Teaching of Astronomy in Asian-Pacific Region

Bulletin No. 6

The 1st Part
of Special Issue
of Teaching Astronomy Meeting
in the Asian-Pacific Region

Mitaka Tokyo Japan

1993. 3. 1 --600--

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Syuzo Isobe
National Astronomical Observatory
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If someones are interested in our Bulletin, please make copies of this sheet and give them copies. Thank you for your collaboration.

Syuzo Isobe

Syuzo Isobe.

Preface

This is one of two special issues relating to the first meeting of Teaching of Astronomy in the Asian-Pacific region held in Beijing in October, 1992.
5 years ago in Beijing, we had the 4th Asian-Pacific regional meeting of the IAU which was much successful one. At a session during that meeting, Dr. Il-Sen Nha made a proporsal for us to have a Working Committee of Teaching of Astronomy of the Asian-Pacific region under the IAU. This proporsal was accepted by all the attendances, and accidentaly I was pointed out as its chairman.
In these 5 years, we published 5 issues of our Bulletin to which about 30 authors contributed, and we had two sessions on teachiong of astronomy during the 5th Asian-Pacific regional meeting of the IAU in Sydney in 1990.
Astronomy is the oldest science. China has a long histry over 5000 years in studying astronomy. However, in an ancient time only small fraction of people worked in this field. Nowaday, after develoment of astronomy and astrophysics, many people are interested in astronomy, but it is not well developed how to teach astronomy because of very quick development of astronomical research. In each country, teachers of astronomy have tried their own efforts.
Especially, since public interest in astronomy in the Asian-Pacific region becomes higher and higher, much more activities have been expected. Now it is very happy for us to have holded this meeting just before the 70 year anniversary of the Chinese Astronomical Society which was the most memorable time.
To have a good way in teaching of astronomy, it is very important for us to exchange ideas of people who are working as astronomers, school teachers, staffs in science museum, and leaders of amateur groups.
I believe this meeting made the first step to this direction, and I hope the 2nd, 3rd, 4th, and the further meetings will be held with many supports of people in each country.
Finally, I as a representative of all the attendances would like to express our thanks to the SOC co-chairman, Dr. Li Zongei, the LOC chairman, Dr. Lin Yuangzhang, and their colleagues to bring this meeting into reality and successful. We express also our thanks to the Chinese academy of science, the Chinese astronomical society, the Beijing astronomical observatory, and the Dynic Co.Ltd of Japan for their different kinds of supports.

1993, February 15

Syuzo Isobe
Chairman of Teaching of Astronomy
in Asian-Pacific Region.

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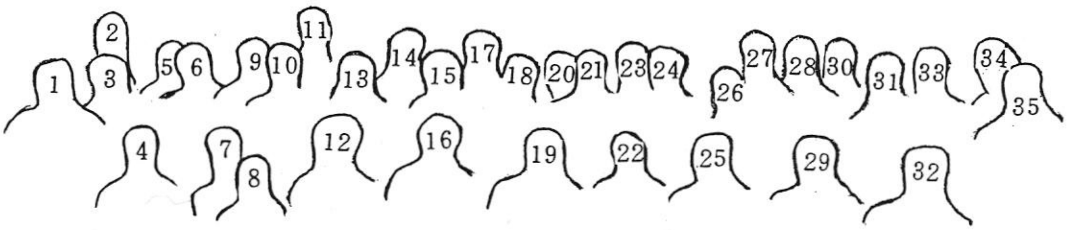

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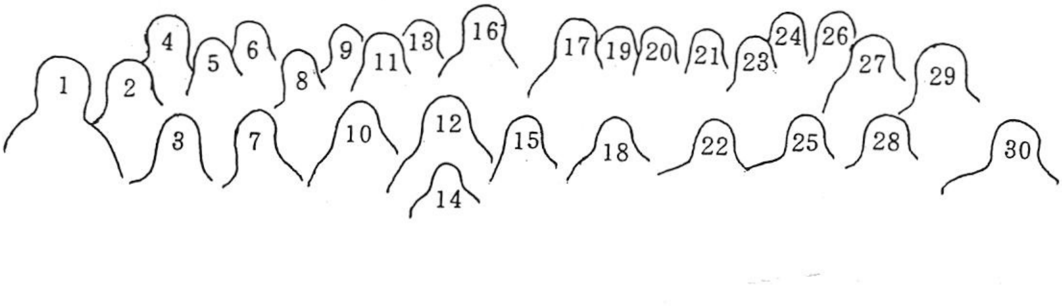


ASIAN-PASIFIC MEETING ON TEACHING OF ASTRONOMY
亚太地区天文教育研讨会


ASIAN-PASIFIC MEETING ON TEACHING OF ASTRONOMY
亚太地区天文教育

Scientific Program
Asian-Pacific Meeting on Teaching of Astronomy (APMOTA)

Beijing, Oct. 26-29, 1992

Monday, 26 Oct.

9:00-10:00 a.m. Session I: Opening Ceremony Chairman: LIN Yuanzhang

Welcoming Address: LI Qibin, President of the Chinese Astronomical Society and Director of the Beijing Astronomical Observatory

Opening Speach: S. Isobe, Chairman of Scientific Organizing Committee, APMOTA

Speeches of Congratulation:

Representative from Department of Mathematics and Physics, National Natural Science Foundation of China.

Representative from Bureau of Education, Chinese Academy of Sciences.

10:30-10:45 a.m. Break

10:45-12:00 a.m. Session II: Astronomical Science and Education

Chairman: W.J. Zealey

S. Isobe: A Flower and a Star – An Important Aspect of Human Being

LI Zongwei: Teaching on Modern Astrophysics – An Introduction of Some Astrophysical Books

Ben Mayer: Noumena Transcend Phenomena

2:30-5:30 p.m. Session III: Astronomical Science and Education (continue)

2:30-4:00 p.m. Chairman: I.-S. Nha

JI Peiwen: Science Foundation and Development of Astronomical Human Resources

W.J. Zealey: The Place of Astronomy in Tertiary Science Education

LI Yuan: Space Art and Astronomy

WU Shaohao: Planetattium Projectors in China and Their Education-Orientated Applications

4:00-4:15 p.m. Break

4:15-5:30 p.m. Chairman: DENG Zugan

I.-S. Nha: Teaching of Astronomy in Korea

M.S.A. Sastroamidjojo: "A Chinese-Puzzle" Method for the Visualization of Cosmological Evolution

LU Baoluo: The Present Condition of Chinese Astronomical Instruments used for Astronomical Education

7:00-9:30 p.m. Banquet

Speaker: LI Zongwei, Co-chairman of Scientific Organizing Committee, APMOTA.

Tuesday, 27 Oct.

8:30 a.m.–.5:30p.m. Excursion to the Great Wall and the Huairou Solar Observing Station of Beijing Astronomical Observatory

Wednesday, 28 Oct.

8:30 – 12:00a.m. Session IV: Teaching of Astronomy in Colleges and Institutes

8:30 – 10:00 a.m. Chairman: M.S.A. Sastroamidjojo

CHU Yaoquan: Graduate Program in the Center for Astrophysics, University of Science and Technology of China

S.Isobe: An Activity Against Light Polution for Teaching of Astronomy

HU Jingyao: Trainning of Astronomical Graduates in Astronomical Observatories

ZHOU Tijian: Simple Discussion on Astronomical Textbooks for Non-Astronomical Students

10:00 – 10:15 a.m. Break

10:15 – 12:00 a.m. Chairman: S. Isobe

DENG Zugan: On the Foundamental Teaching of Physics for Graduate Students in Astronomy

LIN Yuanzhang: On Teaching of Solar Physics

Xiao Naiyuan: Trainning of Undergraduate and Graduate Students in Department of Astronomy, Nanjing University

D.V. Sathe: A Study of the Comprehension of Planetary Motion

2:30 – 5:30 p.m. Excursion to the Beijing Planetarium (Beginning with the ceremony of gifting ASTROCOMPASS by Mr. Ben Mayer)

7:00 – 9.30 p.m. Excursion (Beijing Opera)

Thursday, 29 Oct.

8:30 – 12:00 a.m. Excursion to the Forbidden City and the Beijing Ancient Observatory

2:30 – 5:30 p.m. Session V: Popularization of Astronomy

Chairman: CHU Yaoquan

2:30 – 4:00 p.m.

BIAN Yulin: Science is too Important to be Left to Scientists

CUI Zhenghua: Popularization of Astronomy in China

WANG Jialong: On Necessity of Teaching of Solar-Terrestrial Knowledge

JI Desheng: Popularizing Astronomy in Shanghai

4:00 – 5:30 p.m. Chairman: LI Zongwei

K.C. Leung: Astronomical Leadership Training in Hong Kong

XIAO Tiansheng: Astronomical Easy-to-Use-Paper-Tools

MEI Bao: Base.Network.Cell – A New Mode of Popularizing Astronomy

S.Isobe: Summary

List of Participants

Asian-Pacific Meeting on Teaching of Astronomy

Beijing, Oct. 26-29, 1992

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JI Weizhu	The Middle School Attached to Shanghai Teacher's University, Shanghai, China
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WANG Shouguan	Beijing Astronomical Observatory. Beijing. China
HONG Mingyuan	National Natural Science Foundation of China. Beijing. China
HUANG Fengbao	Bureau of Education. Chinese Academy of Sciences. Beijing. China

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LIN Yuanzhang	Beijing Astronomical Observatory, Beijing, China
WANG Jialong	Beijing Astronomical Observatory, Beijing, China
JI Peiwen	National Science Foundation of China, Beijing, China
CUI Zhenghua	Beijing Planetarium, Beijing, China
ZHOU Tijian	Department of Geophysics, Peking University, Beijing, China
WU Shaohao	Beijing Institute of Technology, Beijing, China
CHU Yaoquan	Center for Astrophysics, University of Science and Technology of China, Hefei, China
LU Baoluo	Research Center of Astronomical Instruments, Nanjing, China
JI Desheng	Shanghai Observatory, Shanghai, China
XIAO Tiansheng	The Children's Palace of China Welfare Institute, Beijing, China
MEI Bao	Youth Astronomical Observatory of Suzhou, Suzhou, China
CHEN Kaige	Suzhou Institute of Ancient Astronomical Instruments for Timing, Suzhou, China
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ZHANG Caicheng	Beijing Astronomical Observatory. Beijing. China
CHEN Ying	Beijing Astronomical Observatory. Beijing. China
ZHENG Xiaonian	Bureau of Education. Chinese Academy of Sciences. Beijing. China

The Place of Astronomy and Astrophysics in Tertiary Education

W.J.Zealey *Department of Physics, University of Wollongong, Box1144, Wollongong, NSW2500,Australia.*

Abstract:
University First Year Physics has a reputation among students for being a difficult but necessary evil. Rarely is it described as stimulating. Astronomy, on the other hand is seen to be exciting. In the Department of Physics at the University of Wollongong we use astronomy and astrophysics subjects to emphasise and clarify concepts in the Physics degree subject. They also serve to introduce both undergraduate and postgraduate students to skills in computing and instrumentation not encountered in traditional subjects.

1. Introduction and Philosophy:

Australian high school students come university having spent two years studying for their HSC examinations. Their knowledge of physics extends to core topics on motion, forces, mechanical interactions, electrical interactions, electromagnetism and waves, and a number of electives, including astronomy.

The ground laid in University First Year Physics necessarily recaps topics covered at high school, particularly in the areas of motion, forces, energy etc. To many students physics subjects at university appear to merely repeat what they learned in their final years at high school. This leads to a view that physics is dry, dusty and boring. Once the students lose motivation it is very difficult to regain it.

Physics has a high mathematical content and is seen by many as a difficult subject. Only mathematics is thought of as a more difficult subject because "it contains even more mathematics than physics"!

Students progressing to subsequent years of a physics degree may find the classical style degree to be highly theoretical, the concepts difficult to comprehend and their applications obscure.

Astronomy and astrophysics can play an important role in invigorating university physics for the following reasons:

* Astronomy is a highly visual science. It attracts considerable public interest and therefore provides a good vehicle to bridge the gap between the community, primary and high school students and the universities. It provides images to hang ideas on.

* It is attractive to both Science and Humanity students alike. Indeed it is often the only contact that Humanities students have with science .

* It can provide concrete examples of often difficult theoretical concepts encountered in other areas of physics. Astrophysics also provides a linking theme between several fields in physics.

* It can be used to introduce concepts and practical skills not usually taught in a classical physics degree. These skills may include detector physics, image analysis, database management etc.

For these reasons astronomy subjects form an important part of the core of the Physics Degree offered at the University of Wollongong.

2. A case study

The University of Wollongong occupies a coastal site 3km from the centre of the city of Wollongong and 80km south of Sydney. The total student enrolment now exceeds 10000, which places the University in the small to middle size range of Australian Universities.

The Department of Physics is made up of 10 full-time academic staff and provides service subjects for Science, Life and Environmental Science, Engineering ,Informatics and Nursing students in addition to a traditional Major in Physics. The Department supports research in three main areas: Solid State Physics, Nuclear Physics, and Astronomy and Astrophysics.

Our Astrophysics Group is composed of three academic staff and one professional officer. We have attempted to integrate our astronomy and astrophysics research and teaching with the traditional Physics degree.

First Year: In first year we teach electrical engineering students and physics majors introductory physics covering dynamics and kinematics. The common examples used to illustrate these segments are distinctly earthbound. The recent introduction of examples with an astronomical bias and the use of short video segments to illustrate key ideas maintains the students interest and gives them a different perspective on the subject.

Particularly useful video clips are segments of the NASA Voyager Retrospective videos which can be used to illustrate topics relating to distance measurement, gravitation and orbits. The shape of the volcanic plumes on Io can be used to illustrate projectile motion without worrying about an atmosphere. Discussion of rotation can be illustrated by a short review of planetary atmospheres, their circulation patterns and culminate in videos of Jupiter's Red Spot.

"Powers of Ten" produced by Charles and Ray Eames, is now available on video and also provides a good introduction to the scale of the Universe.

Later parts of the course covering electromagnetism, light and modern physics again provide opportunities to use astronomical examples to illustrate quite difficult concepts. Short segments on stellar spectra provide examples of Black Body emission and absorption and emission mechanisms.

Optics can be taught from an instrumentation point of view, stressing the field of view, speed, resolution and aberrations for cameras, and the characteristic of detectors. Once again astronomy provides vivid illustrations of these concepts in terms of large optical telescopes, radio telescopes etc. Images from the Hubble Space Telescope can be used to illustrate lectures on optical aberrations and Helvellius' aerial telescope allows an interesting discussion of chromatic aberration.

Second Year: In their second year students get the opportunity to take **"Concepts of the Modern Universe"**. This subject is tailored for general interest groups and Physics majors alike. The course is intended to lead students to an understanding and appreciation of the Universe. Astronomy and astrophysics is an observationally driven science. The ever changing relationship between observations and their interpretation is stressed throughout the course. No previous knowledge of the subject or of either physics or mathematics is assumed. The emphasis throughout is an understanding of the concepts behind the astrophysics and in the student's ability to develop them in explaining new observational phenomena. Lectures are interspersed with films, demonstrations and practicals. Copies of the video clips used are available for viewing outside class hours.

Each week we deal with a different topic in a fairly flexible way although we stress the link between the astronomical ideas, the historical context and the modern viewpoint.

Third Year: In their Third Year students attend **"The Physics of Radiation"** . This provides a broad and detailed understanding of the mechanisms involved in black body and line emission, using specific examples of taken from astrophysics. It provides links with the quantum mechanics subject. At this stage computer spreadsheets can be introduced into discussions of black body emission and linked to the interpretation of IRAS Point Source Catalogue data. Practical work can access this data either from computer CDROMs or from the printed IPCS catalogue.

Honours Year: In their Honours year, students take an astrophysics subject which deals with **Astronomical Detectors.** This subject covers aspects of filters, telescope optics and spectrometers, detectors and analysis techniques. Although taught using examples taken from astronomy, the subject is generally applicable to almost any area where radiation detectors are used eg. solid state physics, nuclear physics , medical physics etc. Students gain experience in image analysis and gain practical insight into image processing and Fourier techniques. They also carry out an independent study of a major instrument development using the preliminary design concept documents circulated by major observatories and space authorities [HST, COBE, GAMMA, GRO, ISO].

Honours students may choose to carry out thesis work in astrophysics. Over the past few years minor theses have been completed on IRAS observations of Cometary Globules, High Latitude Molecular Clouds, Supernova Searches and Dust in Wolf Rayet Stars. Australian students can compete for the Bok Prize for the best Honours thesis.

Postgraduate: Thesis work may be carried out as part of a Masters or a PhD degree. In addition Masters students undertaking course work may attend the following astronomically based subjects.

"The Physics of Imaging" includes extensive hands-on image processing using PC based imaging systems. This subject will provide the basis of a major component of the Medical Physics degree offered for the first time in 1993. Examples chosen for analysis include CCD astronomical images, Voyager planetary data as well as images input from simple video digitising systems.

" Comparative Planetology" allows students to gain an understanding of planetary surfaces and atmospheres and introduces students to remote sensing techniques used in planetary mapping. Practical work is based on the interpretation of Magellan radar images of Venus. These images are accessed using PC At's [80286 processor] equipped with a CDROM drive. The complete Voyager images (Jupiter to Neptune) are available commercially and Magellan images are obtainable from JPL.

Clearly this kind of integration of astronomy and astrophysics into the physics curriculum requires that the staff involved be actively engaged in research. All members of our Astronomy Group pursue research interests, which include topics as varied as Infrared Studies of Star Formation, Long Period Variable Stars in the SMC and Theoretical Studies of Gas and Stellar Dynamics in Galaxies.

Over the past five years we have developed the area of "Image Digitising and Analysis" as a common linking theme between these diverse interests. We have established a low cost digitising system based on IBM compatible PC/AT computers equipped with PCVISIONplus frame grabbers.This system has allowed us to develop both software and hardware expertise in the area. We can now process images from a variety of sources which include our own telescope's CCD camera , infrared images from the Anglo-Australian Observatory, IRAS sky flux maps.In parallel we are developing a digitising machine based on a Thompson CCD chip and novel XY table.These facilities allow us to carry out photometric and morphological analysis of ESO/SERC survey plates. The flexibility of the systems has allowed us to demonstrate applications in biological and other areas of image analysis.

We have recently begun to offer a Medical Physics degree which draws on the Astronomy and Astrophysics Group's expertise in imaging and detector physics and on the expertise of the nuclear physics research group.

3.Conclusions

Astronomy should not only be taught in isolation. In a small physics department astronomy can offer a fresh approach to demonstrate well worn physical principles.

Astronomy and astrophysics far from being a narrow specialty topic can play an important role in a Department's teaching program. The astronomy and astrophysics subjects can be developed to form a coherent sequence which stress the role played by instrumentation and detection techniques and introduce concepts and practical skills not usually taught in a classical physics degree. These skills may include detector physics, image analysis, database management etc. In addition it can provide concrete examples of often difficult theoretical concepts encountered in other areas of physics providing a linking theme between several fields in physics.

Useful teaching aids:

Software:

Voyager images: Jupiter, Saturn,Uranus and Neptune: CDROMs commercially available

An introduction to Astronomical Image Processing, Richard Berry, published Willman-Bell P.O.Box 35025, Richmond, Virginia 23235,USA. [Includes Imagpro PC based image processing software]

IMDISP: PC/AT Image Processing software: Jet Propulsion Laboratory, Planetary Data System, PDS Operator, 4800 Oak Grove Drive, Mail Stop 525-3610, Pasadena, CA 91109

Videos:

Voyager: A Retrospective: NASA

Flying by the Planets: Sky Publishing Corporation, PO Box 9111, Belmont, MA 02178-9111, USA or The Astronomical Society of the Pacific, 390 Ashton Ave., San Francisco, CA.94112, USA.

The Astronomers: Sky Publishing Corporation, PO Box 9111, Belmont, MA 02178-9111, USA

The Planet Earth,Tales from Other Worlds: Columbia-Tristar-Hoyts.

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TO: **A.P.M.O.T.A.** DATE: **Nov.92** SIGNED: Ben Mayer BEN 本思

A QUARTERLY NEWSLETTER
PROBLICOM BULLETIN
SPECIAL AstroFest **1992 #78** SPRING

"A USEFUL DEVICE THAT WILL ENCOURAGE INTEREST IN ASTRONOMY AND THE MYSTERIES OF THE UNIVERSE" LUC. PROF. STEPHEN W. HAWKING

NEWTONIAN DIMENSIONS: IN & OUT

No more 'Down and Up' 'Up' and 'Down' are relegated to elevator buttons!

Little could I have anticipated when I first photographed the explosion of NOVA CYGNI from the roof of my house in West Los Angeles during the night of August 31 1975, that it would lead me to write four books: STARWATCH, and ASTROWATCH with the topical 1985 "HALLEY'sCOMET" FINDER between.

Nor would I have dared dream that a joint book with Professor William Liller would lead to the "ASTRONOMY book-of-the-year award for'86 bestowed by the Californian A.S.P.

But there was to be more: Not only were the 13 Nova images "pre-discovery", but my co-author was to discover the first ever comet with a STEBLICOM, making it the original "PROBLICOMET" by employing the PROBLICOM-STEBLICOM-VIBLICOM method for discovery, utilizing an ordinary 35 mm. camera, with off-the-shelf-film.

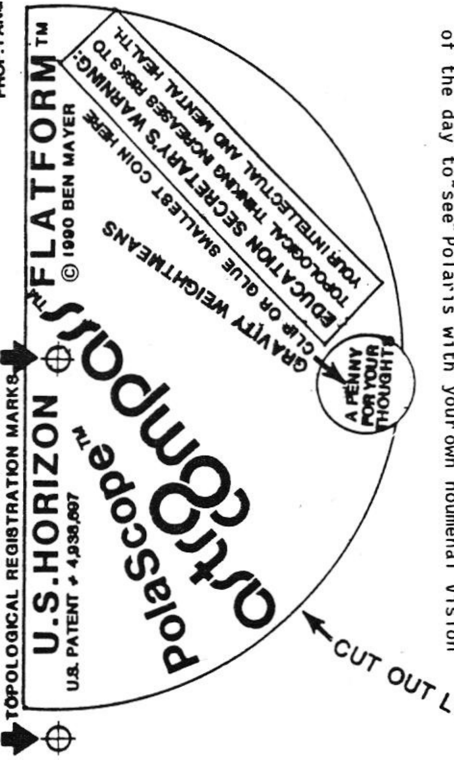
After I had invented the ASTROCOMPASS™, and received U.S.patent # 4,938,697 my prof. friend endorsed it as " an invention of Newtonian Dimensions". I stand on the verge of book number five, (by the same name).

If my (then) Harvard astronomy professor co-author had any misgivings about writing a book with a mere rank amateur, I was able to alleviate them by suggesting that I would write "only the 'odd' chapters". He, in his expert capacity would write the 'even' numbered ones for accuracy.

It early became evident that in inventing the Multi-Dimensional Astral Position Finding Device I had made an important Dimensional Newtonian discovery, first confirmed by noble Professor Fang LiZhi of the historic China Academy of Science, and subsequently by my US co-author. I call it "The GRAVITY COMPASS

To offer the novel and topologically registered StellaPlate™ to persons wishing to make their own PolaScope, it is reproduced here again from Problicom Bulletin #73. Winter 1990. It may be copied and reprinted after obtaining written permission from the address given above.
Enjoy!!

"ASTROCOMPASS HAS EXTENDED SSI-NAN FROM TWO DIRECTIONS TO THREE DIMENSIONS" PROF. FANG LIZHI



This instrument works during any night of the year, and the PolaScope works at any time of the night- from dusk until twilight. Yes, you can even use it in the middle of the day to "see" Polaris with your own noumenal Vision

The Astronomical Society of the Pacific(ASP) 1986 Award Winning Astronomy Book of the year is available from Cambridge University Press THE OLDEST PRESS IN THE WORLD (since AD1584) in Paperback 22.0X23.0cm. 176pp.50 colour plates 70 half-tones # 0 521 399157....£10.95 net. Ask for The Liller/Mayer Cambridge Astronomy Guide 24 hr. service:0223-325970

Please Cut Out the PolaScope half-round STELLAPLATE™ below, spear it on a wire coathanger "Horizon Axis" as shown (or use a knitting needle). Weight the PolaScope with a paperclip and attach the core from a roll of bathroom tissue to the Polar axis as illustrated. Heading approximately north, look through the sighting tube and Presto, you will see POLARIS, the North Star in the F.o.V.= 'Field of View' of 18 degrees. * Use near +35° or +40° latitudes.

