INTERNATIONAL ASTRONOMICAL UNION
COMMISSION 46 — TEACHING OF ASTRONOMY
NEWSLETTER

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Editorial

Greetings once again! For many of us, it is the time of year when school and university classes resume. Somehow, it does not seem logical that the length of the school year (which should be determined by some property of human brain cells) is actually determined by the orbital period of the Earth!

This issue contains some contributed articles, but not enough. PLEASE send me your short contributions AS SOON AS POSSIBLE. As you will see, many of the articles in this issue have been reprinted from other publications.

The lead article is about the problems which women astronomers (or potential astronomers) face in different countries. In many countries, including my own, a serious shortage of scientists and engineers is predicted for the future. In order to avoid this shortage, and its economic and social consequences, we shall have to recruit scientists from among women and from among other groups in society which have traditionally avoided science. Another article, on research centres for the third world, brings to mind the possibility of an academy for the training of astronomers from the third world.

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WOMEN WORLDWIDE IN ASTRONOMY

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and

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Reprinted, with permission, from Status, the Newsletter of the Committee on the Status of Women in Astronomy, American Astronomical Society, January 1989 issue.

A special session on "Women Worldwide in Astronomy" was held at the XX General Assembly of the IAU on 8 August 1988. The purpose of the meeting, which was attended by about 200 women and men, was to focus attention on the problems that women astronomers face throughout the world. The goal was to gain an international perspective and to compare the problems women face in different countries. The program consisted of 7 speakers from 6 countries who talked about the problems and statistics particular to their country or region, followed by a discussion from the audience. The speakers were V. Abalakin (for A. Massevich, U.S.S.R.), E. Athanassoula (France), J. Bergeron (France), C. Flanagan (South Africa), V. Krishan (India), S. Torres-Peimbert (Mexico), and S.-H. Ye (P.R. China). The discussion moderator was M. Burbidge (U.S.A.), S.-X. Li (P.R.China), A. Massevich, and S. Torres-Peimbert. A summary of the discussion follows.

The percentages of astronomers who are women varies from country to country but they are generally low. Among the staff working in astronomy in China one-third are women. However, at the higher levels less than 10% are women. In India although women have historically played a role in other fields like writing, in astronomy there have been few women. Of 20 Ph.D. astronomers in South Africa one is a woman and there are two women graduate students. In Japan there are 600 astronomers and graduate students. Of these there are only 4 women with Ph.D.'s, of which 2 have permanent positions, and 10 graduate students. In Scandinavia there is one female astronomer with a full-time, permanent job. There are more female astronomers, but they either have no jobs or are employed part-time. On the other hand, 20 of 50 astronomers in Egypt are women.

In the U.S.A. historically women have made up a small but important component of astronomers who have been responsible for a number of fundamental discoveries. However, these women did their work despite overt discrimination against women in science. Until several decades ago regular astronomical positions were open to men, and women were prohibited from using the Mt. Wilson and Palomar telescopes. Today discrimination is not as overt, but women still represent only 8% of the astronomers in the U.S.A. and are even more under-represented in senior positions.

France, on the other hand, has a very high percentage of astronomers who are women, about 30%. There are several reasons for this. First, historically universities in France have always been open to women at all levels. The universities became somewhat closed to women in the 15th century, but in the 20th century France was one of the few places that a women could get a Ph.D. in physics. In other countries there is not such a tradition. In the U.S.S.R., for example, it was only after the revolution that women were admitted to universities. A second factor aiding women astronomers in France is that academic positions are tied to the person rather than to a specific place. This makes it easier for a couple to combine two careers and still live in the same place. Finally, child care is very good and easy to obtain. Children of working women can stay longer at school; and, since the majority of women work, there is no stigma on the child who must stay longer. In many other countries child care is not as easy to obtain, and the woman with a career is expected to do double duty. Nevertheless, even in France there are problems. The percentage of women in astronomy has been declining recently, and the percentage of women in senior-level positions is lower than that overall in astronomy. As the salary-class goes up, the percentage of women decreases.

