seminar for beginners.

A couple of years ago, the Ministry of Education decided to promote "a life-long education" to meet the demands of "the age of advanced life". So, the local governments have been building many hi-tech planetariums, again with an inadequate staff. Part-time staff members are increasing but I believe the best way to increase good planetariums functioning as the centre of active astronomy education is, first and foremost, to increase professional full-time planetarians. We know that money alone cannot buy good astronomy education. We have to employ good staff with sufficient knowledge of astronomy for planetarium operations, and to encourage them to work out their own HOMEMADE shows.

REPORT ON PERMANENT SEMINAR OF ASTRONOMY IN CATALONIA (SPAIN)

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Abstract

This is to present the Permanent Seminar of Astronomy of the Education Science Institute of the Polithecnic University of Catalonia and its activities regarding the Teaching of Astronomy in Catalonia, the pionner zone of Spain introducing Astronomy to secondary and primary schools.

Introduction

Astronomy is not on the curriculum for secondary schools in Spain, but it is possible to study it as an optional subject. A lot of teachers and students are interested in Astronomy. A group of those teachers along with the universitary teachers organized, in 1983, a Commission to strengthen the Teaching of Astronomy in Catalonia. A year later the Permanent Seminar was formed to support the teachers. This seminar depends on the Education Science Institute (ICE) of the Polithecnic University of Catalonia. At the moment there are a list of 150 teachers interested who periodically receive information and support. No fee is charged for these services.

Activities

The Permanent Seminar organizes teacher training about differents astronomical subjects, and publishes interesting material made by groups of teachers.

We have teaching materials to lend to the teachers: books, collections of documented slides and videos, which can be borrowed from the ICE. We also have a telescope lending service;

it is a reflecting telescope with equatorial mounting, automatic tracking motor and searcher, 100 mm in diameter and 1000 mm in focal length. Every year a course for teachers has been developed in order to explain the use and handling of the telescope. The course is limited to twelve teachers because the loan period is a month. At present, we have developed this service for three years, and the teachers are very happy with it. There are a lot of schools which buy one after having used it for a month.

Six years ago the Permanent Seminar organized the first meeting for Catalan teachers; two years afterwards we held the third meeting for teachers of every zone of Spain, and last year we held an international conference, -"Teaching Astronomy IVth International Conference"- with people from 10 countries. About 90 teachers of different teaching levels attended the conference held at the Museu de la Ciència in Barcelona, on 12-14 Setember. We had 43 talks and 4 general lectures given by Dr. C. Iwaniszewska of Torun University (Poland), the past president of Commission 46 of IAU; Dr. J. Nussbaum of Jerusalem College for Women (Israel); Dr. L. Gouguenheim of Paris University (France), vice-president of Commission 46 of IAU anCON Dr. R. Canal of Barcelona University (Spain). At present we are doing the proceedings of this conference, and it will be finished soon.

Expectations

After the meeting we think it is necessary to strengthen the international exchange. Then we will start a programme of workshops with European teachers (with Europeans because the trips are cheaper). At the moment, for the first workshop, we are having difficulties taking all teachers who have sent us the preliminary registration because there is a lot of interest. This has inspired us to do more next year, and to introduce the Permanent Seminar to more teachers.

REFERENCES

Ros, R.M., Català, M.A., Telescope Lending Service. Newsletter Commission 46 International Astronomical Teaching, 28, 9, 1989.

Proceedings of Teaching Astronomy IVth International Conference Ed. Sirius. Madrid, 1991. (in press).

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