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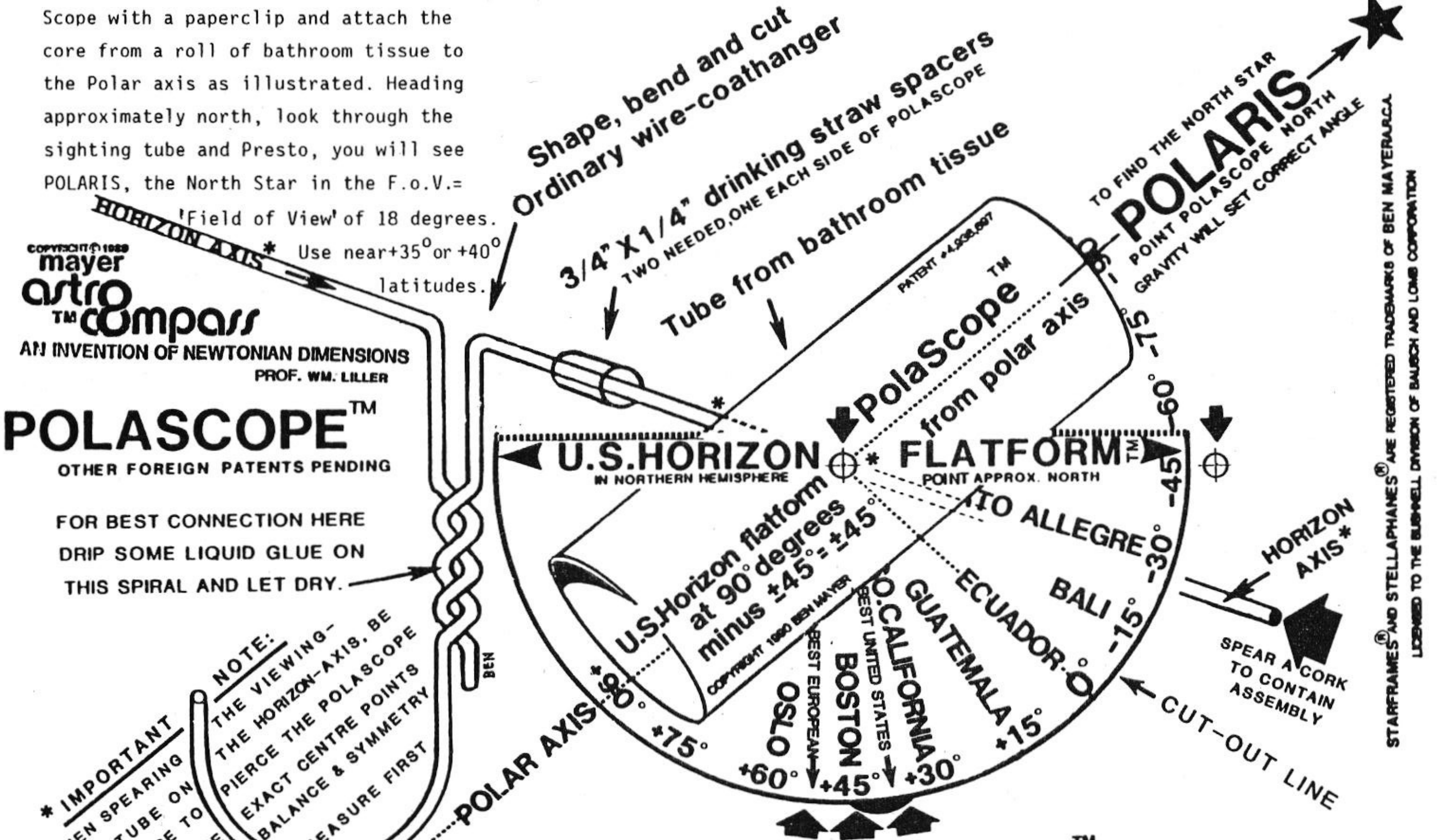

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Summer 1992 #79

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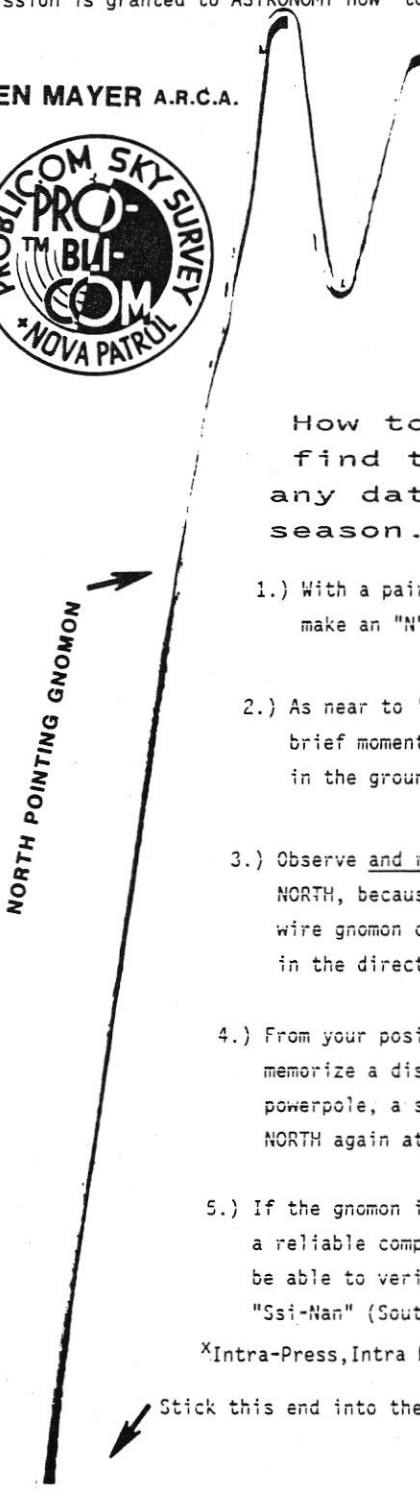

How to "ORIENT" yourself and find the northern direction on any date of the year, during any season. Please follow these steps:

1.) With a pair of pliers and using an ordinary wire-coathanger, make an "N" gnomon (sun-dial pointer), as illustrated on left.

2.) As near to 'high-noon" on any day and -hopefully- during a brief moment of sunshine stick the long (pointed) end below, in the ground in an otherwise unobstructed location.

3.) Observe and remember the direction of the shadowline pointing NORTH, because the sun at noon stands in the SOUTH. Turn the wire gnomon on its long axis to match and point the Compass "N" in the direction of the shadowline and parallel to it.

4.) From your position at this mid-day moment, seek out, find and memorize a distant landmark near the horizon, such as a tree, a powerpole, a streetlight or even a building, so that you can find NORTH again at midnight, twelve hours later.

5.) If the gnomon is left undisturbed, the N-pointer will serve as a reliable compass direction indicator until such time as you may be able to verify your bearings with a compass, or with a Chinese "Ssi-Nan" (South-pointing spoon) on which all compasses are based.

[x]Intra-Press, Intra House, London W12 9RA U.K. *Trade Mark

Stick this end into the ground at high noon

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The AstroCompass has extended the Ssi-Nan from two-directions to three dimensions

PROF. FANG LIZHI

COPYRIGHT© 1988 mayer astro TM compass
AN INVENTION OF NEWTONIAN DIMENSIONS
PROF.WM. LILLER

The Astrocompass is a useful device that will encourage interest in astronomy and the mysteries of the universe

Luc. PROF. STEPHEN W. HAWKING

ENDORSEMENTS:

Whether it is the recognition first given by Prof.Fang Lizhi formerly of the Academia Sinica of Beijing, China, for the invention of the ASTROCOMPASS TM, or the subsequent endorsement of my co-author (of the recent Cambridge Astronomy Guide) first published in 1985 by C.U.P. then re-published in its paperback edition, again by Cambridge Univ. Press in 1990, it feels wonderful for an amateur-astronomy author and inventor to read words of plaudit from the professional ranks. That is why the hopeful ideas from the stellar Lucasian Professor Stephen W. Hawking CBE FRS were so important when his fax of 23 March '92 arrived at my home on the same date within speed-of-light pico-seconds. This is also why- in reply to the kind words of Prof. Fang Lizhi who speaks of the 1000 year-old protocompass Ssi-Nan, I am offering a simplest sun-guided compass created out of a wire-coathanger, which is my "trademark". Not everyone- least of all children- may own, or be able to afford a compass. Fewer yet, may ever have seen, or be able to purchase a Ssi-Nan "Southpointing spoon" which points unerringly south, as discoverd in China during the Han Dynasty (at least) one millenium ago. (North was extrapolated from this earliest device.)

Implicit in the Orienting GNOMON TM is ancient astronomical wisdom combined with even earlier astrological understanding of the zodiac and the travels of the sun within its clearly defined boundaries May this Bulletin become an invitation to the countless numbers of Afficionados, who militantly espouse superstitious belief in "pseudo-science" and in unsubstantiated records of data harking back to early astrologers who first embraced the scientific method of Astronomy.

I am proud to share with readers that I was able to show and demonstrate my newest patented and copyright ASTROCOMPASS (U.S. Patent # 4,938,697) in its first "PolaScope TM" embodiment at the first European AstroFest 'in the Royal venue of the Kensington Town Hall' in London England. As any reader of this bulletin will readily understand, the PolaScope, used to find Polaris a.k.a Alpha Ursae Minoris can easily be converted into a so-called "OctanScope TM" to seek and find (σ)Sigma Octantis from anywhere in the southern hemisphere. (See Problicom bulletin #78, please).

In case you have not heard, my above-mentioned mentor and co-author Prof. William Liller (now Sr. Research Astronomer at the Instituto Isaac Newton in Santiago Chile (Ministry of education) had the following entry in Circular # 5428 (12 Jan.1992) of the Central Bureau for Ast. Telegrms:

"W. Liller, Vina del Mar, Chile, reports his discovery with PROBLICOM exposures taken Jan. 11.16 UT of a supernova (mag 12.8) in NGC 1380. Nothing was visible on exposures taken Jan 7. N.Brown, Western Australia made an independent discovery of the object visually on Jan 12.7 at mag 13.0. R.H. McNaught, Siding Springs, reports the following position for SN 1992A: Alpha= $3^h34^m31^s.52$, delta= $-35^\circ 07' 22''.5$ (equinox 1950.0. Offset from the galaxy's center is3" west, 62" north. Visual magnitude estimate by McNaught on Jan 12.45: 13.0 Nova was near max. light."

It is fine to know that the PROBLICOM SKY SURVEY and NOVA PATROL is doing its worthy part in keeping an eye (or a camera open and out) for happenings <u>OUT</u> in space. "OUT" not "UP".

Hope to see some of you at the Riverside Telescope Maker's Conference on Memorial Day . Until then, and with kindest regards Yours

Ben

P.S. Don't forget that the Problicom Bulletin is a gratis newsletter, yours in return for four (4) S.A.S.E.'s (Self-Addressed-Stamped-Envelopes) or with 4 international airmail postal orders.

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Teaching on Modern Astrophysics

Li Zhongwei
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The development of astronomy and astrophysics needs talented persons.
The talented persons depond on the astronomy education.
The education requires the astronomical textbooks!

1.The discoveries and achivements (60′s~80′s)

(1) 60′s Four important discoveries

Quasar: An object with a starlike with an emission line spectrum, showing a large redshift(Z).

Pulsar: An object has the mass of a star, radius no larger than that of earth,emits radio pules with a very high degree of regularity(ms to 3s).

Cosmic Background Radiation:Isotropic radiation first detected in 1964 by Penzias and Wilson at $\lambda=7.35$cm(T~2.7K),it is interpreted as relict radiation from the primeval fireball,it represents Z~3000.

Interstellar Molecules:Molecules in interstellar space and around the stars.1963 OH molecule was discovered with radio method.

(2) 70′s achivements and discoveries

1972 VLBI—Very Long Baseline Interferometry, was operated.

1973 Skylab is launched, the coronal ho!e is discovered.

1974 Pulsar PSR1913+16, it is a binary pulsar.

1975 Solar 5 minutes(300s) oscillation is observed.

1978 Einstein Satellite is launched;

IUE——International Ultarviolet Explorer is launched.

1979 γ–ray Burst are discovered.

(3) 80′s discoveries

COBE observing the relict radiation from earliest years of the Universe.

Quasars were found at large distance, Z~4.

Galaxies can act as lenses,refracting light of Quasars.

Universe is organized on larger scales.

The possibility of giant black holes in the centers of some galaxies and quasars.

SN 1987A in LMC,neutrinos from supernovac were detected.

Neutron stars spinning a nearly 1,000 revolutions per second were discovered.

Experiments done with solar neutrinos hinted at new physics not included in the standard textbooks.

(4) 90′s is discovery decade

Hubble space telescope(HST) arised into space in 1990.

The first 10–m telescope—Keck telescope will come into operation; new radio telescope will reveal invisible details at mm and submillimiter wavelengths.

Four great observatories(NASA) will view the cosmic across the IR,Visible, UV,X–ray and Gamma–ray.these instruments will answer critical questions and many reveal objects not yet imagined.

2. Some Astrophysical Books

The book market is currently flooded with Astronomy & Astrophysics Texts;we introduce only some astrophysical texts briefly.

(1)The Physical Universe.An Introduction to Astronomy

Frank H.SHU 1st 1982. 2nd. 199?

The text not only to describe and catalogue knows facts ,but also to origanize and explain them on the basis of a few fundamental principles.For example, students are told what red giants, white Dwarfs are, and why stars become red giants or W.D.Author emphasizes the deep connections between the microscopic world of humans,stars,galaxies, and the Universe. He strongly believes that gee–whiz astronomy offers only cheap thrills,whereas the real beauty of Astron of science—lies in what Sciame has called The Unity of the Universe.

part I. Basic Principles: 1.Instroduction; 2.Classical mechanics, Light,Telescope ;3.Great laws of Microscopic physics;4.Great laws of Macroscopic physics.

part II.The sun, stars, stellar Evolution. H–R Diagram Binary stars

part III. Galaxies and cosmology.

part IV. Solar System.

(2) Astrophysical concepts, 2nd Edition

M.Harwit, 1988

This classic text , aimed at senior undergradute and beginning graduate students in physics and astronomy, presents a wide range of astrophysics topics in sufficient depth to give the reader a general quantitative understanding of the subject. Emphasizing physical concepts, it provides the student with a series of Ap.sketches. Second Edition includes a new chapter, a synthesis of all subjects discussed in the book by tracing the history of the Universe from its beginnings to formation of the sun and planets.

Chapter 1.An Approach to Astrophysics
2.Cosmic Distance Scale
3.Dunamics and Masses of Astronomical Bodies
4.Random processes
5.Photons and Fast Particles
6.Electromagnetic Processes in Space
7.Quantum Processes in Ap.
8.Stars
9.Cosmic Gas and Dust
10.Structure of Universe
11.Life in the Universe
12.Cosmic Origin.

(3)Observational Astrophysics

By P.Lena, 1988

The aim of this book is not to give an extensive overview of all thetechniques currently in use in Astronomy, not to provide detailed instructions.Its purpose is methodological:How we are to collect,sample, measure, and store this information is the unifying theme of the book.

Observational techniques are evolving swiftly.

Nowadays astrophysicists freely use data extracted at all wavelengths.

(4)Fundamental theory of Astrophysics

byS.Kato (in Japanese)

part I . Plasma and Electromagnetic Wave	Chapter 2—8
part II . Astronomical Phenomenon as MHD	Chapter 9—17
part III. HIgh Energy Phenomenon	Chapter 18—21
part IV . Stellar System	Chapter 22—25

3. General Astrophysics (in Chinese)

Li Zongwei, Xiao Xinghua

Higher Education press,1992.

Students interst in Ap. has grown dramatically during the last decade, and from it has sprung a need for modern texts reflecting the advances in theoretical and observational astronomy of past thirty years. This need has previously been met largely at the introductory level, at advenced level.This Ap. is intended to fill the intermediate range. Much of the material that follows developed from lecture presented over some years to upper level undergraduate students and graduate students in Astronomy and physical department of Beijing Normal University.The textbook is intended for senior–level or first–level graduate course in Astrophysics.

Our main aim was present a wide range of Ap. topics in sufficient depth to give readers a general quantitative understanding of the subject.

Throughout the book we emphasize the physical fundation and Ap. concepts in Modern Ap. The first a few chapter(1,2,3) outline the scope of modern Ap. and deal with elementary problems concerning the observation and theory. Chapters 4～9 present the topecs about cosmic objects:Sun,Stars,Compact Object,ISM,Milkyway,Quite and active galaxies,and cosmology.

Chapter 1.Introduction to Astrophysics

Outline of the Universe, Fundational Laws of Cosmic Matter, Eqation of State, Relations between Ap and physics.

Chapter2.Radiative processes in Ap.

Radiative Transfer, Thermal Radiation, Cyclotron, Synchrotron, Curveture Radiation, Inverse Compton scattering...

Chapter3.Observational Astrophysics

Channel for Ap. Collecting informations Telescope and detectors, Observational methods physical quantities of objects...

Chapter4. Solar physics

Solar atmosphere & Interior, Plasma & MHD, Solar activities, Solar—Terrestrial relations.

Chapter5.Stellar Structure and Evolution

H–R Diagram, Equation of State, Evolution of massive mass. ...Supernovae

Chapter6. Compact Stars

White Dwarf, Neutron Stars, Pulsars.

Black holes, Close Binary.

X−ray sources and X−ray burst, γ−ray burst.

Chapter7.Interstellar Matter

Interstellar Gas and Dust ,Gaseous Nebulae, Physical processes of ISM, Hydrodynamics of ISM Stars and ISM, Supernova Remnants.

Chapter8.Our galaxy, Quite and Active Galaxies

Milkyway,galaxies, Active galaxies are AGN galactic clusters.

Chapter9. Cosmology

On Teaching of Solar Physics

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1. Introduction

As the Sun is closely related to the Earth and the mankind, many people are greatly interested in understanding the structure and evolution of the Sun. Moreover, studying the Sun is helpful for understanding other stars. Therefore, the teaching of solar physics is important for college students and in the popularization of astronomy. According to my studying and teaching experience, I would like to suggest that in the teaching of solar physics, the following might be the key subjects which are most significant for the correct understanding of the Sun and are likely to be misunderstood by students, i.e.

(1) The layering structure of the solar atmosphere

(2) The abnormal heating of the chromosphere and the corona

(3) The origin of solar activity

(4) The spectrum of solar radiation at various wavebands

(5) The evolution of the Sun

2. The Layering Structure of the Solar Atmosphere

In structure, the Sun can be divided into several layers, i.e. the core, intermediate zone, convective zone, photosphere, chronosphere and corona. However, the compositions of the different layers are nearly the same (hydrogen of $\sim 78\%$, helium of $\sim 20\%$ and others of $\sim 2\%$) excepting the solar core where the abundance of hydrogen is slightly lower. Many people have the question that as the sun is gaseous and nearly uniform in chemical compositions, why it has a layering structure. The reason lies on that since the solar energy is produced in the core, it results in a specific gradient of temperature along the solar radius and forms several layers with distinguishable physical conditions. The radiative energy produced by the nuclear fusion in the core transfers upward through the intermediate zone, convective zone and then the photosphere where it goes to the interplanelary space without futher absorption by the chromosphere and the corona. In the process of radiation transfer, the total energy of the radiation does not lose, while the effective wavelength of the radiation increases gradually from the γ and X-ray at the core to the visible light at the photosphere because the temperature decreases outward along the radius. Now why is there a convective zone between the intermediate zone and the photosphere? This should be attributed to the ionization of hydrogen which is the most rich element on the Sun. Roughly, the zone from r=0.86 to r=1.0R⊙ is a region where the atoms of hydrogen are partially ionized. The hydrogen atoms are completely ionized under the zone and neutral above the zone. In this case, the balls of mass with upward velocity at the boundary r=0.86R⊙ will continue to move upward because their temperatures increase due to the gain of the energy released by recombination of atoms, and hence their densities decrease. On the contrary, at the boundary r=1.0R⊙, the balls of mass with downward velocity will continue to move downward because their temperatures decrease due to the loss of energy caused by the ionization of atoms and hence their densities increase. Thus the convective zone is formed in this way. The granulation on the photosphere is an evidence for the existence of convection.

3. The Abnormal Heating of the Chromosphere and the Corona

Another problem which is hard to understand is that since the temperature decreases from 15×10^7K at the solar center to 6000K in the photosphere, why it increases again to $10^4 - 10^5$K in the chromosphere and even reaches to 10^6K in the corona. This is so-called the problem of abnormal heating in solar upper atmosphere. If the radiation is the only energy source which is input to the chromosphere and the corona from the photosphere, their temperatures must continue to decrease along the radius. The only possibility to explain the abnormal heating of the upper atmosphere is that, besides the radiation from the photosphere, there must be non-radiative energy input. In fact, we now have learnt that the additonal non-radiative energy input is the mechanic waves produced by the convection under the photosphere. It is these waves that make the temperature of the upper atmosphere increase abruptly when they propagate upward and dissipate in the chromosphere and the corona.

The consequent question is that why the chromosphere and the corona are so faint that they can be seen only during solar total eclipses though their temperatures are far higher than that of the photosphere. The reason is that even though the radiation wavelengths of the chromosphere and the corona are very short, indicating the high energy of the photons, due to their high temperatures, the intensity of their radiation is very weak due to their low density of mass. In other words, the quality of the radiation is very high, but the quantity of the radiation is not large enough to be seen during the non-eclipse period by naked-eye.

4. The Origin of Solar Activity

Solar activity is interesting and complicated. It is usual that after a teacher's talk on the rich reguralities of solar activity, students ask that why sunspots appear on the sun, why most sunspot groups are dipolar, and why the average latitude of sunspot groups changes in a solar cycle, etc.

All these questions are related to the origin of solar activity. The best answer is to introduce briefly the Babcock's theory on solar cycle. It is highly important to emphasize that solar activity is caused by the interaction between the originally weak magnetic field of the sun and the solar differential rotation. It is easy to accept that there is an original weak magnetic field in the sun since many stars and planets have also such a weak field. They might arise from the nebula from which these stars and planets were formed. However the solar rotation is very special, i.e. it rotates faster near the equator and slower near the polar regions. This is called solar differential rotation. Theoretical researches show that solar differential rotation can magnify the originally weak field and creat a lot of magnetic loops with high magnetic strength. Then each magnetic loop will rises upward due to the magnetic floating force and forms a sunspot group when it hits the solar surface, therefore sunspots actually are the local regions with high magnetic field on the Sun. According to the Babcock's theory, the solar cycle with 11 year period and the latitude drift of sunspot group can also be explained by the evolution and interacton of the magnetic fields of sunspots with the solar general dipolar field. And other phenomena of solar activity, such as prominences, plages and solar flares are resulted in the interaction between the magnetic fields of sunspots and the moving plasma of solar atmosphere. As the Babcock's theory can explain many important reguralities of solar activity, it is well accepted by most solar physicists.