Women who do become astronomers find that they must work against prejudices. Work by women is often rated lower than that by men. Today women may get jobs in the physical sciences that would have been denied them in the past, but they may not get fair access to laboratory space and equipment and may be promoted more slowly than men. In India until recently women were not allowed to observe at night. Men are preferred in hiring and advanced faster, and women must endure an atmosphere in which they receive very little respect. In Mexico discrimination is not overt, but there is again a reluctance by men to appoint women to jobs with responsibility. A survey of papers and salaries of women astronomers in Latin and South American countries showed that women publish as much as men but for lower salaries.

Prejudices within society also work to prevent women from becoming astronomers and make it harder if they do. In Mexico the expectations for women are different, and discrimination is evidenced in education, games, and responsibility at school and at home. Professionally women have the problem of not being able to interrupt their careers to have children. In India women often disappear from astronomy after getting their Ph.D.'s because the social pressure to marry is very high. Many marry other scientists and then have the trouble of finding two jobs in one location.

In South Africa social pressures are probably largely responsible for discouraging women from going into science. First, women are regarded as secondary employees because women's primary function is considered to be caring for a family. The view that women belong in the home is reinforced through advertising and legislation. For example, there is no maternity leave. Second, sciences such as physics and engineering are considered to be "men's jobs." In addition, a shortage of science teachers and a lack of female role models discourages girls from following science careers.

Slowly the situation is changing; one can find distinguished women astronomers at higher-ranking positions. Acceptance of women on an equal footing, however, will come slowly as more and more young women enter the field. The entrenched, and often unconscious, prejudices that women face now will erode only if the task is tackled from the beginning at the educational level. To change the situation women should promote science among young girls through their own visibility.

In summary, women worldwide in astronomy face many common problems and situations: 1) The percentages of women in astronomy are generally low, and those of women in senior-level positions are even lower. The numbers are not changing very rapidly. 2) The discrimination today is primarily subtle rather than overt as it has been in the past. Women are not prohibited from using telescopes as they once were, but they still face discrimination in the form of attitudes. 3) Women generally work in atmospheres in which they are not taken seriously, not given responsibility, and not recognized as readily as men for their contributions. 4) Married couples in which both husband and wife have careers have difficulty finding jobs for both in the same location. Often the woman bears the primary burden of juggling family and career. 5) Finally, the prejudices of society are perpetuated through the educational system and peer pressure. If the situation is to be changed, little girls must learn that they too can be scientists.

SCIENCE FOR DEVELOPING COUNTRIES

This is the title of a fascinating article by Mano Singham which appeared in the August 1989 issue of Physics Today, published by the American Institute of Physics. I quote only the last paragraph below. For those of you who do not have access to Physics Today, I would be pleased to send a copy of the rest of the article - JRP.

"New ideas are important in the development of any society. Creative people, whether they practice "useful" or "useless" science, tend to have more ideas than others. When those creative people are allowed to flourish in the universities and research institutions of a developing country, they will stimulate the best in the students, who, let us not forget, will eventually end up as the leaders of that society. It is these creative people who will push the local technology further. It is they who must confront and solve problems as they arise. Ultimately, the basic issues of underdevelopment can be resolved only in the global political arena, and we must be realistic about that. All that we as scientists can do is to try to support the people who have good ideas. Otherwise they will surely stop having them, and then everyone, everywhere, will be the loser."

TRIESTE SPAWNS THREE NEW RESEARCH CENTRES FOR THIRD WORLD

Acting as a kind of magnet, the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, is drawing support from the Italian Government and international agencies for the establishment of several new satellite research centres. Now in its 24th year of operation, ICTP will provide both a model and a focal point for the cluster of autonomous but interrelated institutions.

Professor Abdus Salam, in his capacity as Director of ICTP and President of the Third World Academy of Sciences, has proposed that each of the new centres should stress excellence, high level scientific achievement among practitioners from developing countries, and international cooperation. Mr. Andreotti, Italian Foreign Minister, has offered his blessings to the project on the grounds that it is now Government policy to give priority to assistance activities which encompass research and transfer of technology, including "high tech" operations.

The first of these new institutions will be called the Centre for Earth Sciences and the Environment. It will concentrate on: earthquake and mineral deposit prediction; air-sea-land interactions effecting climatic changes; upper-middle-lower atmosphere interactions with special emphasis on the tropical ionosphere; and environmental control and remote sensing. A formal link between this Centre and the International Geosphere-Biosphere Programme is presently being worked out.