5. Solar Radiation on Various Wave Bands

It is well known that the solar radiation ranges from hard X-ray with wavelength shorter than 1Å to the radio wave with wavelength longer than meters. However, few people know that within such a wide wave band the intensity of solar radiation varies by about 26 orders of magnitude, from 10^{-20} to 10^{6} erg/cm^{2}·sec·μ, and the radiations at different wave bands arise from the different layers of solar atmosphere. Generally speaking, the radiation from 1600Å to 200μ comes mainly from the photosphere, and the intensity varies by 9 orders of magnitude, from 10^{-3} to 10^{6} erg/cm^{2}· sec ·μ, with the maximum at the visible light. The spectrum of the photospheric radiation is a continuum with some absorption lines which are caused by the selective absorption of atoms and molecules. However, the X-ray, EUV and UV light with wavelength shorter than 1600Å, arise from solar upper atmosphere, in which those with wavelength >1000Å come from the chromosphere and the others from the corona. The spectra of the radiation at these wave bands are basically an emitting line spectrum because of the low density of the emitting gas in the upper atmosphere, and the intensity of the radiation is many orders of magnetude weaker than that from the photosphere. Solar radio radiation with a continuum arise also from the upper atmosphere. Among them, the radiation at millimeter and centimeter wavebands come from the chromosphere, while that at decimeter and meter wavebands from the corona. The intensity of solar radio radiation is far weaker than that at other wave bands, i.e. from 10^{-6} to 10^{-20} erg/cm^2· sec·μ. Without knowing these facts, it is not easy to understand many phenomena on the sun.

For example, some people usually ask that the solar spectrum is a continuum or an absorpting line, or an emitting line spectrum. In fact, it is impossible to answer in a few words. Moreover, some students may ask that during a solar flare, the intensity of solar radio radiation usually increases by times of millions, but why we can not find it in the daily life. The answer, of course, is that even if the sun enhances its radio radiation by times of million millions, it is still far from our detection in the daily life.

Therefore, the correct concept of the spectrum and intensity of solar radiation at various wave bands is very important for college students.

6. The Evolution of the Sun

This is a subject in which many people are interested because it is closely related to the future of the Earth and the mankind. They may ask that how the Sun was formed, how long the sunshine will be lasting in such an enormous scale and what will be the future of the sun. In order to answer these questions, the evolution of the sun should be mentioned. The five stages of solar evolution, i.e. prestellar nebular, main sequence star, red giant, helium burning and white dwarf, should be described briefly based on the variation of solar energy source. According to the theoretical calculation, the present Sun, as a main sequence star with very stable radiation, has already existed for about 5×10^9 years, and will continue to stay at this stage for about 4×10^9 years.

Then the luminosity of the Sun will decreases greatly as the running out of the hydrogen in solar core. Now the problem is, at that time; how about the mankind? We think there are many possibilities. One of them is by the time, instead of the Sun, some kind of artificial effective energy would have been developed. Another posibility will be that the astronautic technique may have been highly developed so that the mankind could move to another star suitable for life. However, we have to emphasize that the mankind have mastered the techniques of atomic energy, electronic computer, artificial satellite, space shuttle and landing on the moon within the short history of only years of thousands. And in recent years, much progress has been made in the technique of controlled nuclear fusion. A project of landing on the Mars has been seriously undertaken. Since there is 4×10^9 years left, the mankind can certainly find out a way to live without the Sun.

Science Foundation and Development of Astronomical Human Resources

Ji Peiwen

Depat. of Math. and Physical Sciences , NSFC

Introduction

National Natural Science Foundation of China (NSFC) was established in February 1986,its aim is to promote basic research and part of applied research of the country.The category and scope of projects supported by NSFC are General Projects (including Free Application Projects ,Young Investigator Projects and Developing Regions Projects),Key Projects ,Major Projects and International Cooperation and Exchange Projects .Excellent Young People Program and other Programs.

I. General Projects:

1.Project of Free Application

Scientific and technological workers from different departments,regions and nstitutions throughout country can freely choose their projects in the light of the "Guide to Programs" and apply for according to prescribed procedures.

2.Young Invesigator Program

The procedure for project application and evaluation of this category is the same as for the project of free application,but the chief investigator of the proposed project must be under 35 years of age,and have a doctor's degree(or a medium or higher title of professional post).Moreover,he must be able to research work independently ,keen in academic idea and full of pioneering spirit.In addition,the members of the project group should be mainly young people.

3.Projects Supported by Fund for Developing Regions

These research projects are prepared to support scientific researches in the universities and colleges and research insitutes of remote areas or regions where minority nationalities live and scientific bases are weak.The procedure for project selection and application of this category is the same as for the projects of free application.

II Key Projects

Key projects mainly aim at the key scientific problems in the development and layout of various disciplines in our country and at the new growing points in different discilines,and are to be given in–depth research and highly funded. These projects are also directional research programs.All research groups and scientific and techological workers of the country,who have sufficient research ability and approptiate conditions,can make application according to the "Guide to Key Projects" of the National Nature Science Foundation of China.

III Major Projects

Major projects mainly deal with major scientific and technological problems in science and technology,national economy and social development in our country by interdisciplinary and interdepartmental joint research.They are directional research programs.All research groups and scientific and technological workers of the country.who have sufficient research ability and appropriate conditions can make application according to the "Guide to Major Projects" of the National Natural Science Fundation of China.

IV Special Funds

Projects of special funds include projects of Tianyan Fund Project on Mathematics, projects of Fund of President and Fund of department Directs of NSFC,ect.

V International Cooperation and Exchange Projects

A certain amount of fund,including foreign currency,is allocated by the National Natural Science Foundation to support international joint research and exchange carried out by the scientific workers who are undertaking projects of NSFC.

The projects of international cooperation and exchange which have been carried on include:international joint research,holding international scientific conferences in China,participation of Chinese scientists in international scientific conferences abroad,inviting foreign scientists to visit China, and organizing scientific investigation abroad by Chinese scientists.

NSFC has so far signed agreements / memorandums of understanding or exchanged letter of intention for scientific cooperation with 24 organizions in 20 countries and regions.

VI Excellent Young People Program

This program is defferent from the young Investigator Projects.In this program, NSFC is mainly to evaluate the scientific capability of young investigator not to evaluate a proposal. And the pricipal investigator's age must be under 45 years old.NSFC also confins the number of people who will be get grant,he will obtain more money than other general projects'investigator.

In another hands,NSFC also supports the middle school students to attend the Olympic game in mathematics,physics,chemistry,computer science and biology. If some day,there is a Olympic game in astronomy and astrophysics, I think NSFC will support this activity.

Basic research is a broad scientific discipline whose health depend on a countinuing flow of new ideas and challenges ,the fiscal and technical resources to address these challenges ,and most critically,top scientists who lead the fields. It has become the main responsibility for Science Foundation over the world to promote the development of scientific human resources.

Astronomical Fund and Development of Astronomical Human Resources

I. The young investigator program

NSFC hopes that the young investigator would become an excellent scientist or acaddemic leader.

In the past five years(1987–1991),there have been 19 proposals of astronomical Young Investigator Projects ,7 projects were supported by grants,approximate 30 young astronomers attended the research group.

In other projects ,such as free application projects ,key projects and major projects ,NSFC urges to attract young people including postdoctorals,doctors, and graduate students participating the research groups.When the grant reaches its expiration ,the principal investigator is required to submit a Final Project Report to the NSFC Program Office.The Final Project Rport should contain a summary of the results of the completed work,a list of Publications resulted ,a brief description of available data,sample,physical collections,and other related research products,especially its contribution to the development of human resources in science and engineering.For example,in the past 4 years a major project, the research of Solar Activity and Other Activive Celestial Objects, has been supported by grants, approximate 4 postdoctors ,17 doctors and 56 graduated students participated the reseach group of this major project, they underwent the practice and obtained research experiences. Some of them became the leaders of research groups or the principle investigators.

II. Excellent young investigator program

From 1992–1993, perhaps one Young astronomer will be supported by the grant.

III. Other Supporting

According to the characteristics of astronomy,the following activities are supported by fund to promote the development of astronomical human resources.

1. When the proposals of international cooperation and exchange are reviewed, the proposal submitted by young astronomers should be given th priority.Science Foundation encourage and support the young astronomers to carry on international joint research,use the large facilities over the would upon a academic competitive basis,participate international scientific conferences ,and invite foreign scientists to visit Chian.We hope young astronomers should know more trends and current status of astronomical development and do forefront and top–quality researches.

2.Science Foundation encourage and support the international conferences that would be held in China and enable young astronomers to have more chances to attend the international conference.The Foundation also support the international school for young astronomers,such as the 19th IAU / UNESCO / ICSU International School for Young Astronomers from Pacific and Asian Region.This school has been held at Beijing Astronomical Observatory from 19 July to 8 August,1992.It was supported by grants.Approximate 50 young astronomers from 16 nations attended this school, 7 famous astronomers from India,Russia,France,U.S.A. and China gave lectures. The topics covered solar activity,the structure of the solar atmoshpere, stellar evolution,observational astronomy,the analysis and reduction of astronomical data,practical training and siminars on selected subjects.

3. Supporting the CVLP

In 1988,the IAU Executive Committe and Chinese Astronomical Society agreed to make a Chinese Visiting Lecture Program(CVLP),that is ,inviting outstanding astronomers from other country to work as visiting professors in China.The invited astronomer together with two to three chinese local senior astronomers,will sponser the academic activity base.Young astronomers from all over China will be awarded fellowship to work at the activity base.Main of the activity base include cooperative researches on projects and series of lectures on selected subjects. The monograph will be printed after the academic activities.This activity would benefit the growth of young astronomers.The first term of the CVLP began in 1991, the visiting lecture was Prof.John Kwan from the

University of Massachusetts at Amberst.The lectures and research topics were on the ″Broad emission line region and broad absorption line region of QSOs″.The monograph was about selected topics on the physics of galaxies.Approximate 20 graduate students attended these activities. The first host institution was Beijing Normal University.

Conclusion

Astronomy is an international enterprise.Global joint observations and multilateral collaborations is an indispensible tread in both ground–based and space astronomical research.Some examples of successful international cooperations include the GONG project for studying the motions of the solar surface, the Solar–A and IRAS satellites,the International Radio Interferometry, the International Ultraviolet Explorer ,etc.Astronomy reaps the benefits of astronomy as an international enterprise,and the international collaboration also benefits the development of the human resources.

I think,this meeting would promote the advancement of cooperative training of· young talented astronomers between Asian–Pacific Nations.NSFC would continue to support these activities.

ASTRONOMICAL EDUCATION IN DAQING PETROCHEMICAL COMPLEX

LIU Yuheng
Planetarium of Longfeng Children's Palace
Chief Petrochemical Works
Daqing City, Heilongjiang Province, China

The Planetarium of Longfeng Teen-agers' Palace is subordinate to the trade union of Daqing Petrochemical Complex which is a large integrated petrochemical enterprise that has 450,000 staff and workers and about 20,000 children and teen-agers. The leaders of the enterprise pay much attention to the training of teen-agers. In 1984, Longfeng Teen ager's Palace was set up which consists of six parts: a 8-storeyed main building, planetarium, observatory, navigation hall, gymnasium and a movie theatre.

1. General Introduction to Astronomical Facillities

The planetarium has a space area of more than 480 m^2. The place for astronomical activities include observation hall, the diameter of which is 8m,and classrooms, etc. A Model ZKP-II planetarium made by Zeiss in Germany was bought in 1987. An astro-observation station, 24m in height and 4.5m in dome diameter, with observation room, exhibition hall, lens grinding room, dark room and lounges was newly built in 1990. In 1992, we installed a dioptric astro-telescope (ϕ 200mm) which was designed and manufactured by Nanjing Astronomical Instrumental Development Center. In addition, the Planetarium is also equiped with total of 13 sets of refracting and reflecting astro-telescopes (ϕ 200mm), Newtonian telescope (ϕ 120mm), and floor type (ϕ 100mm) telescopes for popular science. We have ordered an astrograph (ϕ 150mm) recently and will be put into service in June, 1993.

There are three staffs in the planetarium, of which one is professional teacher, the other is teaching assistant, the third one is projectionist in the astronomical observation hall. The leaders of the enterprise lay stress on enhancing the professional quality of staffs, sending them many times to Beijing Planetarium and Astronomical Department of Beijing Normal University for the in-service training and attending astronomical activities and relevent meetings organized by other cities. Through lateral contacts in various ways, the professional knowledge and experience of the staffs, by ways of exchanging views and learning from each other, have been increased greatly..

2. Organizing Various Forms of Activities in Astronomical Popular Science

(i). Organizing Coaching Classes to Train Students

Since the setting up of the palace in 1984, the astronomical coaching classes have been run 22 times, periodically enrolling students from middle and primary school every year, systematically studying astronomical knowledge, directing the students to keep diary on the astronomical phenomena, organizing activities of astronomical observation and "small making". The students, after years of observation, wrote and published more than 20 pieces of treatise on national or provincial juvenile publications, such as "There is a Rule for Sunrising and Sunsetting", "The Variation of the Sun Height During the Whole Year", etc. The students plotted "Curve of the Sun Height Variation in the Whole Year in Daqing District", and "The Long and Short Variation Trend in the Day and Night in Daqing District". They also surveyed the geographic longitude and latitude of Daqing, traced diagrams of sunspot and the orbit of planets, observed solar and lunar eclipses and occultation and took astrographic. They made more than 30 kinds of "astronomical small makings" such as celestial globe, permanent calendar phase of the lunar calendar and astronomical "seven skills", etc.

(ii). Going to School for the Astronomy Popularization

We use the method of "going out and inviting in" to widen the extent of astronomical popularization. The astronomical teacheres often go to school to spread astronomical knowledge. They, bringing astro-telescope with them, organize the teachers and students to observe the sunspot, the Moon, planets, star cluster and nebula after school. On the other hand, the students of primary school and high school also came to planetarium to practise the identification of stars, thus to get a deeper understanding of the textbook and a broad knowledge of astronomy. This helps the training of key members who will play the part of the main force in spreading astronomical knowledge among students.

(iii). Makeing the Astronomical Science Popularization.

We organize activities for the popularizing of the astronomical knowledge. This activities obtains great financial support from leaders of Daqing Scientific Worders Association and responsible person of the teen-agers' department. The students of primary school and middle school, as well as the large masses have enriched their astronomical knowledge through playing astronomical performance, such as slide show, observation of the Moon and planets with astro-telescope, visiting picture exhibition which include the photoes of sunspots, the Moon, planets, cluster and nebula, etc. Whenever special astronomical phenomenon appears, we send out forecast in advance through Daqing Petrochemical Daily and TV station to inform staff, workers, and students to observe on time. Since 1985, we have organized more than 20 times observation activities to observe Halley's Comet, to find the favorable position of Mars, and to enjoy looking at the Moon in "Mid-Autumn". About 1000 people took part in such activity each time.

Through various forms of popularization activities, astronomical knowledge has struck root in the hearts of the people. The number of astrophiles are steadly increasing. In recent years, the planetarium of Daqing Petrochemical Complex has become the center of popular astronomical acitvities in Daqing district. In the period of every summer vacation, a continuous streams of summer camps, tourists and visitors groups came to planetarium for visit.

3. Cooperation and Exchanges

In order to improve the quality of astronomical activities, we invited professors and experts to give lectures on astronomical observation and make report on special topics. We also established contacts with more that 30 units in other cities. We keep each other informed so as to improved the quality of activities. Moreover, we sincerely wish to make more friends with colleagues of other countries. We expect to have the opportunity to exchange information and establish cooperation with foreign units.

Training of Undergraduate and Graduate Students in Astronomical Department of Nanjing University

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I. Genaral Situation

1. On the University

Let' s have a brief look at our university—Nanjing University as background materials of our department. It has a history of 90 years. Its main origin is Sanjiang Normal School founded in 1902. It is one of China' s earlist institutions of higher learning with modern significance. During the nationwide readjustment of universities, colleges and departments in 1952, Nanjing University was formed. Its current campus occupies a space of 104 hectares.

Nanjing University is one of the key universities directly under the state Education Commission. It has rallied a galaxy of scholars and celebrities. Of the university' s 2,400 faculty members engaged in teaching and research, over 1,100 are full professors or associate professors, 100 are Ph. D supervisors, 15 are members of the Academic Committee of the Chinese Academy of Sciences. It aims to gradually become a high level comprehensive university with a coordinated development of various disciplines. The university now has 28 departments plus a department of intensive undergraduate instruction and a department of research and advanced studies for foreign students and scholars, with 62 undergraduate specialities, 80 Master' s specialities, 40 Ph. D specialities, 18 key disciplines, and 8 post-doctoral programs.

In the past forty years, Nanjing University has trained over 40,000 graduates and graduate students. At present, it has a total enrolment of over 12,000 of whom over 6,700 are undergraduates, over 1,300 are graduate students and over 200 are foreign students.

2. On the Department

The Astronomical Department at Nanjing University was formed in 1952, during the nationwide readjustment, by the merging of the Department of Astronomy and Mathematics of the former Qilu University in Jinan, Shandong Province, a department that had existed for nearly a centry and the Department of Astronomy of Zhongshan University in Guangzhou, Guangdong Province, which was formed in 1926.

The Department owes a great deal to the Chinese goverment for its gradual expansion and consolidation in the years that followed. The faculty which consisted of no more than 7 teachers is now as strong as 60, of whom 33 are full or associate professors, 8 are qualified to supervise Ph. D students and 12 to graduate students, and one member of Academic Committee of the Chinese Academy of Sciences.

Findings and inventions totalling 200 and teaching materials or astronomical textbooks made by the department' s faculty members cover a wider range of topics, including high energy astrophysics, neutrino astronomy, origin and evolution of the solar system, galactic astronomy, stellar physics, solar physics, celestial mechanics, theory of artificial satellite motion, astrometry and astronomical reference systems. Thanks to them, since 1978 the Department has won some National Science Conference Awards, National Science Natural Science Awards, State Education Commission Science and Technology Progress Awards, and Natural Science Research Fruit Prizes at or above the provincial level.

The enrolment has a total of some one hundred, of whom about 80 are undergraduates and the others are graduate students. The Department has accepted and accepts visiting scholars home and abroad as well as post-doctoral students. Within the four decades since its inauguration, the Department has trained over 900 graduates and graduate students, who are now working in observatories, in universities or colleges, or in other scientific research institutions. Many of them have been appointed to responsible position and have emerged as headers in their respective academic fields.

The Department has three teachnig and research sections, dedicated to astrophysics, astrometry and celestial mechanics, respectively, and there in addition an astrophysical institute, a solar tower, a laboratory equiped with various astronomical and physical instruments, a center for astronomical data analysis and a library.

Ⅱ. Aims of training and Principles of teaching

The Astronomical Department has a whole series of programs for training students. In the past 12 years, while bringing its current superiority into play and further consolidating the major basic courses, it has actively updated and reformed some traditional courses to make them more adaptable. It has emphasized developing applied and newly-emerging disciplines, promoting interdisciplinary overlapping, combination and infiltration, and optimizing the accademic structure. It has paid great attention to link theoretical knowledge to practice.

The aims of training of the Department are as follows:

Adhering to the study style of "being rigorous, realistic and innovative", the Department, through classroom teaching, scholarly activities, social practice and scientific experiments, trains quality personnel who have a solid foundation, a wide range of knowledge, a high foreign language proficiency and an active scholarly mind, and are competent, creative, competitive and adaptive to social needs.

The principles of teaching are as follows:

To give students a wide range of knowledge, to intensify basic training, to teach students in accordance with their aptitude, and to strengthen students' mental well-being. The credit system allows students the freedom to take elective courses or to choose dual bachelor's degree. all possible measures have been taken to train and encourage students to enhance their accademic creativity. Exceptionally gifted students can get special training and instruction.

Ⅲ. Syllabus

There are two specialities for undergraduate and graduate students, i. e. Astrophysics, Astrometry and Celestial Mechanics.

1. Main Courses of Undergraduate students

An undergraduate student must take the bulk of required courses listed below which are assigned to his speciality:

Foreign Languages
General Astronomy
Mathematical Analysis
Analytic Geometry
Linear Algebra
Ordinary Differential Equation
Function of Complex Variable
Function of Real Variable
Electromagnetism
Mathematical Methods of Physics
Optics
Theoretical Mechanics
Quantum Physics
Thermodynamics and Statistical Physics
Hydrodynamics
Observational Astrophysics
Theoretical Astrophysics
Spherical Astronomy
Astrometry
Computational Astronomy
Celestial Mechanics
Methods of Celestial Mechanics
Some elective courses

2. Specialities and Main Courses of Graduate Students

Each speciality consists of several different research fields. Research Fields and corresponding main courses for graduate student are as follows:

(1) Speciality of Astrophysics

A. Research fields

(a) High Energy Astrophysics

(b) Neutron Stars and Cosmology

(c) Quasar and Galaxy

(d) Physics of Solar Active Regions

B. Main courses

Corresponding to Research fields (a)(b)(c)

Radiation Theory in Astrophysics

Plasma Astrophysics

Advanced quantum Mechanics

Physics of Galaxy and Active Galaxy

Structure and Evolution of Stars

General Relativity

Neutron Stars and Their High energy Phonomena

Corresponding to Research field(d)

Radiation Theory in Astrophysics

Plasma Astrophysics

Physics of Solar Active Region

Flare Dynamics

(2) Speciality of Astrometry and Celestial Mechanics

A. Research fields

(a) Astronomical Reference Systems

(b) Earth Rotation

(c) Nonlinear Celestial Mechanics

(d) Applied Celestial Mechanics

(e) Theory of Motions of Planet and Small Bodies in the Solar System

B. Main Courses

Corresponding to Research fields (a)(b)

Theory of Reference system

Vector Astrometry

Dynamics of Earth rotation

Astrometry of VLBI

Corresponding to Research fields (c)(d)(e)

Qualitative Theory of Three-Body Problem

Nonlinear Celestial Mechanics

The Orbital Theory

Estimation Theory

The Theory of Motion of Artificial Satellites

Mathematical Methods of Celestial Mechanics

Real and complex Analyses

3. Some Key Teaching Links

Besides classroom teaching there are some other key teaching links.

An undergraduate student studies for four years. In the summer vacations of third year students are sent to one of the observatories to exercise observational and data-reduction practice for at least two weeks, so that they have an occasion to apply their theoretical knowledge got in classroom into practice and get some additional perceptual knowledge.

The last semestre of university study is committed to writing a bachelor thesis for which an undergraduate students is asked to do some elementary scientific research, and he/she does' nt reach bachelor degree until the thesis is reprensented to and accepted by the Teaching commission of the Department. An excellent student can be recommended as a candidate for graduate student.

As for graduate students, they study for three years. From beginning to end they are encouraged to do scientific research and often involved in a research group. They write Master' s thesis in the last year and after the theris is presented to and accepted by a specialist Commission of the University, they get Master' s degree. An excellent graduate student can be recommended as a candidate for Ph. D student.

Ten Years Of Astronomical Education In China

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The astronomical education of china was generally at a recovering stage during 1977 to 1981 and its principal aim was to cultivate undergraduate students at that time. Since 1982, some graduate programs leading to either Master′ s or Ph. D degrees have been established in many institutes. These institutes include the following four universities and five observatories, which are Nanjing University, Beijing Normal University, Beijing University, Chinese University of Science and Technology, Beijing Observatory, Purple Mountain Observatory, Shanghai Observatory, Yunnan Observatory and Shaanxi Observatory. The programs established in these institutes are listed as follows: they are four doctor′ s programs of Astrometry and Celestial Mechanics, six doctor′ s programs of Astrophysics and three postdoctor′ s programs of Astronomy and Astrophysics. On the other hand, about 400 students have graduated from universities with their B. S, more than 300 graduate students with M. S and nearly 60 graduate students with Ph. D have graduated from these mentioned four universities and five observatories in the past ten years. Still, some excellent persons with Ph. D degrees either of this country or of others have been enrolled in postdoctor′ s programs. Being youthful, well-background and creative, all these graduate students and postdoctors have been an indispensable force of each astronomical institution in its education and its scientific research. They have instilled new blood to the astronomical cause of China.

As a kind of education reform, the curricula and the teaching materials for undergraduate students were constantly renewed and more than 20 kinds of new teaching materials were formally published in the past ten years. These universities paid much attention to the cultivation of students′ capabilities of experiment and computer use as well as to the fundamental education of mathematics, physics and astronomy. On the other hand, a complete system of the cultivation of graduate students has gradually formed. The institutes each established its graduate educational group and its overall educational plans, each offered a two-level graduate degree curriculum. The emphasis of the curricula was laid not only on the fundamental knowledge, but it was also laid on the scientific natures and advancement. The bulk of these courses were principally adapted from the latest resultes of international standard in the corresponding areas. All these graduate degree curricula were often arranged concentrately in one or one and a half years. Especially, some of these courses usually became part of the tutors programs so that the students could aslo be trained to do some research work in their systematic studies. In fact, some graduated students have already undertaken the bulk of these programs. The institutes aslo offered young people the opportunities of entering high-level academic communications. For example, they often sent specialists to give lectures to each others, and often invited foreign specialists to give lectures in China. All this brodened the young people' s kens and let them contact the advancement of their research field as soon as possible.