The proposed Centre for High Technology and Advanced Materials will focus initially on micro-processors, photonics (optical fibres and lasers), high-temperature superconductors, semiconductors and composites.

And finally, the Centre for Pure and Applied Chemistry will be devoted to research on polymers, catalysis and reactivity and others fields attracting particular attention for their relevance to industrial applications.

All these Centres will be grouped under an umbrella organization called the International Centre for Science and it is proposed also to incorporate the International Centre for Theoretical Physics and perhaps eventually the International Centre for Genetic Engineering and Biotechnology (ICGEB).

Like ICTP, the new Italian-based research centres will combat the-brain-drain by offering advanced training to scientists and technicians from developing countries who then return home to share their know-how and expertise. Through the centres in Trieste, these people are assured of moral and material support for their activities, and they become members of a worldwide network in turn. Another feature common to the Trieste Centres will be the availability of experimental facilities and advanced instrumentation not currently available in most of the Third World. The

existence of permanent research teams in Trieste with whom Third World scientists can collaborate, will guarantee that everyone has access to first-rate facilities that would not otherwise be affordable. A large computer operation, with training provided, is another important element of the Trieste cluster.

Provisional terms of reference for each of the new Centres were drawn up last winter, and a number of pilot activities have been identified. Worth 10 million dollars over the next two years, these pilot projects will be hosted on the premises of ICTP until they get their own locations and funding. It is expected that the Centres will need 10 million dollars a year each in the initial phase of their operation.

Reprinted from: Science International: Newsletter of ICSU; #37, June 1989.

A NEWSLETTER ON THE TEACHING OF ASTRONOMY

Many of you who attended the 1985 IAU General Assembly in New Delhi remember the very successful one-day meeting with local school teachers. Some of you may even have visited the Nehru Planetarium, which is a major contributor to astronomy education in India. I am pleased to report that the Nehru Planetarium is now publishing a four-page newsletter which "brings the universe into your school". The newsletter is designed to meet the strong need for astronomy information for school teachers and interested students. The newsletter is similar, in format and quality, to the Astronomical Society of the Pacific's "The Universe in the Classroom", but the content reflects the particular culture and curriculum of India. The version which I received, incidentally, is in English.

The first issue (Spring 1989) deals in particular with the calendar and the Zodiac. The lead article is entitled "Kumbh Mela - The Super Festival", and has sections on rhythms in the sky, the stars of the Zodiac, rhythm of the planet Jupiter, the legend of Kumbh Mela, and the astronomical significance. There are sideboxes on: The Zodiac (with an explanatory figure), A Zodiacal Mnemonic and Planetary Clock. There is also a useful set of activities which are designed around the contents of the newsletter. Finally, there is a letter from the editor, and an "Astro-Flash" highlighting the August 1989 encounter between Voyager 2 and Neptune, and showing a photograph of Neptune taken from a distance of 685 million miles.

IAU Commission 46 strongly supports initiatives like this newsletter. I urge astronomy educators to contribute or subscribe to this newsletter, or to set up an exchange arrangement between their newsletter and this one. For more information please write to: Dr. Nirupama Raghavan, Director, Nehru Planetarium, Teen Murti House, New Delhi 110 011, India.

INTERNATIONAL SPACE YEAR

You may be interested to know that the IAU passed the following resolution (#4) at its 1988 General Assembly in Baltimore.

considering

that the international Space Year (1992) will provide a great opportunity to further international cooperation within many areas of science and technology which are closely related to astronomy and astrophysics and also that the related educational and public information efforts may make important contributions to the dissemination of knowledge, also in countries which do not normally engage in space activities, and

noting

with satisfaction the interest shown by International Council of Scientific Unions, Committee on Space Research, International Astronautical Federation and other organisations in the International Space Year,

recommends

that all IAU Adhering Bodies, IAU Commissions and individual Members actively participate in International Space Year activities, also during the preparatory phases.