The comnunication with other countries was aslo high-lighted. Many young persons have been schematically sent abroad for Ph. D programs in some famous univerities and some of them have been back to work with their degrees. However, to cultivate young people in this way is still problematical and needs further study and development. In a word, the multi-way in the cultivation of young people will lead the astronomical education of china to a worldwide way in every education level so that it will be viable in the fast-developing astronomy world.

BASE · NETWORK · CELL
— A New Mode of Popularizing Astronomy

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Abstract

A mode of conducting popularizing activities in astronomy both within the astronomical groups and in the Suzhou area to get widespread public response and social benefits in the current situation is proposed. It consists of bases, networks and cells. Bases are centers of popular science education such as astronomical observatories, planetariums and science halls. They are responsible for training, serving, demonstrating, researching and radiating. Networks include amateur astronomer associations (i.e. regional amateur astronomer association or mass organizations). Their functions are linking, exchanging, organizing and coordinating. Cells refer to the grass-roots astronomical groups. The role and responsibility of them are teaching students astronomy combining with the textbooks, popularizing astronomical knowledge to the public and taking part in observations of the major celestial phenomena. This mode advantages not only the macroscopic coordination of the area but also the improvement of each astronomical groups' activities. Through more than ten year practice in Suzhou area, the mode shows a great vitality and an obvious social benefits. Although the mode mentioned above stresses on the popularizing activities in astronomy, it can be used for reference for all kinds of popularizing activities in science.

1. Introduction

The science and technology are rapidly developed in the present days. Under such situation the importance and urgency of popularizing activities in science are realized by more and more people. Workers in popular science are seeking and practising various kinds of modes and methods to raise the efficiency and the standard of their work. China began to establish centers for scientific activities in 1962. By now more than 700 large-size and 700 or so small-size stations and youth palaces for conducting activities in sciences have been formed.

At present most of the clubs, associations, activity stations, grass-root astronomical groups as well as amateur astronomers only remain at the stage of producing "individual effect" or "internal effect". Professional astronomers and the public are lack of frequent and extensive connections and exchanges for some aspects. Moreover, the money invested to the astronomical popularization by the state is limited and cannot meet the needs of popularizing activities. Although astronomy plays an important role in the national product and daily life, it hardly come into the life of the public. Therefore it is an urgent requirement to find a mode which needs less investment, has high efficiency and can produce the effect like "rolling a snow ball".

The mode "bases, networks and cells" proposed in this paper is a new conception, which is probed and practiced according to the characteristic of astronomy and the local condition by the authors in organizing astronomical activities in Suzhou region.

2. Bases, Networks and Cells

(1) Bases – centers of conducting popularizing activities

Bases are centers of popular science education, such as astronomical observatories and stations, planetariums and science halls, which are more special and wider spreading than those Youth Palaces. The bases devote training, demonstrating, researching serving and radiating.

Training – bases are responsible for the professional training to astronomical teachers and amateur astronomers, provide information, knowledge and methods of activity. It is the regular work of the bases.

Demonstrating – bases demonstrate standard operating process, explain and answer difficult points before special observations, in order to ensure the observational process correct and the projects high quality and high level. Demonstrates are even more encouraged especially when the projects and activities have not been realized by the public but worthy to be introduced and popularized to the public.

Researching – besides popularization, research should be also carried out in the bases. The research should not only be limited in observations but also extend to the theoretical studies on the effects and influences between popular science education and student training, the characteristic and method of popular science education and so on.

Serving – service of the bases are concentrated on four parts, i.e. editing and distributing popular science material, helping newspaper, radio and TV to answer some knotty problems in astronomy, suppling observational equipment and necessary data for the astronomical groups and amateur astronomers; organizing contests in astronomical knowledge and summer camps.

Radiating – bases are centers with strong radiation. They exert a tremendous influence through radiation. The description of such radiation "Light up a lamp and illuminate a large area" or "a single spark can start a prairie fire" fully reflects the role of bases.

Taking Suzhou region as an example, there are only 6 staff members working in the base of this region – Suzhou Astronomical Observatory. They are responsible for astronomical popularizing activities in 4 small cities, 2 counties and suburbs of Suzhou city. Since 1983, this observatory trained a large number of grass-root astronomical groups, recruited many astronomical amateurs and established a network of astronomical popularization in the region. Based on this, the second-class bases are formed, each of which has its own network. Meanwhile, a criss-cross network of astronomical popularization appears in the Suzhou region.

(2) Networks – link of the popularizing activities in astronomy

Networks mean astronomical amateur associations. Regional Association for Amateur Astronomers is an mass organization, consisting of astronomical groups and individual amateur astronomers.

The roles of associations::

Linking – associations are ties between bases and cells (astronomical groups), and also ties among each cells. They turn the dispersal individual amateur astronomers and astronomical groups into a concentrated organization. Associations convey instructions of the bases to each cells. At the same time, they report the activities, observational results, important inventions and puzzled problems of the cells to the bases.

Exchanging – the establishment of association benefits exchanges among the colleagues inside and outside networks, promotes popularizing activities in astronomy. For example after the founding of Suzhou Amateur Association, exchanges with the colleagues in other associations, even in U.S. Japan, Hong Kong and Taiwan have been frequently made.

Organizing – As one of the organizer in large-scale astronomical activities in the region. Together with bases, Suzhou Amateur Astronomical Association organized its members to take part in observations of Halley's Comet during 1985 – 1986, contests in astronomical knowledge in the city and the province. It also organized the observation of solar eclipse in Sept. 23, 1987 and hold various of meetings of exchanges, watch and emulates, parties and summer camps, etc. These activities promote popularizing activities in astronomy.

Coordinating – programs of astronomical observation require different places, different times and different emphasis. The association coordinates all these programs in an overall point of view.

Necessary fund is the material guarantee of associations. The financial supports of administration and large-scale activities come partly from the bases, partly from the contributions of its member and the donates from the society.

(3) Cells – element units of the activities

Cells are grass-root astronomical groups consisting of amateur astronomers. Students who are interested in astronomy may join in the groups. The students are classified into element, middle and advanced classes of astronomy, according to their ages and levels. The astronomical teachers are invited by the groups (usually the teachers are science teachers of the school). The astronomical groups are members of the network, and accept the guidance of the bases. The main tasks of the cells are learning astronomical knowledge, making small astronomical instruments, carring out astronomical observations, and propagating astronomy etc.

Teaching – Students are taught systematic astronomical knowledge in the astronomical groups.

Observing – this is the most important function of the cells. General speaking, each grass-root astronomical group has its own observing equipment. Using these equipment, the regularly trained students make the observations of sunspots, the moon, meteors, binary stars, comets, solar eclipses, lunar eclipses, star occultation and other special astronomical phenomena. A large number of the well-trained astronomical groups and amateur astronomers have obtained many satisfactory and qualified data and results during the co-observation to some important astronomical events.

Propagating – members of astronomical groups undertake the task of propagating astronomy to the surrounding people and the public in order to make astronomy, for which people always think to be a profound and mysterious science, enter into ordinary families and be easily accepted by the public.

Another function of cells is to attract more people to be interested in astronomy and to be an amateur astronomers. During these years some amateur astronomers were entered into universities to learn astronomy.

"Bases, networks and cells" forms a complete system of instruction, exchanges and activities. This system regularly held meetings analyzing the situation of popular science, studying recent developments, exchanging information, coordinating programes and deploying further activities. Mutual supports among each parts of the system solve the problems of equipment shortage. The system strengthens the astronomical activities, enlarges their scale, raises their standard and gets an obvious social benefits. By now, there are one central base, ten second-class bases, three amateur astronomer associations, hundreds of astronomical groups, and a thousand of amateur astronomers in the Suzhou region.

3. Conclusion

As a new mode of conducting popularizing activities in astronomy, "bases, networkes and cells" system rapidly, correctly, deeply and extensively transmits astronomical knowledge to the public. Through ten year practice in the Suzhou region, it is proved that this mode fits well the characteristic of the astronomy and meets the need of rapid development of current situation. Recent years many countries in the world and many regions in China established various of scientific centers and clubs. If all the centers and clubs could produce such "mass effect" like this system, a notable impact on scientific progress of the mankind would be taken place.

The mode proposed in this paper stresses on the popularizing activities in astronomy for the youth, but it can be also used for reference for all kinds of popularizing activities.

ASTRONOMY TEACHING IN HIGH NORMAL SCHOOLS IN CHINA

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There is no doubt that it is necessary to teach teenagers to know something about astronomy. It will help them to understand natural world, to recognize heavenly body correctly and to acquire a scientific world outlook. In China, astronomy courses are not offered in middle schools. Students learn some knowledge about astronomy through geography courses. In geography textbooks of high middle schools there is a special chapter which title is "the earth in universe" to explain the basic knowledge about astronomy. It includes knowledge about heavenly body and celestial system, the sun and solar system, the earth and the earth-moon system and the motion of the earth. to make students in high normal schools to do well when they become geography teachers, departments of geography in those schools generally offer courses "An Introduction to the Earth" or "General Astronomy".

The schools for high normal education in China can be divided into three types. One is normal universities or teachers colleges with 4 to 5 years length of schooling. Most of students in those universities or colleges are undergraduates or post-graduates. Another one is normal training school with 2 to 3 years length of schooling. Most of students in those schools can get specific certifications but no degrees.. Besides, we have education institutes which offer the post-experience courses to middle school teachers. According to a rough estimation, in China there are about 150 high normal schools with geography specialities. Among them at least 50 departments offer courses "An Introduction to the Earth" or "General Astronomy" in the first term. Those departments enrol about 30 to 100 students every year. In geography departments of provincial high normal schools there are totally about 120 teachers who specialized in astronomy. Among them about 40 ones have the higher title. Some physical departments of high normal schools also offer astronomy course, such as Huadong Normal University and Huazhong Normal University. A research group of teaching " An Introduction to the Earth" was established by those teachers who lecture on this lesson in 1978. The conference is held every two years and teachers come together to discuss the textbooks and teaching methods, to exchange their experience and to visit and appraise teaching equipments.

At present there are three kinds of astronomy textbooks which can be chosen by undergraduates. they are *General Astronomy* by Zhu Guanghua and others in 1990, *A Course in Introduction to the Earth* by Xu Baofen and others in 1988, and *An Introduction to the Earth* by Jin Zumeng in 1983. There are another four kinds of textbooks for high normal training school students and middle school teachers. The titles of three of them are the same " *An Introduction to the Earth*" written by Guo Ruitao in 1988, Liu Nan in 1987 and some one in Sea Publishing House in 1982 separately. Another book is titled *General Survey of the Earth as a Planet* by Liu Nan also in 1987. All those texbooks have been compiled according to the teaching syllabus issued by Chinese Education Commission and discuss astronomy knowledge centered on the earth in the nearly same way. For example, following knowledge are discussed in the book *A Course in Introduction to the Earth*: 1.

The earth in universe: some basic knowledge about solar system including the sun, planets, small planets, comets, meteors, meteoroids and the motion law of celestial body in the solar system; the Galactic System including basic parameters of stars, binary stars, stellar clusters, variable stars, pulsars, neutron stars, nebulae and interstellar matters; the metagalaxy including external galaxies and quasars; the universe including basic concept of it and big-bang cosmology. 2. The overall characteristics of the earth. 3. The rotation of the earth including celestial sphere and celestial coordinate system; celestial apparent diurnal motion in different latitudes, the direction, the period, the velocity and the evidence of the rotation, the geographic effect of the rotation. 4. The revolution of the earth including the orbit, the period and velocity of the revolution, the solar apparent annual motion, the apparent motion of planets, calculating of the solar apparent diurnal motion, the solar diurnal apparent motion in different latitudes and date, the evidence and geographic effect of the revolution. 5. The satellites of the earth including the moon, the solar eclipse and lunar eclipse, astronomical tide, artificial satellites. 6. The time on the earth including the measurement of time and calendars. 7. The origin and evolution of the earth including the origin and evolution of star, the origin and evolution of solar system, the origin and evolution of the earth.

Apart from the course, two supplementary books were published. One is *Practice Guide for an Introduction to the Earth* by Ying Zhenhua and others in 1991. This book includes two parts. The first part is "classroom practices and exercises" with 15 tasks. those tasks deal with solving astronomical problems by using celestial globe, compiling the traditional Chinese calendar, calculating the time when a solar eclipse will occur and making sundial and moving planisphere. The second part "observing starry sky and determining geographic coordinate" includes 19 tasks, such as observing sunspot, lunar surface, planets, meteoric stream, binary stars, stellar clusters, nebulae and galaxies; determining clock error, meridian, longitude, latitude, azimuth of ground target; fixing and adjusting telescope and using theodolite. Another book is *Exercise Collecting for an Introduction to the Earth* by Fang Mingliang in 1992.

As everyone knows that astronomy is a observing science. For enhancing the effect of teaching of astronomy almost all departments of geography of high normal schools are equipped with 120mm catadioptric telescopes. This kind of telescope is made in Nanjing Astronomical Instrument Research and Manufacture Center, with 1500mm focal length, 4 eyepieces which magnifications are separately 37.5, 60, 100 and 200, camera and driver. So heavenly bodies can be observed by following their tracks and photographed. Provincial high normal schools are equiped with 63/840 refracting telescopes specially for schools. This kind of telescope is made in Zeiss-Jena Optical Factory of Germany in fifties with good optical functions. Besides those, planetarium for teaching are built in more than 10 high normal schools. Most of them are built with 6 to 10 meter diameter dome and are equiped with medium and small planetarium made in China except Shandong Normal University with GOTO-V made in Japan. Many teachers in high normal schools also developed a lot of astronomical teaching aid, such as celestial globes with different variety, demonstrating apparatus of lunar aspect, cislunarium, astronomical coordinate model, astronomical umbrella, precessional motion apparatus of earth axis. Some of them have been produced by factories. For example, cislunarium designed by Huadong Normal University, precessional motion apparatus of earth axis by Hubei Normal University and world clock by Huadong Normal University cooperating with Shanghai Electric Clock Factory and so on. They are excellent astronomical teaching aid. Precessional motion apparatus of earth axis can be used to demonstrate some phenomenon caused by precessional motion of earth axis such as the change of polaris, the western retreat of varnal equinox. And the world clock can be used to read standard time of 24 whole time zones and six half time zones including 97 countries and cities. Furthermore wall maps for teaching astronomy, moving star maps and astronomical slides have also been compiled, drawn and published.

Graduate Students at the Beijing Astronomical Observatory: Situations and Suggestions

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In this short paper the situations of training graduate students at Beijing Astronomical Observatory(BAO) are listed, we also give some suggestions.

1. SITUATION: It is their right for some research institutes in China to graduate the master's and doctorate degree. BAO is one of such institutes. Since 1978, 12 Ph.D. and 38 graduate students have graduated. At present 11 Ph.D. and 12 graduate students are studying at BAO.

The advantage of training students in the research institutes is that there are more chances to train them in practice. Most students at BAO are trained in the fields of observational astrophysics using the advanced observational and computational facilities. On the other hand there is shortage of systematical basic courses.

SUGGESTIONS: i. Set a series inter-institute courses or summer schools for the graduate students. ii. Co-promote the graduate students with professors from universities.

2. SITUATION: Young students are short of fundamental astronomical knowledge, such as spheric astronomy, stellar atmosphere(or process of radiative transfer in astrophysics). It spends too much time for undergraduate students in the department of astronomy to learn the advanced courses, such as high energy astrophysics, relativistic astrophysics.

SUGGESTION. Make a continuous training arrangement for undergraduate and graduate students studying astronomy.

3. SITUATION: Computer is a very useful tool in the research of astronomy. But it spends too much time on computer and too less time in thinking for graduate students now.

SUGGESTION: This is a common problem for the students in the West. I have no idea to change this situation.

4. SITUATION: There are few students who are interested in the pure sciences such as astronomy in China. Most of young students are interested

in business, computer science, law and so on.

SUGGESTION: It is also a common problem in many countries. I have no idea.

5. SITUATION: Talented persons move from developing countries to the developed countries. More than 50% students trained at BAO have moved to the Unites States. The developed countries, especially the United States, gain the talented persons from developing countries such as China, India and without any payment in education.

SUGGESTION: UN or UNESCO should make a decision that the developed countries which gained the talented persons from developing countries should support the education of the developing countries to balance the deficiency in education.

6. SITUATION: There is a good record in the co-promoting the graduate students between BAO and Institutes in Europe, such as ESO. The students are trained in the advanced observational astrophysics and come back to China.

SUGGESTION: Thanks for the help.

GRADUATE PROGRAM IN THE CENTER FOR ASTROPHYSICS (CfA) UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA (USTC)

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SUMMARY: This is to introduce the graduated program and its members, research activity in the Center for Astrophysics in the University of Science and technology of China (Hefei). The CfA serves as a basic training base for youth astronomer in China.

1. INTRODUCTION

The University of Science and technology of China (USTC) was established by the Chinese Academy of Sciences in Beijing in 1958 year and move to Hefei in 1970 year. USTC has now become one of the key university in China, which lays great emphasis on the combination of teaching and research and urges the young generation to enrich themselves under the academically democratic atmosphere. The main Campus is located in Hefei, with two graduated schools: one in the Hefei and the other in Beijing. Here in this paper I would like to introduce you mainly the graduate program on astrophysics at Hefei.

In the USTC there are sixteen departments, including Mathematics, Physics, Chemistry, Biology, Computer and Electronics et al., eight public teaching divisions, thirteen key institutions for scientific research, one hundred and nine laboratories. There are 1785 teachers at USTC, among whom are 128 professor or research fellows, 495 associate professors.

2. SENIOR FACULTY IN THE CENTER FOR ASTROPHYSICS

In the Center for Astrophysics there are 6 full professors and 3 associate professors. They are:

Zhou Youyuan:	Director of CfA, Professor and Guide of Ph. D.
Cheng Fuzhen:	Executive Director of CfA, Professor.
Zhang Jialu:	Professor and Guide of Ph. D.

Chu Yaoquan:	Professor.
Lu Jufu:	Professor.
Wang Renchuan:	Professor.
Zhu Xingfen:	Associate Professor.
Xiang Shouping:	Associate Professor.
Cheng Fuhuan:	Associate Professor

We also have 4 part time professor they came from other related department in our university or from other university and observatory:

Wang Shouguan:	Beijing Astronomy Observatory.
You Junhan:	Shanghai JiTaon University.
Wang Shui:	USCT, Department of Earth and Space Science.
Deng Zugan:	USCT, Graduate School at Beijing.
Liu Yongzhen:	USTC, Graduated School at Beijing.

The part time professor are very helpful in providing relevant contribution. They come to our center frequently and give lecture or semina and enhances our teaching and research activity.

3. RESEARCH SCOPES AND ACHIEVEMENTS

Research work on astrophysics have been carried out since 1972. the main research field as follows:

Cosmology.
Large Scale Structure in the Universe.
QSOs and AGN: Observation and Theoretical Models.
Relativistic Astrophysics: Compact Objects, Neutron Stars and Black holes.
Accretion Disk and Jet.
Gravitation.
Theoretical Analysis of Solar Flare.

More than 300 papers were published in academic journals in China, USA (*Ap. J.*, *A. J.* et. al.) and Europe (*A. Ap.*, *MNRAS*, *Ap. S. S.* et. al) and 14 books published in national press during last 15 years. They have won the Prise of National Conference of Science and Technology, three times B prise of Chinese Academy of Science two times C prise of Chinese Academy of Science for Important Nature Science Achievement, first prise of National Popular Science and The First and Third prize of Science thesis of International GRG Foundations.

4. FACILITIES

An IUE (International Ultraviolet Explorer Observatory) archives was established in the center for Astrophysics in November 1989. Other astronomical Data Base (for example EXOSAT data, HEAO x-ray data and many catalogues) are also running at the Center. There are several microcomputer like PC 286 and PC 386 in the CfA. A Sun Station will come soon. The IRAF and other astronomy software package are available. Beside these a Vax 8700 and other large Computers at Center Computer Center of University also open for the staff and students.

Central Library of USTC have 776000 volume books and 160000 volumes periodicals. The Center for Astrophysics also have a Special Library houses. Almost all the major journals and many books for astronomy and related research field are available.

5. THE GRADUATED COURSES PROGRAMME

*1) Introduction to Advanced Astrophysics	80 hours
*2) General Relativity	80 hours
*3) The Emission Processes in Astrophysics	70 hours
*4) The Structure and Evolution of Stellar Objects	80 hours
*5) Quantum Fields	80 hours
6) Cosmology	60 hours
7) The Early Universe	60 hours
8) Large Scale Structure and formation of Galaxies	60 hours
9) Active Galaxies Nuclear	60 hours
10) High Energy Astrophysics	60 hours
11) Physics of Compact stars	60 hours
12) Accretion Disk and Jet	60 hours
13) Plasma Astrophysics	70 hours
14) Nuclear Astrophysics	80 hours
15) Modern Gravitational Theory	60 hours
16) Statistical Methods in Astrophysics	60 hours
*17) Astrophysical Techniques	

The courses name with * sample are main courses for the A.M Degree program.

6. THE A.M. DEGREE PROGRAM

According to the rule of USTC, the graduated student are required to pass examinations of 6 major courses, about 3 elected courses and one foreign Language (English) with no grade lower than B-, and an overall grade average of B or better during first year and a half. After that the student should complete thesis under the guidance of one or two member of CfA in second year and a half. The thesis should include a general review of the background knowledge and original research results. Finally, the thesis must be defended by the student at an oral examination and an unanimous vote of a committee which consist of 5 members determines whether the degree is granted. Among the 5 member of the committee, at least have one professor come from out of our university. In addition the student is required to be teaching assistant for 120 lesson periods. Those who are not qualified will not get any degree.

7. THE Ph.D DEGREE PROGRAM

Only graduates with A.M. degree can apply for Ph.D. Degree Program. A CfA committee on Graduate Student and studies considers applicants for admission and selects the best to study for Ph. D. The student have to pass additional 3 or 4 courses with distinction and to be research assistant for at least one year. Under the guidance of one or two advisers, They should complete Ph. D. Thesis which has to be systematic and creative, and also required to published at least one paper on a first-class academic journal The Ph.D. Thesis must be defended by the graduates at the final oral examination and an unanimous vote of the committee which consists of 7 members determines whether the degree is granted, among the 7 member of the committee, two have to be come from out our university.

Almost every week we have a semina at Center for Astrophysics. Every student are required to attend the semina. At Semina we have reports on the research results and Review reports on the new development in varies field of astrophysics which given by senior staff of CfA and by visitor.

8. THE POST-DOCTORAL POSITION

There are one or two post-doctoral position in CfA each year. The post-doctor can continue doing research work in which he is interested for one or two years. They have a duty to give specialized lectures and teach parts of the graduate students every years in CfA. Since 1988 there are 5 post-doctors doing research work in CfA.

9. INTERNATIONAL EXCHANGE

It is became more and more important for the student to have international exchange experience. The center for astrophysics warmly welcomes and strongly encourages international academic collaborations and exchanges. The exchanges programs and activities developed among the faculty member and students of the CfA and the scholars of the same occupation abroad have been expanding rapidly and proved to be successful and fruitful. The center of astrophysics sent students to university, institutes and observatory abroad to do research work for one or two year, then go back to China to finish their Ph. D. theses. For example we have cooperation program together with ESO; Max-Plank-Institute for astrophysics in Garchen, Germany; Institute for Astronomy, Liege University at Belgium; Institute of Astrophysics, Padova University at Italy; International Center for Theoretical Physics and International School for Advanced Study, Trieste at Italy; In addition many students go to U.S.A. to study as Ph.D. candidates.

On The Fundamental Training in Physics for Graduate Students in Astronomy

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Abstract

Fundamental training in physics is extremely important for graduate students if they want to succeed in researches of astrophysics. Problems met in astronomy have their own characters compared with those in other fields of natural sciences. Requirements on the fundamental training of physics for an young astronomer would be, of course, different from that of students in physics or in other fields. A training program and textbooks of physics which are designed specially for students in astronomy may be necessary.

1. Introduction

Astronomy and physics are closely related each other in their development. Historically, astronomy was the pioneer of the physics and even the all sciences for several times. As well known, astronomy played a very important role in the establishment of classical mechanics and the classical theory of gravity, and even the development of the modern views of the world depends heavily on the progresses in astronomy. On the other hand, almost every progress in physics also provides possibility of improving the observational or theoretical status in astronomy, as the discoveries of photograph, spectroscopy, and recently the CCD camera. these developments in technology provided astronomers the possibilities of more accurate and much deeper observation. The theory of nuclear physics helped astronomers understanding the H-R diagram discovered by astronomers in last century. Interaction between astronomy and physics have played very important role during the development of these two branch of sciences during the last few centuries.

Today, astronomy and physics are well developed each as an independent science. However, their relationship is not becomes estranged but even closer. Owing to the developments of new technology and equipments, astronomer discover a lot of phenomena from observations. Understanding these observational facts needs our knowledges over almost all branches in physics. Moreover, the new facts presented by astronomical observations often provide clues of the developments of physics or impact the existed physics theories. For example, observational cosmology has provide a lot of evidences which show that nonbaryonic dark matter most likely to be the dominate matter in the universe. This fact poses the problem of what kind particles corresponds to this dark matter and what is their properties. Nowaday, particle physics still can not answer this interesting question.

Another point is that the phenomena observed in astronomy are much more complicate than that in physical laboratories, where the condition of a processes can be well-controlled.

Any astronomical phenomena involves a lots of physical processes which can be understood only if we can build a model in which many different branches of physics are well combined. It requires that astronomers have to grasp essentials of the physics related to this complicate process. For example, investigating AGN with accretion disk model, to explain the observational facts we have to combine the existed theories of hydrodynamics, gravitations, thermodynamics, optics, electrodynamics, atom physics etc. together. For an young astronomer, this is much more difficult than the problems usually appeared in physics, where in most cases problems are posed under a cleaner condition.

I think that, nowaday, an astronomer must have a deep and extensive understanding in physics if he(or she) wants to succeed. An excellent astrophysicist have to know physics even broader than a physicist. Training an young astronomer according this requirement is the goal of astronomical education, especially, the astronomical education for graduate students. Our problem is what is the existing problems in the training of physics for a student in astronomy and to investigate the best way to improve the situation.

2. Case in Graduate School

Graduate School, Chinese Academy of Sciences, was founded in 1978 as China wanted training her own graduate students with Ms. or PhD. degree. Aim of this School is to enlarge and reinforce the background of the graduate students before they start their research work. The students in our School are come from: 1. Students who will earn their degrees from institutes of Chinese Academy of Sciences in Beijing; 2. Graduate students of our own school; and 3. The students sent to our school by other institutes or universities for first year training. Except the students who earn degree from the graduate school, all students stay in graduate school only for the first year training. After first year training they go back their own institutes to work for their thesis. Averagely, about 600 - 1000 students enter our school every year.

Graduate School, Chinese Academy of Sciences, is running under the joined efforts of all institutes of Chinese Academy of Sciences in Beijing. Every year there are about 500-550 courses given by professors from the school and the scientists from the institutes of Chinese Academy of Sciences. The proportion of the courses given by scientists from these two sources are about one to two.

There are totally 14 departments in graduate School. Students are distributed into these departments according to their major. Department of physics is the largest one. there are about 120 to 180 students enter this department per year. Graduate students whose major are in astronomy study in this department and the number is about 6 to 15 each year. Besides students studied in astronomy, students in institutes of physics, mechanics, acoustics, thermal physics are all belong to this department. We think that departments with rather large coverage in the research fields are good for students to get more comprehensive training.

To provide more opportunities for every students to enlarge his (or her) knowledge in physics according to his (or her) case, we adopt a system to encourage every student studying courses as many as he (or she) can. In these system, we give a lower limit of points to each student. Every student can earn his (or her) degree only if he (or her) gained enough points of courses in our school. The lowest points are fixed to be 30 to 32 points each comparable to about 16 - 18 hours. Usually, a student has to spend more than 150 hours in class to study foreign language to earn 4 points.

In these 30-32 points, every student has to take courses which are necessary for each student, as foreign language, philosophy in natural sciences and physical education, 8 point are earned from these courses According to the rule given by the National Committee of Education, 3-4 courses for each students must belong to those classified to be so-called 'background of the major' courses, that is, the courses related to the field in which the student will study. From these courses students can earn totally about 8 to 12 points. Other 12 to 16 points of courses can be gained from the courses selected by every student according to their own interests or needness. There is no any upper limit of the points giving to the students. Every student in our school can register and sit in any class free of charge. If he (or her) passed the examination of these courses, the records will be recognized and gives him (or her) corresponding points. Usually, a student earn points more than the lower limit during the first year study. Mean of points gained by students are close to 34 to 38.

In department of physics, we give totally about 68-70 courses 50 to 70 hours each. About half of these courses are in mechanics, in which 3-4 courses, as fluid mechanics, magnetohydrodynamics etc. are relative to the astrophysics. Other half of the courses are in physics. About 10 to 11 of these course are important for a student in astronomy. We have also 3-4 courses in astronomy giving to the student every year, e.g. advanced astrophysics, astronomical software package (such as Starlink, MIDAS etc.), stellar atmosphere and progress in astronomy which likes a set of colloquim etc. Generally, students in astronomy should take courses about 10 to 12 points in astronomy. They can only have few time to study physics during the first year training. The background in physics of these students is also weaker than that of the students in physics, because they have to study many astronomical courses in undergraduate study.

The system in our school is more or less the same as in other universities in and outside China. A common problem faced by the students whose major are astronomy is that they do not have enough time to learn both in physics and astronomy, and can not learn how to solve astronomical problems with physics they learnt from the courses of physics. Generally speaking, the background in physics of students majored in astronomy is weaker than what they need in the research works and meet more problems as they solve problems in their research.

3. Problems in the training of young astronomers

From the case presented above, we can see that giving a sufficient and effective training in physics to a graduate student is a important task putting in front of us. The traditional systems of training in physics for an astronomer can be divided into following two types. First is a two-step style as did in many universities. In this way, a student learn firstly the physics then study astrophysics. This program of training a young astronomers takes too much time which any student can not offer. Actually, in this way, a lot of contents in the courses are repeated. More important, the knowledge studied by the students is not well-joined, that is, the student can not be familiar with using what they learnt in physics to solve problems in astrophysics from beginning. They need taking a long time to study how to use the physics they learnt to solve problems in astrophysics.

Second way is cutting down the training in physics or astronomy, or the training in both side. It is happened in some systems, especially, in the training of undergraduate students. In most cases, the program for training undergraduate student in astronomy is cutting down the the education in physics, especially, in modern physics. But as we see, students do not have chance to study physics systematically after they graduated from university. This kind of program is extensively adopted in many university.

Now, some universities have found this problem in the training of graduate students. They adopt a system in which two or three department joined to give courses to the graduate students. usually, departments of physics, astronomy and others are joined together. A advantage of this system is that students whose major are in astronomy or in physics can know more about the other field. However, in the classes, students still study physics and astronomy separately.

How to improve the education of physics for students in astronomers is faced on by us. What we should do is: a. Give every graduate student enough training in both of the astronomy and physics; b. The time taken by the training would be reasonable for students; and c. Give the knowledges to the student according to usable form for their work in research. That is, during the study, students can learn how to solve astronomical problems based on their knowledges in physics.

4. A possible way to strengthen the training in physics for graduate students in astronomy

We can see from above that to solve the problems on the training in physics for an young astronomer, the most important problem is how to merge the study in astronomy and physics into one system. The current textbook in physics for students are written by physicists and the contents are selected according to the requirement of training an young physicist. In these textbooks, problems and examples are focused on some problems originally proposed from physics. Students who study astronomy can not learn how to solve problems met in astronomy from these books. We suggest that we should modify the courses related to physics and astronomy to one system of courses which gives students training in both physics and astronomy at the same time.

We suggest that this can be done by three steps in the education of physics starting from undergraduate students.

1. In the beginning of the courses in physics for undergraduate students, we may give as many as possible simplest astronomical problems as the examples and exercises in the courses. It is good for giving some ideas about the astronomical problems, and familiar with

the time and space scales etc. At the same time, students can know how to connect the astronomical condition and the learnt physics.

The courses for higher level students may put more astronomical problems with more complicate conditions, or split one complicate astronomical problem into several examples or exercises in the textbook.

2. In advanced courses, we may select the contents of the physics according to the needness of the astronomy. That is, we may add or give up some of the contents in current textbooks of physics based on the necessity for astronomical study. For examples, the radiation theories in electrodynamics have to much attention on the various mechanisms of radiation and the transition of radiation in various medium the atomic and molecular spectrum should be also given to the students. The examples and the exercises in the courses may selected from the more real problems in current astronomy. In this stage, we may give the students training in how to form and solve more complicate problems in astronomy.

3. on this background, students can study astronomical courses without any difficulty. In courses of astrophysics lecturers only need present the existing problems and the up date situations to the students.

To complete the improvements suggested above, actually, we have to rewrite the textbook and give a new calendar to students since they start at undergraduate study. However, the problem for doing this is in the money and who are willing to take much time to do it.

A PROPOSED PROJECT TO IMPROVE THE GREGORIAN CALENDAR

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I. INTRODUCTION

The teaching of astronomy in Vietnamese pedagogical Institute has encountered difficulties as students have no opportunity to learn astronomy in general education schools. Knowledge about astronomy requires teaching in many hours, but the time devoted to the teaching of this discipline is rather limited.

During my years of teaching the discipline in the Hanoi Pedagogical Institute, I have paid attention to elaborating a course somehow simplified . and at the same time to finding out methods to arouse the students' interest in learning. One of those methods is to direct them towards the examination of astronomical phenomena applied to every day life and the analysis of the level of accuracy obtained in their application - from there to define a possible orientation for further improvement. One of the problems I had to solve was that of the improvement of calendars.

As we all know, the Gregorian calendar is at present used by the whole world. Beside its important strong points, this calendar presents some imperfections which were known to the inventors of the calendar at that time - at the time of Pope Gregory in the mid - sixteenth century - but perhaps intentionally left to future generations to adjust. There have been a number of projects already made public intended to improve the Gregorian calendar. Mine is one of those projects, intended to remove the imperfections of the current Gregorian calendar.

II. IMPERFECTIONS OF THE GREGORIAN CALENDAR.

The current Gregorian calendar has two imperfections:

1. The distribution of the number of days by month does not follow any order:

31, 28(29), 31, 30, 31, 30, 31, 31, 30, 31, 30, 31. And consequently, definite days in a month do not fall exactly on definite days in a week.

2. The mean length of the calendar year is at variance with the tropical year, or the cycle of the four seasons. Although the difference is not big in a year, it grows very big as successive years have to be accumulated.

As we know, the basis for the establishment of the solar calendar year is the cycle of the four seasons or the tropical year. A tropical year (Y_{Trop}) has 365.2422 days. As this cycle contains a number of fractions of day while the calendar year must consist of a round number of days, one has to accept conventionally that there are ordinary years (of 365 days each) and leap years (of 366 days each) to ensure that the mean length of the calendar year is equal to the length of the tropical year.

In the old solar calendar, or Julian calendar, it was stipulated that once every four years there should be a leap year. Thus the mean length of the Julian calendar year is:

$$\overline{Y}_{Jul} = \frac{365 + 365 + 365 + 366}{4} = 365.2500 \text{ days}$$

The difference between the length of the Julian calendar year and that of the tropical year is:

$$\Delta Y_{Jul} = \overline{Y}_{Jul} - Y_{Trop} = 365.2500 - 365.2422$$
$$= +0.0078 \text{ day}$$

This explains why after every 400 years the difference grows into:

$$0.0078 \times 400 = 3.1200 \text{ days.}$$

In the new solar calendar, or Gregorian calendar, it is stipulated that in every 400 years there should be 97 leap years. Thus the mean length of the Gregorian calendar year is:

$$\Delta Y_{Greg} = \frac{365(400-97) + 366 \times 97}{400} = 365.2425 \text{ days}$$

The annual difference is:

$$\Delta Y_{Greg} = \overline{Y}_{Greg} - Y_{Trop} = 0.0003 \text{ day}$$

This leads to a difference of 3 days after 10.000 years and after 100,000 years the difference will be 30 days, or one month!

III. IMPROVEMENT PROJECT.

My project to improve the Gregorian calendar aims at eliminating the two above - mentioned imperfections by proposing a new rule to defined leap years and a new distribution of days by month.

1. Rule to define leap years.

As I have expounded above, it would be perfect if we can establish a rule to define leap years so as to ensure equality in length between the calendar year (Ycal) and the tropical year (Ytrop)

$$\overline{Y}_{cal} = Y_{trop} = 365.2422 \text{ days}$$
$$= 365 \frac{2422}{10.000} \text{ days}$$

Starting from this point, we can see that if in each cycle of 10,000 years there are 2422 leap years (of 366 days each) and 10,000 - 2422 = 7578 ordinary years (of 365 days each), the mean length of the calendar year will be absolutely equal to the length of the tropical year.

$$Y_{cal} = \frac{365 \times 7578 + 366 \times 2422}{10.000} = 365.2422$$

and

$$\Delta Y_{cal} = \overline{Y}_{cal} - Y_{Trop} = 0.0000$$

The number 2422 leap years in each cycle of 10,000 years should be obtained by the following proposed rule:

Leap year is a year, the number of which is divisible by 4; excepted the centennial year (ending with at least 2 ciphers as 1900, 2000, 2100 etc) which should be not leap year if the number of century is or not divisible by 4 or divisible by 40 or by 100

Indeed, in 10,000 years, or 100 centuries, according to the proposed rule we can make calculations and see that:

- There are 2500 years represented by numbers divisible by 4 (10,000 : 4 = 2500)

- There are 25 centuries represented by numbers divisible by 4 (100 : 4 = 25). Thus the number of centuries not divisible by 4 are 75. (100 - 25 = 75)

- There are 2 centuries (40, 80) represented by numbers divisible by 40.

- There is 1 century (100) represented by a number divisible by 100.

Consequently the number of leap years obtained by the above said rule to define leap years in 10,000 years is:

$$2500 - (75 + 2 + 1) = 2422$$

And it is easy to see that in the 10,000 following years there will be also 2422 leap years, and thus in 20,000 years there will be 2 x 2422 leap years. 20,000 years is 200 centuries. 200 is the least common multiple of 4, 40 and 100; so 20,000 years is a complete cycle to define the number of leap years. We can proceed from this to say that in 20,000n years (n being any round fugure) there will be:

n x 2 x 2422 leap years.

TABLE OF COMPARISON

Calendar	$\overline{Y}_{cal}$	ΔY_{cal}
Julian	365.2500	0.0078
Gregorian	365.2425	0.0003
Proposed	365.2422	0.0000

2. Distribution of days by month

First of all, I agree in this connection with the leading idea in the projects presented by G.Armetine (France) and M.Matrophili (Italy) to improve calendar, which say that 1956 is a year, divided into 4 quarters, that each quarter of 91 days is divided into 3 months with the first month having 31 days, while the two other have only 30 days each.

However, to ensure that a calendar keeps its own character, there should be a most convenient conventional system for man to measure time, and I propose that:

- A week should have 6 days.
- the ending month of the quarter should have 31 days
- The ending day of the ordinary year should be represented by 365.
- The ending day of the leap year should be represented by 366.
- The 31 st, 365th and 366th days should not be included in any week.

And all this is illustrated by the following calendar's table:

QUARTER

Day of the week	First month					Second month					Third month				
★) Monday	1	7	13	19	25	1	7	13	19	25	1	7	13	19	25
Marsday	2	8	14	20	26	2	8	14	20	26	2	8	14	20	26
Venusday	3	9	15	21	27	3	9	15	21	27	3	9	15	21	27
Jupiday	4	10	16	22	28	4	10	16	22	28	4	10	16	22	28
Saturday	5	11	17	23	29	5	11	17	23	29	5	11	17	23	29
Sunday	**6**	**12**	**18**	**24**	**30**	**6**	**12**	**18**	**24**	**30**	**6**	**12**	**18**	**24**	**30**

The ending day of the quarter	**31**
The ending day of an ordinary year	**365**
The ending day of a leap year	**366**

*)
Monday (Moon) Marsday (Mars) Venusday (Venus) Jupiday (Jupiter) Saturday (Saturn) Sunday (Sun)

IV. CONCLUSION.

If the proposed project is accepted, we shall have a kind of permanent solar calendar, and for any year the above - said table can be put to use.

We can see also that the proposed permanent calendar has the following advantages:

- All months have 5 weeks (with 25 work days) so each year has 300 work days.
- Definite days always fall on definite days of the week.
- At the end of each quarter there are 2 rest days, at the end of an ordinary year there are 3 rest days, and at the end of a leap year there are 4 rest days.
- The number 365 is indicative of an ordinary year with 365 days.
- The number 366 is indicative of a leap year with 366 days.

REFERENCES

William T.Skilling. A.brief text in Astronomy. Librairy of Congress. Number 54 - 6621. USA. 1955

Armetine. G. Réforme du calendrier. L'Astronomie 1888. T1. P.348

E.Axelic. MupoBoŭ Kalengapb. Пpupoga A.H. CCCP . 1963. N03

PHAM VIET TRINH. Mot phuong an tinh nhuan DL.Tap chi Vat li.TII N02 1977

PHAM VIET TRINH. GIAO TRINH THIEN VAN. NHA XB GIAO DUC HANOI 1986 Trg 263 - 264.

A SURVEY OF SCIENTIFIC AWARENESS AT UNIVERSITY LEVEL

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We report results of our survey about scientific knowledge of university students and their complex about science. The survey was conducted at the beginning of the first term. The breakdown of students by subject area is as follows;

Keio University,		
Science and Technology	(freshman)	248 (Female 34)
Economics	(sophomore)	794 (Female 97, unknown 93)
Letters	(freshman)	244 (Female 14, unknown 4)
Tokyo Electronics Technical college,		
Business Information course	(freshman)	157 (Female 45)
Radio Therapeutics course	(junior)	43 (Female 9)
Clinical Examination course	(freshman)	49 (Female 31)

(3) Mean number of words that they have heard (among 30).

Keio University,		
Science and Technology	(freshman)	20.9
Economics	(sophomore)	19.6
Letters	(freshman)	17.7
Tokyo Electronics Technical college,		
Business Information course	(freshman)	18.4
Radio Therapeutics course	(junior)	18.0
Clinical Examination course	(freshman)	15.8

QUESTIONAIRE ON SCIENCE EDUCATION

YEAR(   ) (FEMALE, MALE)
FACULTY (ECONOMICS, LETTERS, SCIENCE AND TECHNOLOGY)

(1) DO YOU OFTEN READ SCIENCE ARTICLES ON NEWSPAPER?

(VERY OFTEN, OFTEN, SOMETIMES, RARELY)

(2) HAVE YOU EVER READ A "BLUE BACKS"?

(YES, NO, DON'T KNOW "BLUE BACKS")

* "BLUE BACKS" IS A POPULAR SCIENCE BOOK SERIES

(3) HAVE YOU EVER HEARD OF THE FOLLOWING WORDS? CIRCLE THOSE THAT YOU HAVE HEARD OF, AND MARK THOSE THAT YOU ARE INTERESTED IN WITH A DOUBLE CIRCLE (◎).

HIGH TEMPERATURE SUPERCONDUCTIVITY

	COLD FUSION	HIGH ENERGY ACCELERATOR
I.V.F.	ECOLOGY	GENERECOMBINATION
INPRINTING	BIOLOGICAL CLOCK	BRAIN DEATH
DIOXIN	ARTIFICIAL INTELLIGENCE	VLSI
HOMOERCTUS	EXTINCTION OF DINOSAURS DUE TO METEORITE IMPACT	
		LANGUAGE LARNING BY CHIMPANZEES
GLOBAL WARNING	OZONE HOLE	PLATE TECTONICS
BLACK HOLE	EXPANDING UNIVERSE	PLANETARY EXPLORER
BIG BANG	SUPERNOVA	SPACE STATION
TOPOLOGY	FRACTRAL	NON-EUCLIDEAN GEOMETRY
MELTDOWN	HOSPICE	AIDS

(4) DO YOU HAVE A COMPLEX ABOUT SCIENCE?

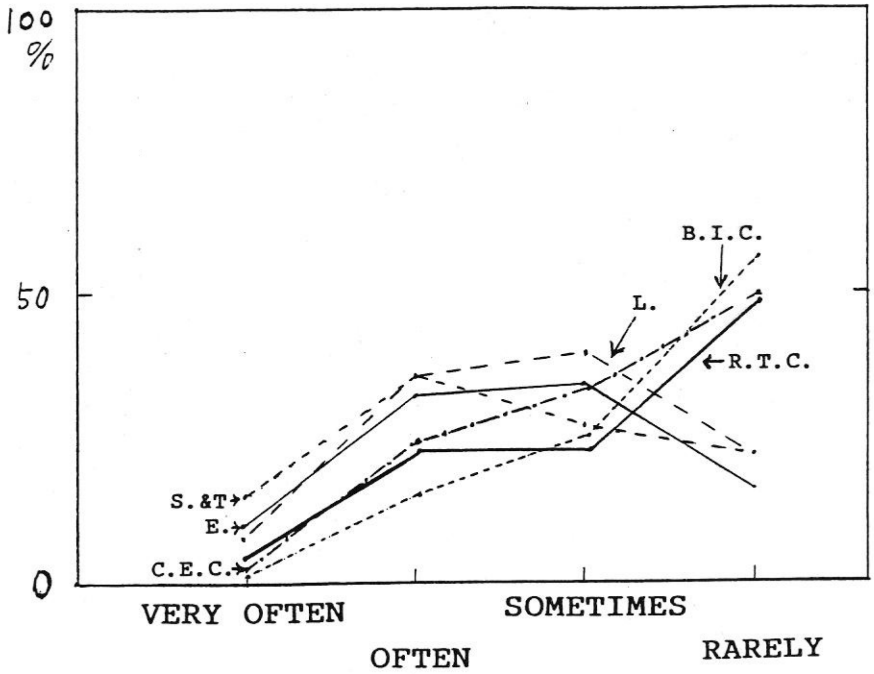
NO, YES (WEAK, AVERAGE, STRONG)

(5) WHEN DID YOU GET SUCH A FEELING?

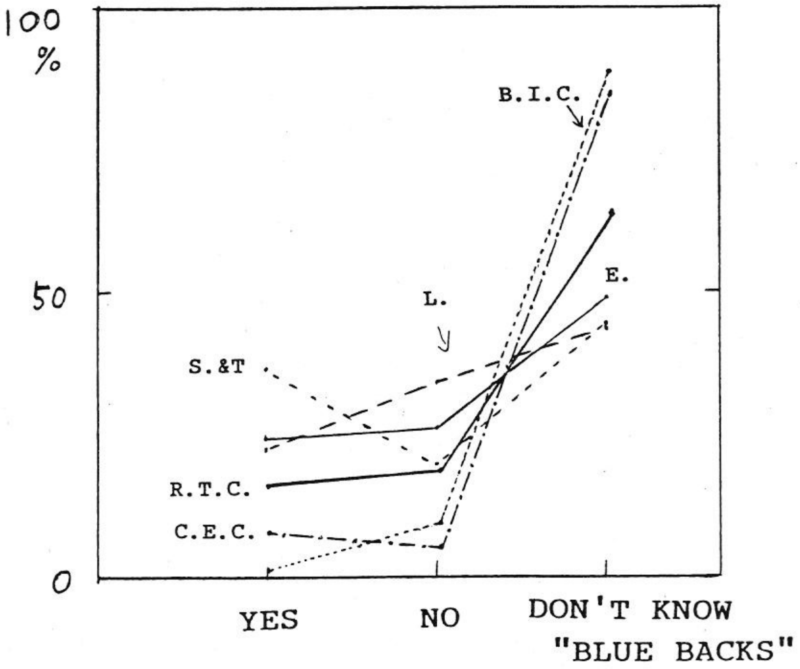
ELEMENTARY SCHOOL:GRADE ( ), JUNIOR HIGH SCHOOL: GRADE ( ),
SENIOR HIGH SCHOOL : GRADE ( )

(6) WHAT IS THE CAUSE OF YOUR SCIENCE COMPLEX?