PROCEEDINGS OF IAU COLLOQUIUM 105 : THE TEACHING OF ASTRONOMY

The camera-ready manuscript of the Proceedings of IAU Colloquium 105 (The Teaching of Astronomy) was sent to Cambridge University Press early in August, and should be published by the beginning of 1990. The editing and typing of the manuscript (in the computer typesetting program LATEX) took exactly one year. There were 120 papers, plus extensive discussions, which occupied a total of 440 pages (not including preface and index). My co-editor Jay Pasachoff and I enjoyed our work very much, and are very pleased and proud of the final product. It is a lasting contribution to the topic of the teaching of astronomy, thanks to all those who attended and contributed to the colloquium. I will provide more information on how to purchase the book in the next issue of this newsletter.

THE TRAVELLING TELESCOPE

The "travelling telescope" is a small, portable, fully-equipped telescope whose purpose is to provide practical training and experience in observational astronomy for advanced students and young scientists in countries which do not have access to such facilities. As described in previous newsletters, this telescope was purchased for the IAU from a grant

from the Canadian Commission for UNESCO. My colleague Dieter Bruckner has put much time and effort into making the telescope functional, and another colleague Brian Beattie has been testing the telescope in an unused dome at the David Dunlap Observatory. The telescope is now ready to travel.

We had hoped to send the telescope to the International School for Young Astronomers (ISYA), being held in Cuba in August 1989, but these plans had to be cancelled due to lack of financial support. On a more positive note: Air Canada has donated a pair of tickets for the telescope and accompanying technician to fly to any Air Canada destination in the world!

We expect that the telescope will go to Paraguay and/or Peru this winter, and to the proposed ISYA in Malaysia in 1990. Other prospective users of the telescope should write to me to obtain information on how to apply to use it.

John R. Percy

EXCHANGE REQUESTED

The "Dr. Max Schreier" Planetarium of the Universidad Mayor de San Andres, La Paz, Bolivia, would like to exchange information about your current works in Astronomy investigation and diffusion.

Our Planetarium has programs for schools, universities and the public in general. We try to gain the public's attention by publishing news and articles in the local newspapers.

The "Max Schreier" Planetarium has an Astronomical Observatory with a 16" reflector telescope and a AFU-75 Russian-made astro camera. It is located 100 Km. from La Paz city and 3,789 meters above sea level; its geographical coordinates are: lat. 17°15'57" south and long. 67°57'07" west.

We wish this to be the first of future relationships.

Ing. Israel Saravia U.
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I urge you to consider this request, especially if you can exchange material in the Spanish language. - JRP

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TELESCOPE LENDING SERVICE

by

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Astronomy is taught as an optional course for students from 16 to 18 years old in a great number of Spanish secondary schools. But in 21 per cent of them, there is not a telescope, and their students need to go to other centers to observe.

In view of this situation, the "Seminari Permanent d'Astronomia" of the Polytechnic University of Catalonia has bought a small telescope and has started a lending service to the schools mentioned.

At the same time courses for teachers, of four sessions of two hours, have been developed in order to explain the use and handling of the telescope. As the appropriate loan period is one month, the course is limited to twelve teachers. At present, we have developed two of these courses, and we are going to buy another telescope.

The first session of a course consists, merely, of the study of the mounting of the telescope with the elements and accessories which are inside a sturdy carrying case. The second session is held in the "Planetarium Barcelona", where we give a brief review of the astronomical coordinates and we explain a method to observe a celestial object from a reference star when both coordinates are known. Finally, in the third and fourth sessions, some practice with the telescope is carried out by teachers.

The characteristics of the telescope are: Reflecting telescope with equatorial mounting, automatic tracking motor and searcher, 100 mm diameter and 1000 mm focal length.

ASTRONOMY EDUCATION IN JAPAN

Dr. Syuzo Isobe sends the following report on astronomy education in Japan and in the Asian-Pacific region in general.

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At Baltimore, all the attendees at the preliminary meeting of the working committee on teaching of astronomy in the Asian-Pacific region (WCTAAP) agreed to continue their activities. Those are:

1. To publish regularly The Bulletin of TAAP

2. To advertise our activities to the Ministry of Education and the University Center in each country

3. To collect textbooks at each school level from different countries and to find the best way for teaching of astronomy.

Please suggest further possible activities for us. To proceed to the second and further steps, we should start, I think, from the first step, which will be a triggering effect for the next one.

At Baltimore, I asked all the first attendees to recommend a style of our Bulletin and send their contribution to the Bulletin. Unfortunately I had no response in this year, although I understand all are very busy. Here, I repeat my request for contributions to TAAP.