(1) DO YOU OFTEN READ SCIENCE ARTICLES ON NEWSPAPER?



(2) HAVE YOU EVER READ A "BLUE BACKS"?



(3) HAVE YOU EVER HEARD OF THE FOLLOWING WORDS?

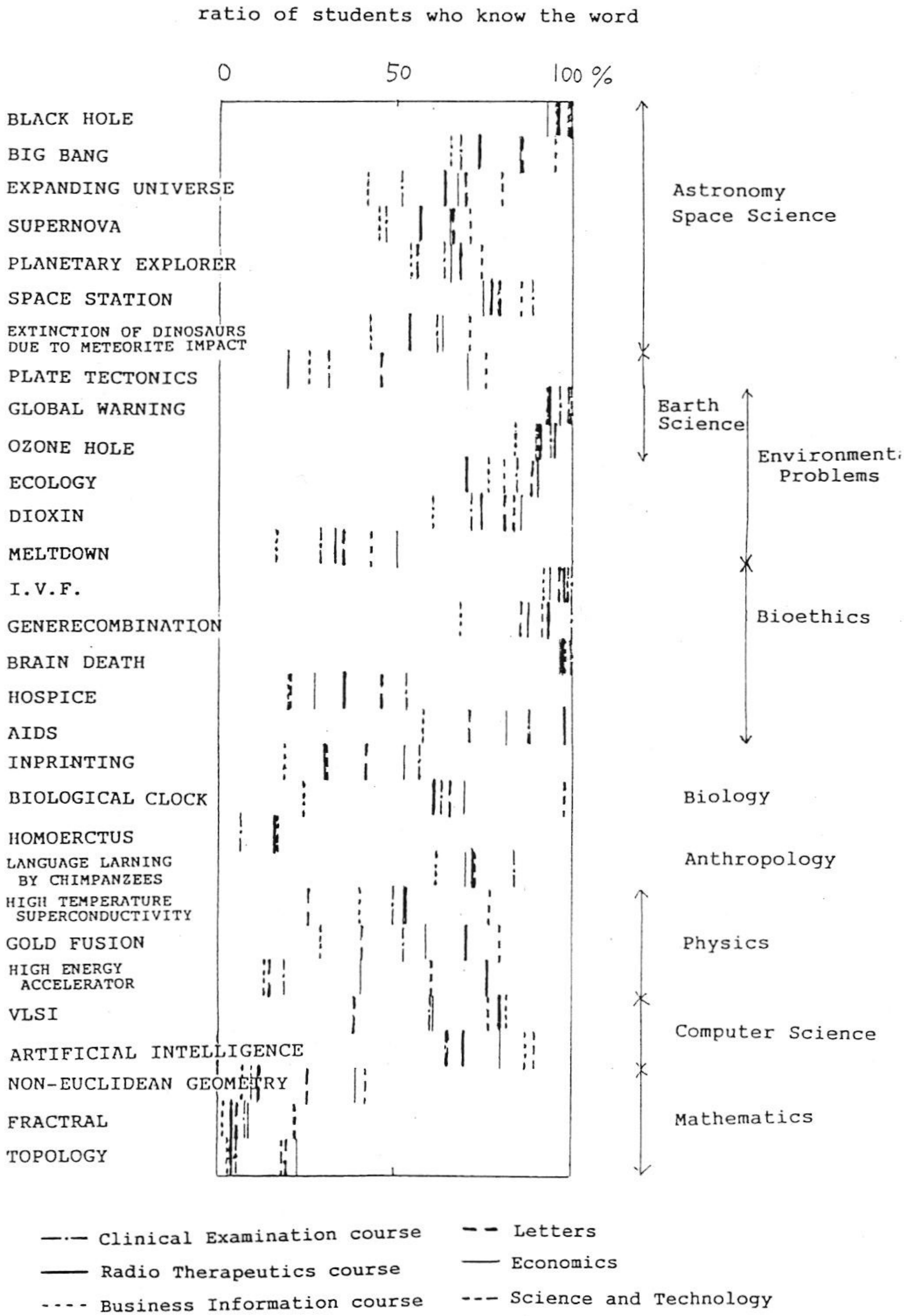


Figure I

Words that aroused students' interest (above 10%)

★ Astronomy · Space Science
• Bioethics
△ Physics · Computer Science
∴ Environmental Problems

Keio University

Science and Technology

★ BLACK HOLE
△ ARTIFICIAL INTELLIGENCE
★ BIG BANG
★ EXPANDING UNIVERSE
△ COLD FUSION
★ SPACE STATION
∴ GLOBAL WARNING
• BRAIN DEATH
△ HIGH TEMPERATURE SUPERCONDUCTIVITY
• GENERECOMBINATION
AIDS
★ SUPERNOVE
△ VLSI
★ PLANETARY EXPLORER
∴ OZONE HOLE
★ EXTINCTION OF DINOSAURS DUE TO METEORITE IMPACT

Letters

★ BLACK HOLE
★ BIG BANG
∴ GLOBAL WARNING
• GENERECOMBINATION
★ EXPANDING UNIVERSE
∴ OZONE HOLE
• I.V.F.
★ SUPERNOVA
∴ ECOLOGY
AIDS
★ PLANETARY EXPLORER
★ SPACE STATION
△ ARTIFICIAL INTELLIGENCE
BIOLOGICAL CLOCK
• HOSPICE

Tokyo Electronics Technical College

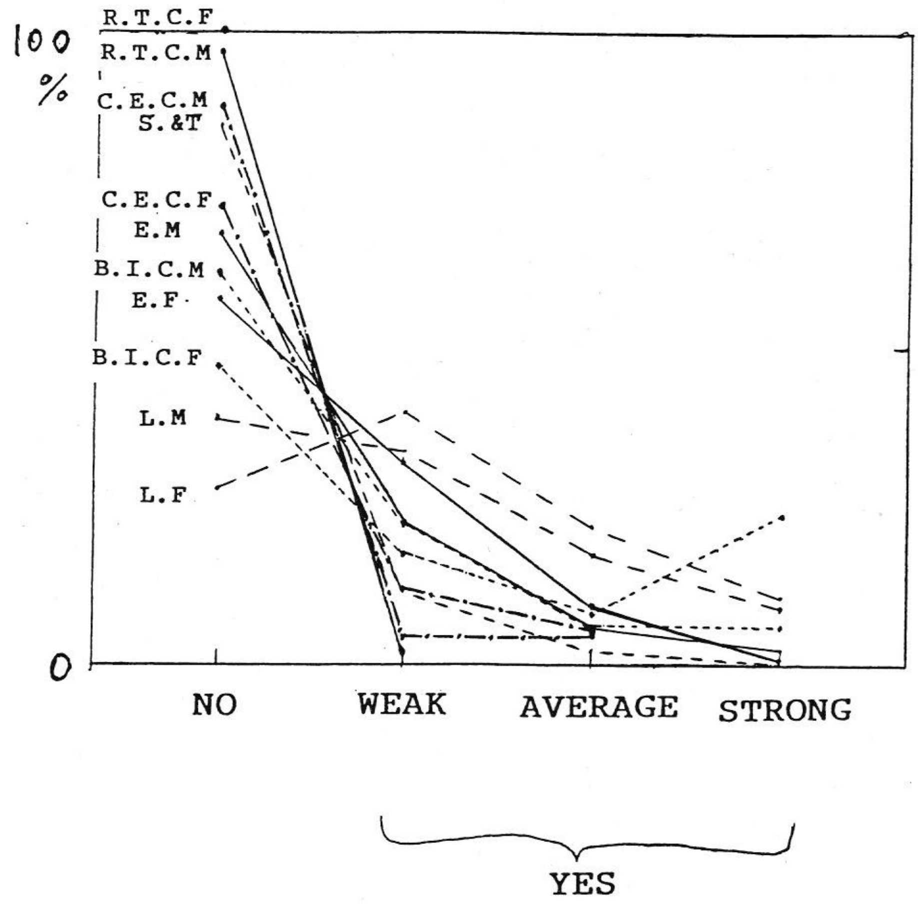
Business Information course

★ BLACK HOLE
∴ GLOBAL WARNING
△ ARTIFICIAL INTELLIGENCE
AIDS
★ BIG BANG
∴ OZONE HOLE
• BRAIN DEATH
★ PLANETARY EXPLORER
★ EXTINCTION OF DINOSAURS DUE TO METEORITE IMPACT
★ SPACE STATION
★ EXPANDING UNIVERSE
• I.V.F.

Radio Therapeutics course

• BRAIN DEATH
AIDS
• GENERECOMBINATION
• I.V.F.

(4) DO YOU HAVE A COMPLEX ABOUT SCIENCE?



SUMMARY OF THE SURVEY

(1) More than half of the students do not read science articles on newspaper.

(2) "Blue Backs" is not well known in university students, even though this series is a typical science book series. Only one third of the students, in faculty of Science and Technology (freshman), had ever read this series. This figure is lower than that we expected, and we are planning a resurvey to the same students to see whether this ratio will increase after one year or not.

(3) Among thirty words listed in the questionnaire (3), items in astronomy is relatively well known. The best known subjects are those in recent social topics, such as environmental problems. These subjects are well known among students in all major areas. Everybody knows "AIDS", but few of them do not recognize it's alias (translated form into Japanese at full length) as shown in Figure I. Words in modern physics and computer science are known only in students of science course.

(4) Depth of complex about science varies among students' subject area. The complex is stronger in female students than in male students.

(5) Students begins to fell complex about science in Junior high school or up to the second grade in senior high school (The peak in the age distribution is at the first grade of senior high school). At this age, lots of students feel that Physics and Mathematics become complicated and difficult to study. Such students will possibly choose non-science course in their future, and therefore science complex is common in university students in non-science course, especially in letters.

A Global Network Observation of Night Sky Brightness in Japan —— Method and Some Results ——

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and
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Remote Sensing Technology Center of Japan,
Roppongi, Minatoku, Tokyo, Japan

Abstruct

Outdoor Lighting is now important for safety living of people in many countries : that is, street light, trafic light, front door light, light at a parking lot and so on. However, over luminous lighting makes its original purpose inefficient, energy resources are lost, and also our beautiful night sky decoration, star constellations, disappers from our view. This is our general feeling, and to confirm this effect scientifically we carried out a global network observations of night sky brightness in Japan in these 5 years and show several results.

1. Light pollution and energy loss.

A problem of light pollution is not recently becoming apparent but went back many years ago. Our observatory was built in the central part of Tokyo in 1878 and moved out to a country-side (Mitaka) of Tokyo at the time of 1920's. Now, some limited number of observations such as solar monochromatic observation, meridian circle observation, and bright star photometric observation are carried out at our observatory site.
New sites escaped from an expansion of Tokyo city were chosen one by one from 1955 to 1973. Recently, we decided to build an 8-m telescope outside of Japan, that is, on Mauna Kea, Hawaii. This situation was nearly same for the Greenwich observatory, the Paris observatory, and so on.

Although professional astronomers were able to escape from the light pollution and have been staying at the best observational sites at each time, light pollution has taken away dark night sky with many beautiful constellations from people's view. When they make a trip to countryside, they may have an opportunity to enjoy a really dark night sky. However, much illumination produced by many resort hotels makes again night sky bright. Garstang(1987) estimated night sky brightness in the next century at Mauna Kea will possibly be 0.5 magnitude brighter than the 1990 level if no regulation for good lighting system inside a Hawaii island would not be given to those hotels.

Looking at a famous map of 'Earth at Night' produced by W. Sulliwan, III., we can find many cities shining brightly. Since this map was obtained from a satellite. light detected was mainly emitted to the sky. This energy was lost without using to make materials visible.

We measured a mean diameter of each bright image on the map and compared it with the total amount of energy used in each city. Figure 1 shows some correlates of these two parameters and some indication of energy loss.

Cities in developed countries use much energy whereas cities in developing countries with same area as those in developed countries use less energy. Therefore, an estimate of degree of light pollution is able to give some indication of non-efficient usage of energy.

In 1987, a global network obsevation of night sky brightness was started in Japan under a strong support from the Environmental Agency who has an intension to find some index of air pollution at different places in Japan. We jointly work this project with a slightly different target, but both of the Agency and us are enjoyning the result obtaind from this observation. A method introduced and some interesting results are given in this article.

2. A method and principle of measurement in night sky brightness.

The Environmental Agency of Japan payed much attension to improve air-pollution from the begining of their funding in 1971, when a condition of air pollution in Japan was worst before the period of oil shortage. They have been measuring a content of oxydant, NO_x, and so on as an indicator of a degree of air pollution. Succeeding their original purpose in some degree, they started to have some new indicators of air pollution and introduced a star watching program proposed by one of this authors(K.H.) as one of their activities.

A star watching program in Japan is a joint program between the Environmental Agency and the National Astronomical Observatory of the Ministry of Education, Science, and Cultur. The Environmental Agency ask every local government organize a group to watch the program stars during a requested period every half year. Fortunately, many local governments took this job from 1987 summer to 1992 winter. Those numbers were shown in Table 1. Many amateur astronomers and public people joined in this program under the organization of each local government.

There are two methods in the star-watching program, both of which are simple even for public people. The first one is a visual observation to count number of visible stars in each celestial area shown in figure 2, using a 50mm binocular with 7 time magnification. This method is strongly dependent on observer's ability and does not give a precise results, but are effective for people's educational point of view since many poeple try to watch the stars.

The second one is a photographic observation to estimate surface brightness of night sky surrounding α Lyrae in summer period and α Tauri in winter period, using a camera for a 35mm film with an focal length 50mm and an f-ratio faster than 2.0. The camera is fixed on a tripod to the celestial direction with and without the reference stars, α Lyrae and α Tauri, and its f-ratio should be larger than 2.8 to reject an effect of lens vignetting (4.0 is requested as a standard f-ratio). An ISO-400 color slide film obtained in a commertial base is used to have a standard film development at each film production company. Exposure times are 80 sec., 150 sec., and 300sec., and each trail of the stars, α Lyrae and α Tauri, on each film exposed in 80 sec. is 0.227mm and 0.283mm, respectivery.

All the films obtained are sent to the Environment Agency who hand over them to H. K., and are measured to obtain density values in areas of a diameter, 0.5mm, with and without the reference stars, α Lyrae and α Tauri, using a Sakura densitometer, Model P-15, which has a measuring dynamic range of 0.01~4.00 in density and a measuring accuracy less than 0.01 in density.

Night sky brightness in magnitude per square seconds of arc, m_2, is given in

$$m_2 = \frac{1}{0.4} \log \{10^{D_1/a} / 10^{(D_2/a - 1)}\} + m_1 + 16.3 \qquad (1)$$

where m_1 is a magnitude of reference star, D_1 and D_2 are measured densities in a 0.5mm dirameter area with and without the reference stars, respectively. a and b are film constant introduced in a equation of

$$D = a \log I + b \qquad (2)$$

where I is an intensity value coresponding to each D value. A value of 16.3 magnitude is derived from an angular area, 3.30×10^6 square seconds of arc corresponding to a diaphram size of 0.5mm. Some examples of film characteristic curve are shown in figure 3 at places with different night sky brightness assuming that all three films with exposure times of 80 sec., 150sec., and 300 sec. have same characteristic curve. A value of 'a' is negative for a positive film, and is from 0.6~to 1.5 at the linear portion of each film. Therefore, it is enough accurate for our further estimation and comparison of data to assume 'a' ~ 1.0.

Figure 4 shows a relation between the limiting magnitude by binocular observation and the night sky surface brightness by photographic observation at each organized region carried out in 1987 winter to 1990 summer. Although one can see some correlation, a scatter of points is far large. Therefore, an accuracy of visul observation is strongly dependent on an abilities of observers.

3. Distribution of night sky brightness in Japan.

Table 1 shows attendances, and periods joining this star watching program additionally to number of local governments. All the data are now compiled and will be supplyed on request showing purpose of their usage. Here, we show some results obtaind from these data file.

Figure 5 shows a distribution of the brightness drawn on a map of Japan where lines of high-way and super-rapid train are superposed. It is quite easy to find that bright zones are running along these lines.

We call a long zone connecting from Tokyo through Nagoya to Osaka as the Tokaido Megalopoly which contains large fraction of population, many cities, industries, trafic roads, and so on. Those brightness is sometimes brighter than 17 magnitude per square second of arc, and people in these zones have lost completely celestial objects. Fortunately, we are still keeping some zones which have the brightness fainter than 21 magnitude per square seconds of arc.

Figure 6 shows some example of night sky photographs at the brightest part, Toyonaka in Osaka prefecture and at the darkest part, Yoka in Hyogo prefecture neighboring to Osaka. In the photographs at Toyonaka many faint stars disappear because of the bright night sky.

4. Time dependent variation of night sky brightness.

We have one observing station at Dodaira mountain locating at the western edge of Kanto plane including the biggest city of Tokyo.

Figure 7 shows time sequence of night view from that station and a clear increase of light glow from 1967 to 1978. Our National Astronomical Observatory is inside this bright area. Photometric observations of brightness at zenith point inside our observatory were carried out in 1958 January, 1978 February and 1989 January when sky brightness are 20.5, 19.5, and 17.6 per square second of arc respectively. We had 1 magnitude increase in the first 20 years and 2 magnitude increase in the second 10 years. This result shows an acceleration of the brightness because of an increase of outdoor lighting, some of which are not certainly necessary for human living. Bad lighting systems give much light loss to the sky as bad as light-up system of monuments, buildings, towers, bridges, and so on.

Table 2 shows time dependence of the brightness at some places. At the bright places, we have a little bit dark periods of the brightness at 1990 summer and 1991 winter during the Iraq war, when many local governments tried to turn off the light for light-up to save electric energy created from oil. This means one can save more than 50% of energy for outdoor lighting, which was used for unnecessary lighting. Table 3 shows all the observational data obtained upto 1992 winter.

Figure 8 shows an another example of energy saving. On November 17, 1990, large member of volunteer amateur astronomers made photographic observations as shown in the figure at 20, 22, and 24 hours of Japan Standard Time. One can easily see the brightness was drastically decreasing depending on time. It is clear that street light is on even at midnight at many observing spots. Here, again we can say much light is thrown unnecessary to the sky.

5. Some interesting areas.

We tried to find out one and two dimensional distribution of the brightness, and asked many amateur groups in Nagoya city with a population of two million and in Tajimi city with that of 100 thousand respectively.

Figure 9 shows a magnitude difference from that of the Nagoya city center to the different spots on each line. This suggests that typical cities of Japan have similar pattern of the sky brightness distribution but cities with low population make much light loss per person to the sky. It is much interesting to compare the Japanese pattern given in figure 9 with those in the other countries.

Figure 10 is two dimensional distribution of the brightness in Tajimi city and shows a beautiful concentric structure. From this figure, one can get enough dark zenith sky if one go out of the city area. However, this is true at zenith but not true at zenith distance more than 45°. There is the Kiso Observatory with the 105cm Schmidt telescope at the central mountain area, whose ridge is shinning by the city light of Nagoya locating at a distance farther than 100km.

6. A global network observation and its contribution to astronomical education.

As shown in this article, our star watching program is running well and has given many useful data. We are starting to compare these data with those obtained artificial satellite. Then, international comparison will be possible.

Besides of this energy loss measurement our star watching program is much useful for astronomical education. At every season more than several thousand people have been joining to this program, and enjoying to look at stars and to take photographs of night sky. Moreover, they start to know energy resource problem as well as stars and universe.

Fortunately, this program is introduced in different mass-communication channels such as astronomical journal, public journal, newspapers, radio, and TV, which give additional influence to people who have not been joining this program. The next step which we should do is to approach to personals having a responsibility to control the outdoor lighting in different organizations, especially in local governments. On this point, a small success has been already obtained in making a law of lighting regulation shown in an article by Dr. David Crawford (Sky and Telescope Feb., p.133, 1991).

Finally, we would like to say 'Let's take back our stars and start to think our universe'.

This paper was presented at the annual meeting of the International Dark Sky Association held in Tucson on April 11, 1992, and I hope many people will join this Association.

Table 1

Numbers of attendances for our star watching program (photographic)

Period	1987w*	1987s*	1988s	1989w	1989s	1990w	1990s	1991w	1991s	1992w
Numbers of attended local government	15	83	23	38	70	124	147	126	158	144
Numbers of attended people	296	9814	1266	1150	2764	2317	3621	2168	2926	2074
Numbers of attended groups	15	242	68	75	153	166	204	142	187	179
Numbers of groups expressing to attend	(15)	(267)	(99)	(103)	(232)	(249)	(259)	(192)	(322)	(215)

* s and w are summer and winter observations, respectively.

Table 2

Surface brightness in different places at each period (mag. per square seconds of arc)

Place	1987w*	1987s*	1988s	1989w	1989s	1990w	1990s	1991w	1991s	1992w
Tokyo										
Nakano	-	-	16.3	16.6	16.8	16.3	17.1	17.1	17.3	
Shinjuku	-	-	-	-	-	15.2				
Itabashi	-	-	-	-	-	-	15.4			
Osaka										
Nakanoshima	-	-	-	-	-	15.4	15.1	15.0		
Toyonaka	-	-	16.3	16.6	16.7	16.4	17.7	17.7	15.7	
Nagoya										
Sakae, Nakaku	-	-	-	-	-	-	-	15.3	15.6	
Kanagawa										
Hiratsuka	-	-	19.5	17.7	19.4	17.4	19.6	18.3	18.7	
Saga										
Imari	-	-	21.0	20.8	19.3	21.6	21.6	22.1	21.2	
Miyazaki										
Takasaki	-	21.4	21.6	22.1	21.8	21.9	21.4	21.8	21.0	
Kobayashi	-	-	-	22.4	21.6	22.1	19.9	21.7	20.8	

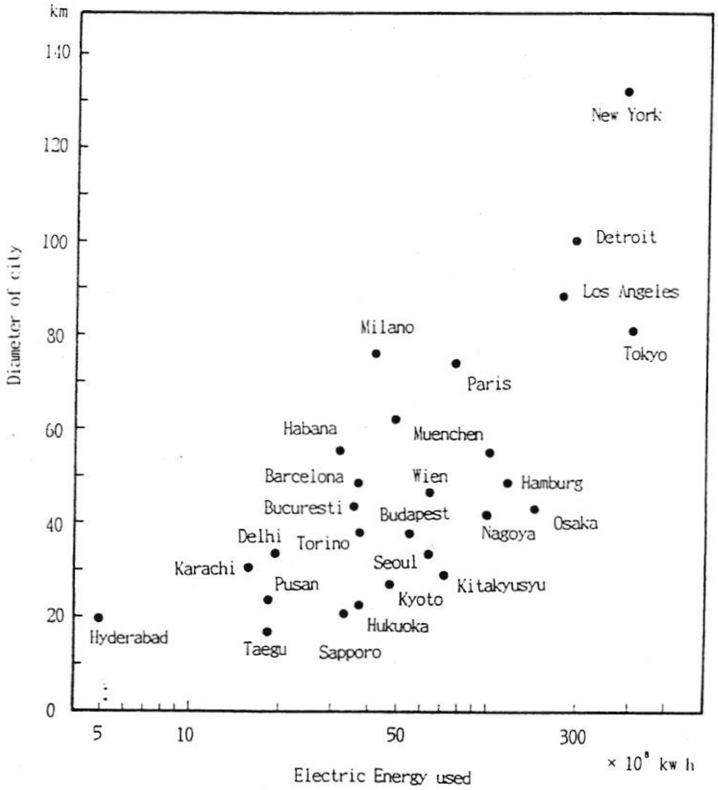


Figure 1. A relation between city diameter measured from a map of 'Earth at Night' by satellite observation and electric energy usage in each city for a case of 1975.

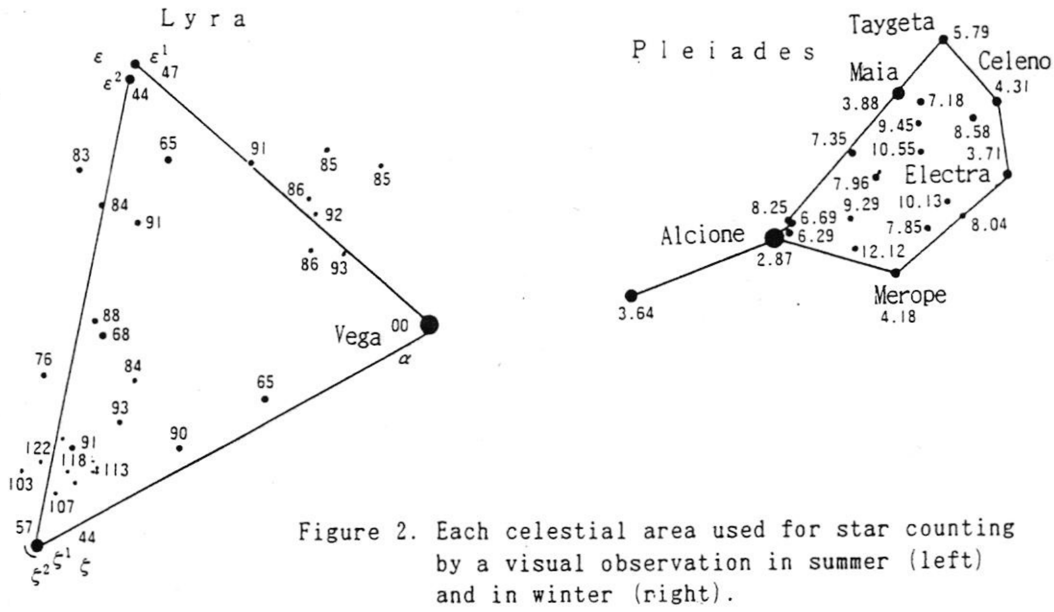


Figure 2. Each celestial area used for star counting by a visual observation in summer (left) and in winter (right).

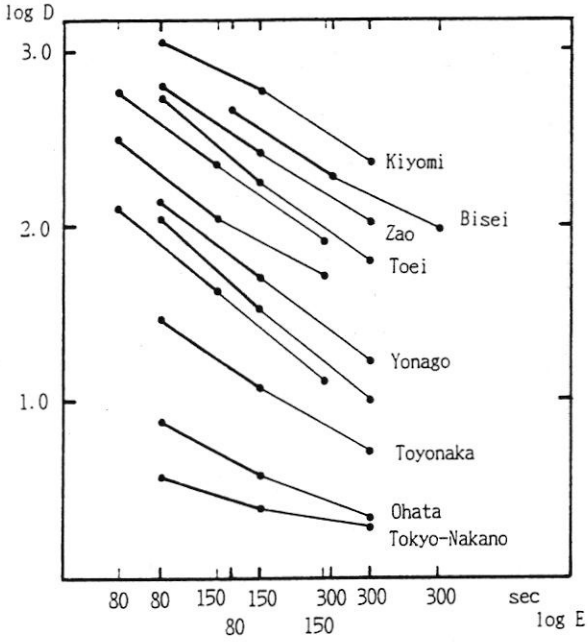


Figure 3. Characteristic curve of each film obtaind at different places with different F-ratio (2.0, 2.8, and 4.0 from left to right with same exposure time on abscissa).

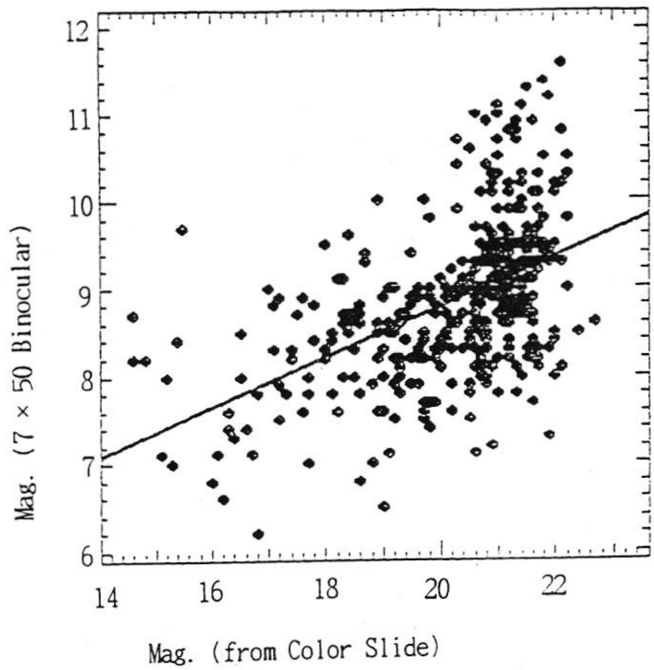


Figure 4. A relation of the limiting magnitude between binocular observation and photographic observation.

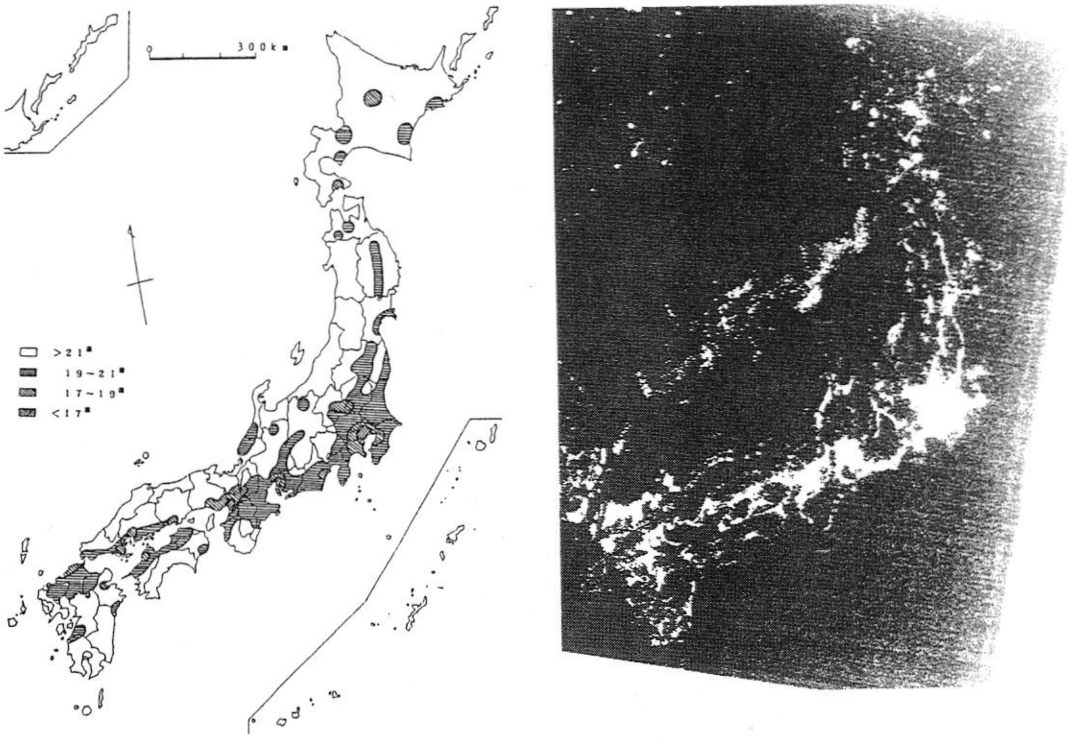


Figure 5. Contour maps of night sky brightness (unit of magnitude per square second of arc) in Japan obtained by our star watching observations (left) and by the satellite observations (right). Both the figures show a good coincidense.

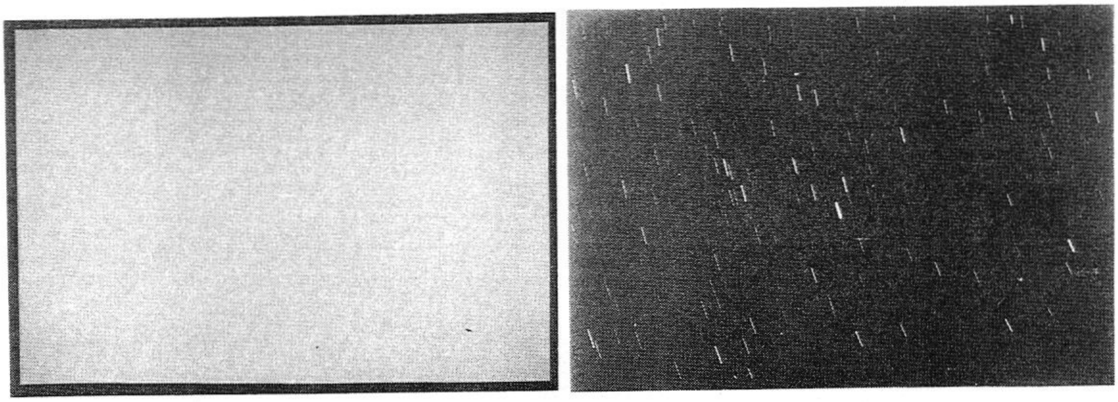


Figure 6. Night sky photographs obtained by 80 second exposure at the brightest part, Toyonaka (left), and at the darkest part, Yoka (right).

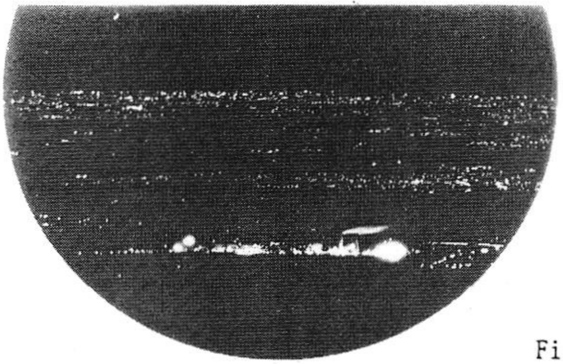
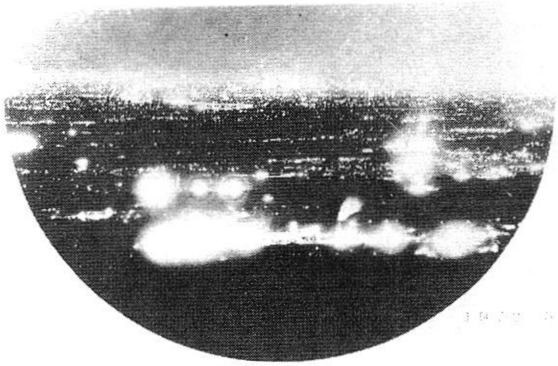
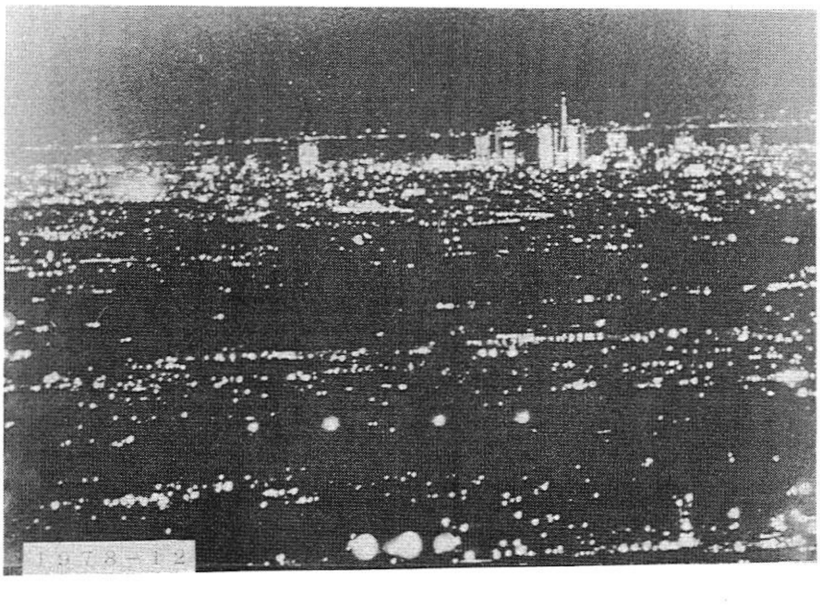


Figure 7. Night view of Kanto plane from the Dodaira station to Tokyo at 1967 (upper), 1972 (middle), and 1978 (lower).





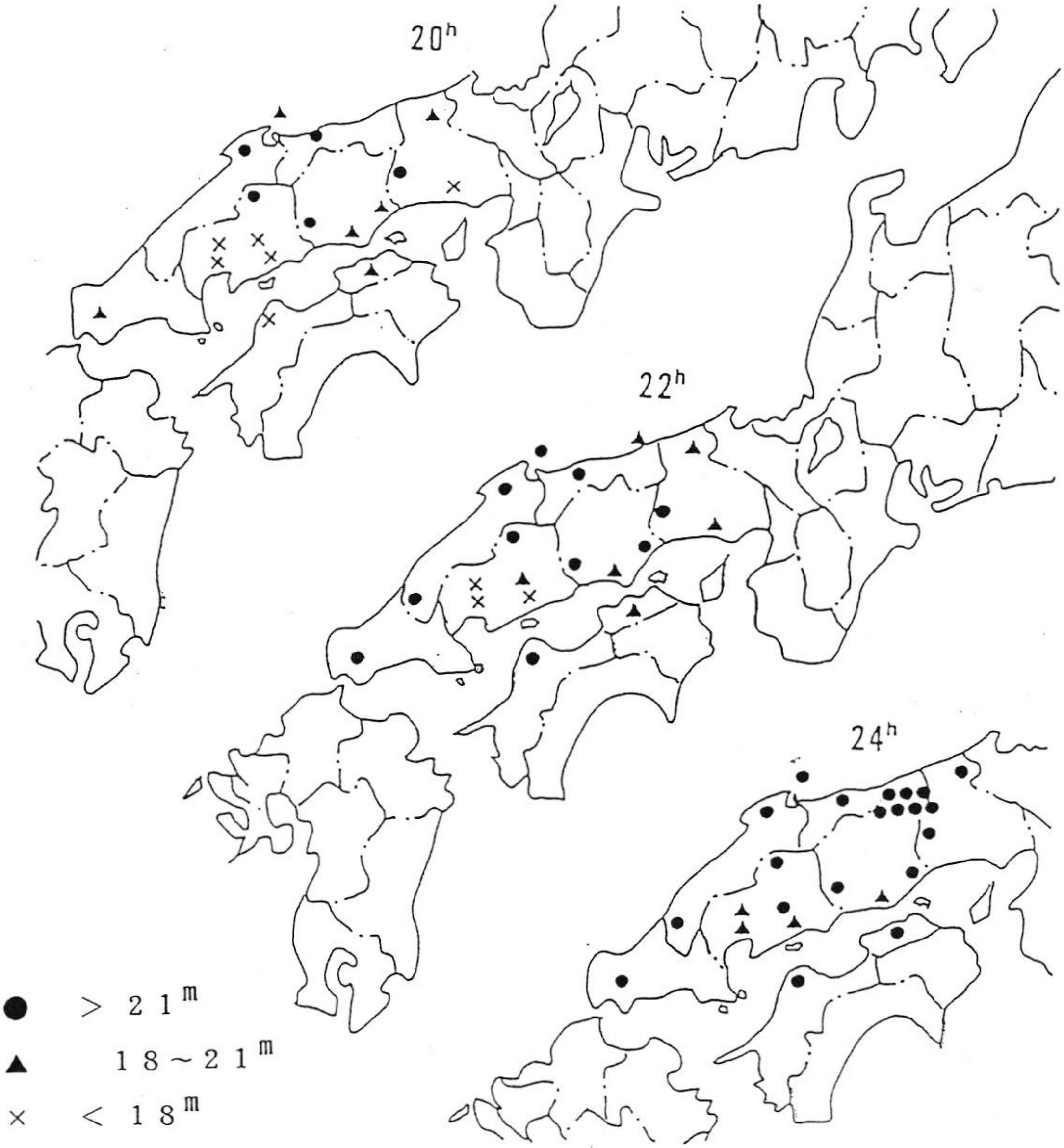


Figure 8. Distribution of night sky brightness (unit of magnitude per square second of arc) depending on time (Japan Standard Time) on November 17, 1990.

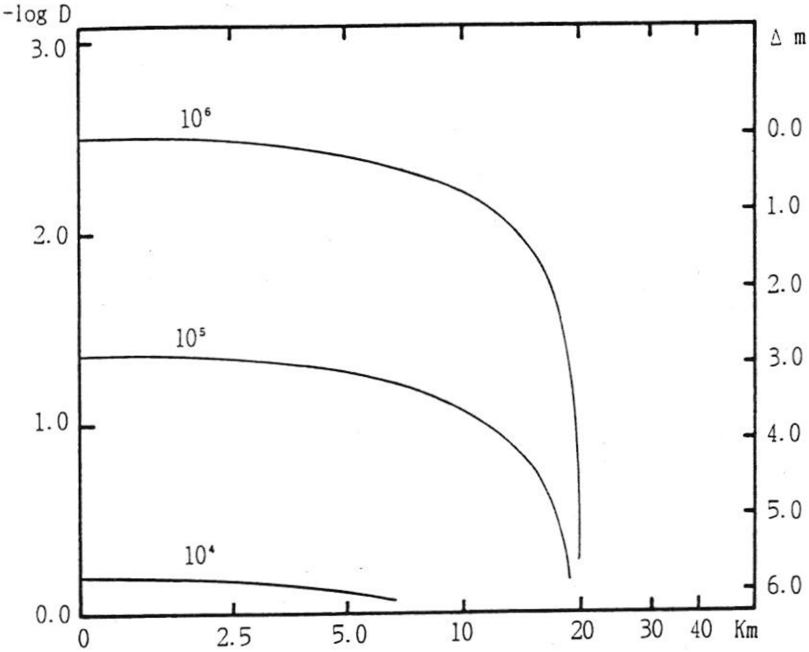


FIgure 9.
Distribution of photographic density (D) of night sky brightness depending on distance from each city center. Number of population in each city is given beside each curve.

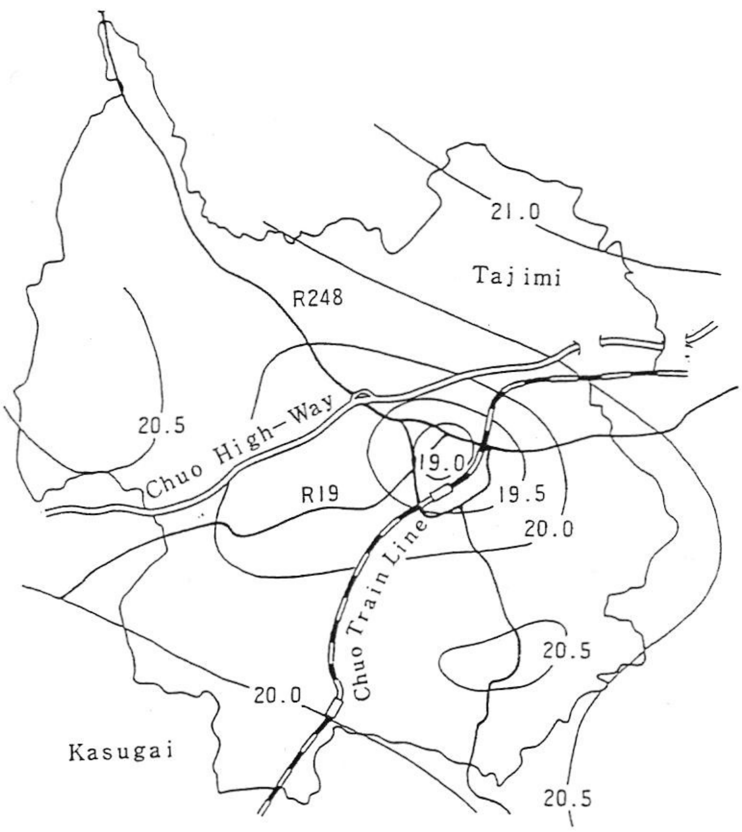


Figure 10.
Contour map of night sky brightness (unit of magnitude per square second of arc) in an area of Tajimi city.

Table 3 Night-Sky Brightness (magnitude per Square second of arc) in Japan Measuered on Color Slide Films

Locations	Magnitude/Arcsec 1987Summer	1988Summer	1989Winter	1989Summer	1990Winter	1990Summer	1991Winter	1991Summer
Hokkaido								
Sapporo	20.9	–	–	–	–	–	–	–
Hakodate	17.8	–	–	–	–	–	–	–
Muroran	19.3	–	–	–	–	–	–	–
Hamutonbetsu	–	21.7	–	21.7	–	–	–	21.1
Kamiyubetsu	–	–	–	21.2	–	–	–	–
Rikubetsu	–	–	–	20.9	–	–	–	–
Nakashibetsu	19.4	–	–	–	–	–	–	–
Obihiro	–	–	21.1	19.7	18.4	–	–	–
Taiki	–	–	–	21.0	20.8	–	–	–
Syosanbetsu	–	–	–	–	20.7	–	–	21.1
Mashike	–	–	–	–	22.0	–	–	21.3
Kushiro(City)	–	–	–	–	19.1	19.3	–	–
Kushiro(Suburbs)	–	–	–	–	21.9	–	–	–
Asahikawa	–	–	–	–	14.8	19.1	–	19.8
Toyoura	–	–	–	–	–	–	–	21.8
Horoura	–	–	–	–	–	–	–	20.5
								–
Aomori								
Hirosaki	21.5	–	–	–	–	–	–	–
Towada	–	–	–	21.4	20.8	21.2	19.8	20.1
Shingo	21.3	–	19.5	21.7	22.1	–	–	–
Hakkoda	–	–	–	21.4	–	–	–	–
Aomori	–	–	–	20.6	–	–	–	–
Soma	–	–	–	–	–	20.8	–	–
Iwate								
Kamaishi	21.7	–	–	–	–	–	–	–
Maesawa	21.5	–	–	–	–	–	–	–
Kitakami	–	–	–	20.6	17.9	–	–	–
Ichinoseki	–	–	–	–	18.0	–	–	–
Iwaizumi	–	–	–	–	22.2	21.7	–	21.6
〃 (Ryusendo)	–	–	–	–	–	–	21.8	–
〃 (Muroba)	–	–	–	–	–	–	21.7	–
(Kumanohana)	–	–	–	–	–	–	21.8	–
(Godocyosya)	–	–	–	–	–	–	22.1	21.8
Murone	–	–	–	–	–	21.3	21.1	–
Ichinohe	–	–	–	–	–	20.4	–	–
Miyako	–	–	–	–	–	21.5	–	–
〃 (Tsugaruishi)	–	–	–	–	–	–	20.8	21.6
〃 (Tarocyo)	–	–	–	–	–	–	21.8	21.6
〃 (Tsugaruishi)	–	–	–	–	–	–	21.9	–
〃 (Tsugaruishi)	–	–	–	–	–	–	21.8	–
〃 (Tsugaruishi)	–	–	–	–	–	–	21.7	–
〃 (Tsugaruishi)	–	–	–	–	–	–	22.1	–
Miyagi								
Sendai	19.4	–	–	–	–	–	–	–
Zao	–	–	22.0	–	–	–	–	–
Yamamoto	–	–	–	–	21.8	–	–	–
Tagajyo	–	–	–	–	19.5	–	–	–
Naruko	–	–	–	–	21.9	–	–	–
Shibata	–	–	–	–	–	20.8	–	20.7
Kesennuma	–	–	–	–	–	21.2	21.8	21.6
Kitakami	–	–	–	–	–	–	–	20.5
Fukushima								
Iwaki	20.1	–	–	–	–	–	–	–