In Japan, the following activities are running:

1. From August 4 to 7, 1989, we will have the third meeting on the teaching of astronomy in Japan, where it is scheduled to organize a new Association of Teaching and Popularization of Astronomy in Japan.

2. For professional astronomers, the Computer Center (the Head, Dr. Shiro Nishimura) of the National Astronomical Observatory (NAO) of Japan started to provide astronomical data catalogues on magnetic tape.

3. For some number of amateur astronomers, the association in Yokohama city to promote popularization of science (the Head, Mr. Yoshiro Yamada) will start, from this summer, to provide some parts of astronomical data catalogues (supplied from NAO) on floppy disk.

4. After the reorganization of NAO from Tokyo Astronomical Observatory in July 1988, a division of astronomical information and popularization service (the Head, myself) was set up from November 1988 with good support from our director, Dr. Yoshihide Kozai.
   a) We are responding to astronomical questions by telephone and letters from the public, the number of which is now about 50 per day and is increasing.
   b) We are transferring information on discoveries of celestial objects from/to International Central Bureau for Astronomical Telegrams.
   c) We are preparing a computer network service of astronomical data to some number of amateur astronomical societies and will start next year.
   d) We will start lecture courses for persons leading in the promotion of education and popularization of astronomy.

I hope these kinds of information will be exchanged through our Bulletin.

DETERMINATION OF THE OBLIQUITY OF THE ECLIPTIC

R.M. Ros[1,2] and M.J. Llinas[2]

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As is well known, the seasons are due to the fact that the rotation axis of the Earth is not perpendicular to the plane of the ecliptic. We intend to determine the angle they form. In order to do it, we take a photograph of four sunrises or sunsets on the first day of each of the four seasons (always at sunrise or always at sunset). It is necessary to take the photographs from the same spot, and to compose them in such a way that it will allow us to relate one photograph with the photograph taken in the next season.

Comparing two photographs corresponding to two consecutive seasons, we can measure the distance **d**, in cm., between the positions of the sun on each photograph. To calculate the number x, in degrees, which corresponds to the distance **d**, we must state the proportions among: **wp** width of the photograph on the paper, **WP** width of the photograph in the negative and **WN** width of the negative, all them in cms, and **MAO** the field of view in degrees of the objective we have used:

$$x = WP.MAO.d/wp.WN$$

Finally to calculate the obliquity of the ecliptic we only must take into account the triangle which relates two consecutive sunsets.

Using the latitude ϕ of the place, for any of the triangles in figure 1, we have:

$$\sin x / \sin 90^\circ = \sin \varepsilon / \sin (90^\circ - \phi)$$

Therefore, the obliquity of the ecliptic based on the photographs taken in two consecutive seasons is:

$$\varepsilon = \text{arc sin } (\sin \quad . \cos \phi)$$

Obviously we can obtain the result with only two photographs, but it is worthwhile to work in the same way for the four seasons, and then, to obtain the average among all the results we have. In some occasions, the weather conditions don't allow us to take the photograph on the first day of a season and we can only do it one or two days later. Then, a way of compensating errors is to average the partial results.

In the two first columns in the table below, there are the mean values a group of our 16-year-old students got. And so, if we finally carry out the mean of the last column we get the value of the obliquity of the Earth rotation axis, which can be compared to the know value of 23° 27'.

TABLE 1

wp : width of the photograph on the paper = 13.4 cms.
WP : width of the photograph on the negative = 3.0 cms.
WN : width of the negative = 3.6 cms.
MAO: field of view of the objective 55 mm. = 36°
ϕ : Barcelona latitude = 41°.5

seasons	distance in cms between two suns d	distance in degrees between two suns x	obliquity of ecliptic
winter-spring	13.8	30	23°
spring-summer	12.5	28	21°
summer-autumn	12.8	29	21°
autumn-winter	13.3	30	22°