Fukushima	21.7	–	19.9	20.9	20.1	21.2	20.1	19.6
Aizu-Wakamatsu	20.2	–	–	21.5	–	20.9	–	–
Koriyama	20.6	–	–	–	–	–	–	–
Funahiki	–	–	–	–	21.3	–	21.4	–
Samekawa	–	–	–	–	–	21.2	–	21.5
Soma	–	–	–	–	–	–	21.1	–
Ibaraki								
Iwai	–	–	–	21.0	–	–	–	–
Ishioka	–	–	–	–	19.0	21.3	18.9	–
〃	–	–	–	–	–	–	19.1	–
Mito	–	–	–	–	20.6	20.2	–	–
Tochigi								
Mimaminasu	21.6	–	–	–	–	–	–	–
Utsunomiya	–	–	–	20.4	20.4	20.4	–	–
〃	–	–	–	–	18.7	–	–	–
〃	–	–	–	–	18.9	–	–	–
〃	–	–	–	–	18.5	–	–	–
Kanuma	–	–	–	–	–	21.1	20.6	–
〃	–	–	–	–	–	–	20.8	–
Ashikaga	–	–	–	–	14.6	–	19.3	20.4
Nasu	–	–	–	–	20.8	–	–	–
Tochigi	–	–	–	–	–	–	20.9	–
〃	–	–	–	–	–	–	20.5	–
Gunma								
Ohta(High-School)	–	–	–	18.6	15.5	–	15.0	–
Ohta	–	–	16.6	–	19.2	20.1	20.5	19.5
Maebashi	–	–	–	–	19.8	18.6	–	–
Tatebayashi	–	–	–	–	–	20.2	19.8	21.5
Ohta-Nkajima-Lib.	–	–	–	–	14.6	–	–	–
Oizumi	–	–	–	–	19.0	–	17.6	–
Maebashi (Highi-School)	–	–	–	–	17.3	–	–	–
Sakai	–	–	–	–	–	–	–	–
Saitama								
Urawa	17.8	–	–	–	–	–	–	–
Kawagoe	19.6	–	–	–	–	–	–	–
Kumagaya	20.6	–	18.2	20.5	18.9	–	17.6	–
Iwatsuki	–	–	20.7	19.8	–	19.7	19.0	19.6
〃(Child-Center)	–	–	–	–	–	–	–	18.8
Kitamoto	19.7	–	–	–	–	–	–	–
Toda	17.2	–	–	18.1	16.8	17.6	17.5	16.7
Moroyama	20.6	–	–	–	–	–	–	–
Higashi-Chichibu	21.1	–	–	–	–	–	–	–
Kamisato	21.4	–	–	–	21.1	–	–	–
Kumagaya Girls High-School	–	–	–	–	18.8	–	16.9	–
〃(Arakawa-Riverside)	–	–	–	–	20.1	–	–	–
Omiya	–	–	–	–	–	18.6	16.1	16.7
〃	–	–	–	–	–	–	18.3	–
Tokigawa	–	–	–	–	–	20.8	20.9	–
Ogawa	–	–	–	–	–	20.4	20.8	–
Soka	–	–	–	–	–	–	16.8	–
Chiba								
Ichikawa	16.5	–	–	–	–	–	–	–
Funabashi	19.3	–	–	–	–	18.4	–	18.1

Chiba	—	19.2	—	—	—	—	—	17.4
Cyoshi	—	20.3	—	21.4	21.3	20.8	21.7	21.7
Nagareyama	—	—	20.0	18.0	18.9	18.9	18.5	—
〃	—	—	—	—	—	—	18.3	—
〃	—	—	—	—	20.8	20.5	—	—
〃	—	—	—	—	21.3	—	—	—
Narita (High-School)	—	—	—	—	21.0	—	—	—
Narashino	—	—	—	—	—	—	18.4	—
Kashiwa	—	—	—	—	—	—	15.2	—
Futtsu	—	—	—	—	—	—	20.7	—
Narita	—	—	—	—	—	—	—	20.2
〃	—	—	—	—	—	—	—	19.0
Sakura	—	—	—	—	—	—	—	20.4
Abiko	—	—	—	—	—	—	—	19.3
Tokyo								
Ome	20.6	—	—	—	21.1	—	—	—
Nakano	—	16.3	16.6	16.8	16.3	17.1	17.1	17.3
〃	—	—	—	—	—	—	16.1	—
Itabashi Akatsuka Dai 2 Mid.School	—	—	—	17.8	—	—	—	—
Shinjyuku Kaijyo High School	—	—	—	—	15.2	—	—	—
Suginami Ikuei College	—	—	—	—	16.6	—	—	—
Hamura	—	—	—	—	18.2	—	—	—
Ome Nariki	—	—	—	—	—	20.3	20.0	—
Itabashi Sci.Mus.	—	—	—	—	—	15.4	20.6	—
Setagaya (Yabuta)	—	—	—	—	—	17.0	17.6	17.7
Ome Sawai	—	—	—	—	19.3	—	—	—
Higashi-Kurume	—	—	—	—	—	—	18.7	18.6
Setagaya (Env.Center)	—	—	—	—	—	—	17.9	18.3
Itabashi	—	—	—	—	—	—	—	17.7
Mitaka Iguchi	—	—	—	—	—	—	—	18.4
Kanagawa								
Hiratsuka Mus.	—	19.5	17.7	19.4	17.4	19.6	18.3	18.7
Sagamihara	—	—	—	18.6	19.1	19.6	18.0	—
〃 (Mineyama Greveyard)	—	—	—	—	—	—	18.5	17.2
〃 Isobe	—	—	—	—	—	—	—	17.5
〃 Touma	—	—	—	—	17.5	19.6	19.2	—
〃 Oshima	—	—	—	—	20.2	—	—	—
〃 Yayoi High School	—	—	—	—	17.2	—	—	—
〃 Vegitable Market	—	—	—	—	17.2	—	—	—
〃 Syowa Bridge	—	—	—	—	18.5	—	—	—
〃 Park	—	—	—	—	—	19.2	—	—
Kiyokawa Miyagase	—	—	—	—	20.7	—	—	—
Fujino Nakura	—	—	—	—	21.7	—	—	—
Yugahara Sports-Parke	—	—	—	—	21.9	21.0	21.7	—
Atsugi Sci.Mus.	—	—	—	—	—	16.9	17.1	—
〃	—	—	—	—	—	15.5	—	—
〃 (Nanatsuzawa Natuer Park)	—	—	—	—	—	—	20.2	—

Kawasaki								
Sci.Mus.	–	–	–	–	18.4	18.4	17.8	–
Yokohama	–	–	–	–	17.4	–	–	–
Yokohama								
Natl.Unv.	–	–	–	–	–	18.8	–	–
〃	–	–	–	–	–	19.0	–	–
〃	–	–	–	–	–	19.2	–	–
〃	–	–	–	–	–	17.3	–	–
〃	–	–	–	–	–	17.1	–	–
Yokohama Isogo	–	–	–	–	–	16.8	–	17.3
〃	–	–	–	–	–	18.5	–	–
Yokosuka								
Morisaki	–	–	–	–	–	–	–	16.5
Fujino	–	–	–	–	–	–	–	21.5
Kawasaki Asou	–	–	–	–	–	–	–	17.0
〃 〃	–	–	–	–	–	–	–	17.1
Niigata								
Tokamachi	21.0	–	–	–	–	–	–	–
Matsudai								
Shimizu-								
Elem.School	–	–	–	–	–	21.4	–	–
Toyama								
Kurobe	–	–	21.4	21.3	–	18.7	21.4	17.6
Takaoka	20.7	–	–	–	–	–	–	–
Hukumitsu	21.6	–	–	20.9	–	20.7	–	–
Toyama	–	18.2	–	17.7	–	17.9	16.9	–
Fukuno	–	–	–	–	–	20.7	–	–
Ishikawa								
Anamizu	20.3	–	–	–	–	–	–	–
Yamanaka	–	–	–	–	–	20.8	–	–
Nanao	–	–	–	–	–	20.6	–	–
Kaga	–	–	–	–	–	20.5	–	–
Fukui								
Fukui	19.9	–	–	–	–	–	–	–
Tsuruga	20.9	–	–	–	–	20.8	–	–
Obama	21.2	–	21.4	–	–	20.6	21.5	20.9
Yamanashi								
Kofu	21.6	–	–	–	–	–	–	–
Fuji-								
Yoshida	20.2	–	–	–	–	–	–	–
Katsunuma	21.5	–	–	–	–	–	–	–
Takane	21.7	–	–	–	21.6	21.0	–	–
Akiyama	–	–	–	20.6	–	–	–	–
Kiyosato	–	–	–	–	21.5	20.7	21.2	20.9
〃	–	–	–	–	21.4	20.7	21.3	20.8
〃	–	–	–	–	21.7	–	21.2	–
〃	–	–	–	–	21.7	20.7	21.2	–
Oizumi Star-								
Villege	–	–	–	21.9	21.4	21.2	20.9	–
Sudama	–	–	–	–	22.2	21.4	21.9	–
〃	–	–	–	–	–	21.3	21.8	–
Mt.Senjyo	–	–	–	–	–	21.2	–	–
Kobuchizawa	–	–	–	–	–	–	–	21.5
Nagano								
Matsumoto	20.6	–	–	–	–	–	–	–
Suwa	–	–	–	21.0	–	19.6	–	–
Ina	–	21.2	–	–	–	–	–	–
Shiojiri	21.1	–	–	–	–	–	–	–

Usuda	21.2	–	–	–	–	20.5	–	–
Maruko	20.9	–	–	–	–	–	–	–
Shimosuwa	21.5	–	–	–	–	–	–	–
Toyoshina	21.0	–	–	–	–	–	–	–
Otaki	–	–	–	21.0	–	–	18.4	–
〃	–	–	–	–	–	–	21.2	–
Hotaka	21.4	–	–	–	–	–	–	–
Asahi	–	–	–	21.2	–	20.1	21.2	–
Saku	–	–	–	–	20.5	–	–	–
Nagano	–	–	–	–	–	19.2	–	–
Fujimi	–	–	–	–	–	–	–	21.0
Togákushi	–	–	–	–	–	–	–	19.5
〃	–	–	–	–	–	–	–	20.5
Gifu								
Furukawa	–	–	–	19.5	21.8	–	–	20.5
Kiyomi	–	–	–	–	21.6	20.3	–	–
Seki	–	–	–	–	21.6	–	–	–
Akechi	–	–	22.0	–	–	–	–	–
Kanayama	–	–	–	–	–	–	20.2	–
Tajimi	–	–	–	–	–	–	21.0	–
〃	–	–	–	–	–	–	20.6	–
〃	–	–	–	–	–	–	–	20.1
〃	–	–	–	–	–	–	–	20.7
Kasahara	–	–	–	–	–	–	–	20.9
Shizuoka								
Gotenba	21.4	–	–	–	–	–	–	21.6
Hamamatsu	–	17.0	21.0	21.2	21.2	20.6	19.9	19.8
Numazu	–	–	–	–	20.7	–	21.0	–
〃	–	–	–	–	–	–	20.5	19.8
Mimamiizu	–	–	–	–	21.7	21.5	–	–
Numazu Nishiura-Elem. School	–	–	–	–	21.5	–	–	–
Minamiizu	–	–	–	–	–	21.5	–	21.1
Shizuoka	–	–	–	–	–	–	17.2	–
Fujinomiya	–	–	–	–	–	–	–	21.3
〃	–	–	–	–	–	–	–	21.5
〃	–	–	–	–	–	–	–	21.2
〃	–	–	–	–	–	–	–	21.1
〃	–	–	–	–	–	–	–	21.5
〃	–	–	–	–	–	–	–	21.0
Aichi								
Handa	–	17.1	17.4	20.1	19.9	19.0	18.9	19.1
Toyoda	20.7	–	–	–	–	–	–	–
Anjyo	18.3	–	–	–	–	–	–	–
Taketoyo	20.5	–	–	–	–	–	–	–
Toei	–	21.2	22.7	–	21.4	21.5	22.1	21.5
〃	–	–	–	–	–	–	22.1	–
Hakkai	20.8	–	–	–	–	–	–	–
Saori	–	–	–	–	18.3	–	–	–
Nagoya	–	–	–	–	–	15.3	15.6	–
〃	–	–	–	–	–	–	–	16.8
〃	–	–	–	–	–	–	–	16.8
〃	–	–	–	–	–	–	–	16.8
Tokoname	–	–	–	–	–	20.1	–	–
〃	–	–	–	–	–	–	–	21.0
〃	–	–	–	–	–	–	–	19.7
Mie								
Yokkaichi	–	–	–	19.3	–	–	–	–
Suzuka	20.6	–	19.2	–	–	20.9	–	–
Owase	–	20.2	20.9	–	21.4	20.2	21.7	–

Nabari	21.3	–	–	–	–	–	–	–
Matsuzaka	–	–	–	–	–	20.5	20.9	20.8
Kumano	–	–	–	–	–	20.8	21.6	–
Tsu	–	–	–	–	–	–	–	20.9
〃	–	–	–	–	–	–	–	21.0
〃	–	–	–	–	–	–	–	20.8
〃	–	–	–	–	–	–	–	21.3
〃	–	–	–	–	–	–	–	20.4
〃	–	–	–	–	–	–	–	20.4
〃	–	–	–	–	–	–	–	19.4
〃	–	–	–	–	–	–	–	18.4
〃	–	–	–	–	–	–	–	19.7
〃	–	–	–	–	–	–	–	20.2
〃	–	–	–	–	–	–	–	20.7
〃	–	–	–	–	–	–	–	21.1
〃	–	–	–	–	–	–	–	21.4
〃	–	–	–	–	–	–	–	20.7
Shiga								
Nagahama	21.2	–	–	–	–	21.0	–	20.1
Hikone	20.7	–	–	–	–	–	–	–
Omi-hachiman	21.1	–	–	–	–	–	–	–
Kusatsu	18.8	–	–	–	–	–	–	–
Ohtsu	–	18.6	18.1	–	19.5	–	–	19.4
Mizukuchi	–	–	–	–	19.7	–	20.7	–
Taga	–	–	–	–	–	20.9	21.0	–
Takashima	–	–	–	–	–	–	–	18.5
Kyoto								
Ayabe	–	–	–	21.3	–	–	–	–
Nagaokakyo	–	–	–	–	18.9	–	–	–
〃	–	–	–	–	18.8	–	–	–
〃	–	–	–	–	19.1	–	–	–
〃	–	–	–	–	19.7	–	–	–
〃	–	–	–	–	–	–	18.8	–
Kyoto	–	–	–	–	–	18.6	–	18.5
Mukahimachi	–	–	–	–	–	–	17.2	15.3
〃	–	–	–	–	–	–	17.2	–
Osaka								
Izumi	21.2	–	–	21.0	–	20.4	20.2	19.2
Toyonaka	–	16.3	16.6	16.7	16.4	17.7	17.7	15.7
〃	–	–	–	–	–	–	–	15.7
Osaka	–	–	–	–	16.1	–	–	–
〃	–	–	–	–	15.4	–	–	–
〃	–	–	–	–	18.9	–	–	–
〃 (Sci. Mus.)	–	–	–	–	–	15.1	15.0	–
〃 〃	–	–	–	–	–	15.1	–	–
Hyogo								
Kobe	–	–	–	17.6	18.5	18.7	18.2	17.7
〃	–	–	–	–	–	19.0	–	17.8
〃	–	–	–	–	–	19.1	–	19.4
〃	–	–	–	–	–	–	–	19.7
Amagasaki	21.3	–	–	–	–	–	–	–
Akashi	20.0	16.3	–	19.7	19.9	20.4	18.8	19.8
Kakogawa	–	–	–	19.1	–	20.2	–	17.0
Takasago	19.6	–	–	19.2	–	19.1	17.6	20.6
〃	–	–	–	–	–	–	18.0	–
Mikata	20.1	–	–	21.2	–	21.1	–	–
〃	–	–	–	–	–	21.0	–	–
〃	–	–	–	–	–	21.0	–	–
Oya	20.9	–	–	–	–	20.8	–	–
Sumoto	–	–	–	–	22.2	21.0	21.9	–

Goshiki	-	-	-	-	22.1	21.0	-	-
Muraoka	-	-	-	-	-	21.2	-	-
〃	-	-	-	-	-	21.4	-	-
Sannan	-	-	-	-	-	20.8	-	20.8
〃	-	-	-	-	-	21.4	-	-
Yoka	-	-	-	-	-	21.5	21.5	21.4
〃	-	-	-	-	-	-	20.4	-
Ashiya	-	-	-	-	-	19.9	19.2	20.3
Tsuna	-	-	-	-	-	20.7	-	-
Inagawa	-	-	-	-	-	20.4	-	-
Sayo-Kozuki	-	-	-	-	-	-	22.0	-
Itami	-	-	-	-	-	-	-	17.6
Nara								
Ohto	-	-	-	-	-	-	-	20.1
Wakayama								
Wakayama	-	-	-	19.3	18.1	-	-	-
〃	-	-	-	-	21.2	21.0	-	-
〃 (Mt.Oishi)	-	-	-	-	22.1	-	-	-
Obou(Hidaka-High-School)	-	-	-	-	21.3	20.7	-	-
Misato (Mid.School)	-	-	21.3	-	-	-	-	21.3
Yuasa	-	-	-	-	-	-	-	20.8
Tottori								
Yonago	-	-	20.3	-	-	-	-	-
Saji	-	-	-	-	22.4	21.5	21.4	21.8
Kokubu	-	-	-	-	-	-	-	21.3
Sakai	-	-	-	-	-	-	-	21.5
Kurayoshi	-	-	-	-	-	-	-	21.3
Shimane								
Nichihara	-	-	21.5	20.0	-	21.3	-	-
Okayama								
Tsuyama	-	-	20.8	21.0	-	21.1	21.2	20.9
Kasaoka	-	-	19.8	19.8	-	-	-	-
Bisei	21.7	-	21.5	21.2	22.0	20.4	21.9	21.2
Osa	21.3	21.5	22.2	21.0	21.8	21.6	21.9	21.1
Yubara	21.1	-	-	-	-	-	-	-
Sanyo	-	-	-	21.0	20.9	-	-	-
Kamogawa	-	-	-	20.8	21.7	21.2	21.9	20.8
Tsuyama (Kagurao)	-	-	-	-	21.7	-	-	-
〃	-	-	-	-	21.5	-	-	-
〃	-	-	-	-	21.6	-	-	-
Kurashiki (Mizushima-Tech.High-School)	-	-	-	-	20.9	-	19.8	-
Niimi	-	-	-	-	-	21.6	21.9	-
YosHii	-	-	-	-	-	21.2	-	-
Tamano	-	-	21.1	-	-	-	-	-
Saheki	-	-	22.1	-	-	-	-	-
Okayama	-	-	-	-	-	-	17.3	18.3
Hiroshima								
Hiroshima	-	-	-	14.4	-	-	-	-
〃	-	-	-	-	-	-	-	17.6
〃	-	-	-	-	-	-	-	19.3
Fukuyama	20.6	-	-	-	-	19.7	-	-
〃	-	-	-	-	-	21.1	-	19.5
Mihara	22.0	-	-	-	-	-	-	-

Ohtake	21.6	–	–	–	–	–	–	20.7
Yuki	21.9	–	–	–	–	–	–	–
Ohsaki	21.9	–	–	–	–	–	–	–
Mitsugi	–	–	–	21.4	–	–	–	–
Yamaguchi								
Hagi	20.5	–	–	–	–	–	–	–
Ube	–	–	–	19.8	–	–	–	–
Hioki	–	–	–	–	–	21.3	–	–
Shin-nanyo	–	–	–	–	–	–	–	21.9
Iwakuni	–	–	–	–	–	–	–	18.9
Tokushima								
Yamakawa	–	19.7	–	–	–	–	–	21.7
〃	–	–	–	–	–	–	–	21.7
Anan	–	–	–	–	–	21.2	–	–
〃	–	–	–	–	–	21.1	–	–
〃	–	–	–	–	–	21.0	–	–
〃	–	–	–	–	–	21.2	–	–
〃	–	–	–	–	–	21.1	–	–
〃	–	–	–	–	–	21.2	–	–
〃	–	–	–	–	–	–	–	21.4
〃	–	–	–	–	–	–	–	21.8
〃	–	–	–	–	–	–	–	21.3
Yuki	–	–	–	–	–	–	–	20.8
〃	–	–	–	–	–	–	–	–
Kagawa								
Kokubunji	–	–	–	21.2	21.0	21.2	21.5	21.0
Takamatsu (Goshikidai)	–	–	–	–	–	–	21.8	–
Ehime								
Iyo	18.3	–	–	–	–	–	–	–
Imabari (West-High School)	–	20.0	–	–	–	–	–	–
Imabari	–	–	19.8	–	–	21.3	–	–
Kochi								
Kahoku	22.0	–	–	–	–	–	–	–
Nishitosa	22.1	–	–	21.6	–	21.2	–	20.1
〃	–	–	–	–	–	21.4	–	–
Sagawa	–	–	22.2	–	22.0	–	21.9	21.1
〃	–	–	–	–	21.9	–	–	–
Fukuoka								
Kitakyusyu	18.9	18.0	–	20.0	–	–	16.8	18.0
Omuta	21.3	–	–	–	–	20.7	17.6	19.6
Hoshino	–	–	–	19.7	–	–	–	–
Jyojima	–	–	–	21.5	20.6	–	–	20.9
〃	–	–	–	–	20.6	–	–	–
Kurume	–	–	–	–	–	19.0	–	–
Fukuoka (West Ward)	–	–	–	–	–	–	18.3	21.2
〃 (Meihama)	–	–	–	–	–	–	–	19.1
Saga								
Saga	–	18.5	21.5	–	–	–	–	–
Imari	–	21.0	20.8	19.3	21.6	21.6	22.1	21.2
Takeo	–	–	–	–	–	–	–	20.9
Nagasaki								
Nagasaki	21.2	–	–	–	–	–	–	–
Sasebo	20.5	–	–	–	–	–	–	–

Nishiariya	21.7	–	–	–	–	–	–	–
Fukue	–	–	–	21.2	22.2	–	–	–
〃	–	–	–	–	22.2	–	–	–
Chijiwa	–	–	–	–	–	21.1	22.1	–
Kumamoto								
Yatushiro	–	–	–	21.2	20.9	21.1	21.9	21.4
Hitoyoshi	–	–	–	19.7	20.3	20.6	–	19.4
Yamaga	–	–	–	21.6	–	–	–	–
Uto	–	–	–	21.4	22.0	20.7	–	21.4
Seiwa	–	–	–	–	–	21.4	–	21.0
Ryugatake	–	–	–	–	–	–	–	22.4
Oita								
Maetsue	21.0	–	–	–	–	–	–	–
Oita	–	–	–	–	19.0	–	16.8	17.9
〃	–	–	–	–	–	–	18.3	17.7
Yayoi	–	–	–	–	21.9	–	–	–
Saganoseki	–	–	–	–	–	21.2	–	–
Yufuin	–	–	–	–	–	–	–	20.8
Miyazaki								
Nobeoka	21.4	19.5	–	–	–	–	–	–
Takasaki	21.4	21.6	22.1	21.8	21.9	21.4	21.8	21.0
Takachiho	21.5	21.2	–	–	–	–	–	–
Kitago	–	–	22.2	–	–	–	22.2	–
Kobayashi	–	–	22.4	21.6	22.1	19.9	21.7	20.8
〃	–	–	–	–	–	–	21.5	–
Aya	–	–	–	–	22.2	–	–	20.9
Kagoshima								
Kagoshima	21.2	–	–	–	–	–	–	–
Oguchi	–	–	–	21.5	–	–	21.5	–
Kaseda	20.9	–	–	–	21.8	–	–	20.9
Yoron	–	–	21.4	–	–	–	–	–
Kihoku	–	–	–	–	21.3	21.1	–	–
〃	–	–	–	–	21.9	21.4	–	–
Izumi	–	–	–	–	–	20.0	21.9	–
〃	–	–	–	–	–	20.6	–	–
Osumi	–	–	–	–	–	–	21.9	–
Zaibe	–	–	–	–	–	–	–	22.0
Oura	–	–	–	–	–	–	–	21.0
Okinawa								
Itoman	–	–	21.4	19.8	–	–	–	21.2
〃	–	–	–	–	–	–	–	21.2
〃	–	–	–	–	–	–	–	21.2
Sub-Total	83	23	38	70	124	147	126	158
Acc. No.		106	144	214	338	485	611	769