Average value of the obliquity of the ecliptic = 22°

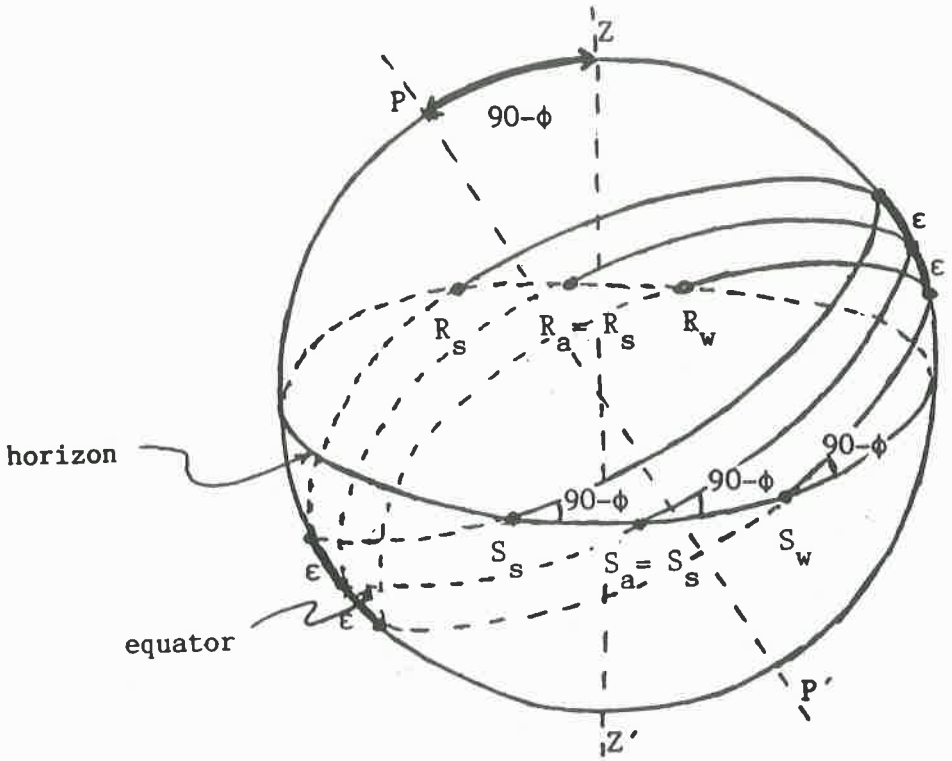

Figure 1 (a) The trajectory of the sun on the first day of each season. R = rise, S = set, s,s,a,w = spring, summer, autumn, winter.

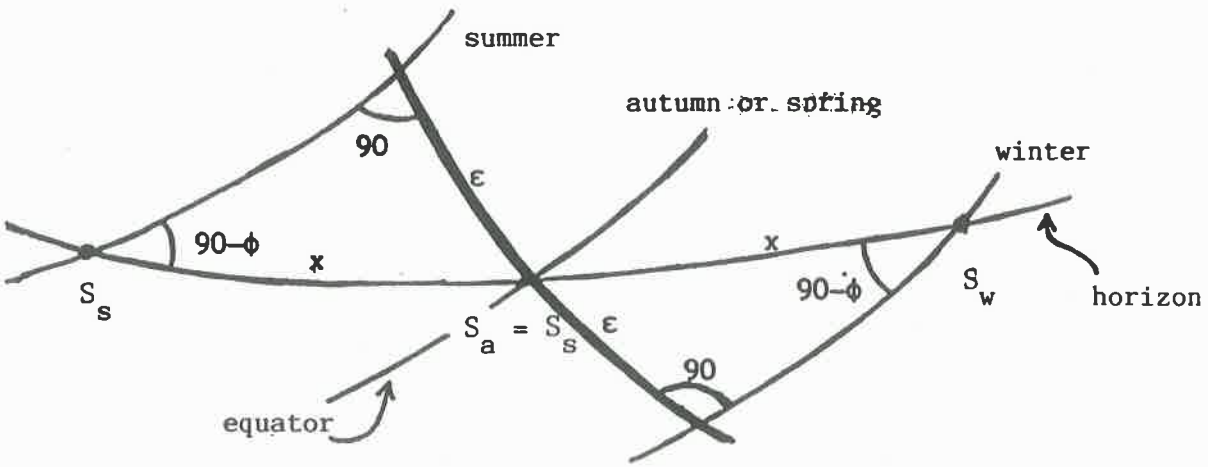

Figure 1 (b) Detail of the region corresponding to the four seasons sunsets.