INTERNATIONAL ASTRONOMICAL UNION

COMMISSION 46 — TEACHING OF ASTRONOMY

NEWSLETTER

Number 22; June 1987

Editorial

Greetings! This issue contains a progress report on IAU Colloquium #105 (The Teaching of Astronomy) and good news about the Travelling Telescope Project. I apologize for the fact that most of the other articles have a North American bias, but I can only publish those articles which I receive. If I do not receive any, I have to write them myself, or use what is at hand. I have even been reduced to including more poetry! I am indebted to J.C.D. Marsh, Director of the Hatfield Polytechnic Observatory, for sending "The Astronomer's Drinking Song". He explains the circumstances: "Whilst having a drink with Derek McNally last week, we were discussing the Newsletter #21 of Commission 46 and it occurred to me ..... ". Unfortunately he did not indicate who wrote the poem. I think that I once knew, but have forgotten.

Please send me your contributions to Issue #23 by December 31 at the latest.

IMPORTANT MESSAGE FOR NATIONAL REPRESENTATIVES

It will soon be necessary for you to prepare your triennial report on the teaching of astronomy in your country. Please start thinking about it now. You will soon receive an official letter from Commission 46, giving information about the format and deadline.

IN THIS ISSUE

THE TRAVELLING TELESCOPE PROJECT - FUNDED!

The Travelling Telescope is a project of the International Astronomical Union designed to provide advanced students and young astronomers in the developing countries with training and experience in observational astronomy. It consists of a small telescope (Celestron-8) equipped with a photometer (Optec SSP-3), spectrograph and 35 mm camera, together with all the necessary manuals and instructions for carrying out simple research projects. All this will be contained in a sturdy shipping case, suitable for sending the telescope to the far corners of the earth.

Initially, the Travelling Telescope will be used in two existing programs of IAU Commission 46: the International Schools for Young Astronomers, and the Visiting Lecturers Program. The first of these consists of intensive three-week schools held approximately once a year in different parts of the developing world. The instructors are experienced astronomers. They work with a group of young astronomers and students from the area, often establishing friendships and collaborations which last for many years. The Visiting Lecturers Program sends a series of instructors into a developing country for several weeks or months, to give courses and generally to improve the level of astronomy in the host country. In each of these programs, the availability of observational facilities would greatly improve the effectiveness of the program.

The Travelling Telescope was conceived a few years ago by Derek McNally (University of London) and Richard West (European Southern Observatory), both of whom have been active in the IAU and its educational programs. Unfortunately, no financial support for the project could be found until recently. Last year, I became aware of a new grants program of the Canadian Commission for UNESCO which seemed ideally suited to the project. Happily, my application to the program was one of the very few which were successful.

The next step is to purchase and assemble the telescope and its auxiliary instruments, and to prepare clear and complete documentation. I will be assisted by my colleague Dieter Brückner, who is in charge of the telescopes and other teaching facilities in my department, and who has a special interest in the problems of the developing countries. Still, we need all the advice and assistance we can get, particularly with regard to:

i) operating a telescope and photometer in a variety of remote and sometimes-harsh environments

ii) using a small computer for data logging and reduction in such environments

iii) designing a small spectrograph for a Celestron-8

iv) selecting suitable, meaningful research projects for such a telescope

v) writing the necessary manuals and instructions

vi) packing and shipping the equipment

The list goes on. If you have any comments or suggestions, or anything else to contribute to this project, I would be delighted to hear from you. We hope that the Travelling Telescope will lead to the eventual establishment of small observatories in the developing countries, and thereby help to make these countries full partners in the science of astronomy.

John R. Percy

PROJECT STAR - SCIENCE TEACHING THROUGH ITS ASTRONOMICAL ROOTS

The teaching of astronomy in schools in the United States is more common than most people believe. In a survey completed by the Center for Astrophysics, Cambridge, MA, over 11,000 United States science department heads were contacted and over 2,400 responded. A surprising 56% of the responding high schools offer astronomy to their students as a part of earth science, physical science or physics courses. Over 15% offer a separate astronomy course for one or two semesters, and it is estimated that over 26,000 students a year enrol in such a separate course. The national significance of these figures should not be underestimated. The number of qualified physics teachers in U.S. high schools has been dwindling for the last ten years. The best estimate from the American Association of Physics Teachers is that there are only about 8,000 remaining. At present, only about 35% of high school students take a physical science (chemistry or physics) course before graduation. By supporting and increasing the number of astronomy teachers in the nation's schools it should be possible to attract more students into taking physical science in the eleventh or twelfth grade. Since astronomy is a subject in which most people have a natural interest, it appears to be a natural vehicle for increasing the general public understanding of physical science. The present high school astronomy courses are being taught by individuals with a wide range of undergraduate major backgrounds, including physics, earth science, chemistry and mathematics. We believe that with proper assistance, high school astronomy can be effectively taught by most science generalists.

The Center for Astrophysics has obtained a grant from the National Science Foundation for developing curriculum materials to assist the present teachers of high school astronomy, and to attract a large number of interested teachers. Currently three units, each representing about two to three weeks of instructional time, are being developed. A teacher-writer team of 10 experienced high school astronomy teachers are cooperating with the project staff in the design and testing of the materials. The three units under development are: **The Solar System, The Stars,** and **Galaxies.** These are being designed around the process themes of estimation, developing a sense of scale, prediction, etc. The materials will employ simple materials, and stress student acquisition of data. Three additional units will be developed and tested next year.

Dissemination plans include making presentations at regional and national meetings of planetarium associations, the American Association of Physics Teachers, and the National Science Teachers Association. A summer workshop (1987) is being planned at the Center for Astrophysics, pending approval of external funds.

For the beginning high school teacher, a resource booklet has been prepared and is available for free distribution from Project STAR. It parallels **The Universe at Your Fingertips** developed by Robbins and Fraknoi under the auspices of Commission 46, but is written with the beginning high school teacher in mind, and includes references to materials found most useful by our teacher-writer team and our project staff.

For additional information contact, Mr. Phillip Sadler, Project Director, Project STAR, Center for Astrophysics, 60 Garden St., Cambridge, MA 02138, U.S.A.

Darrel Hoff,
Associate Director

A CONFERENCE FOR COLLEGE PHYSICS TEACHERS WHO ALSO TEACH ASTRONOMY

In the United States, most colleges and universities offer survey courses in astronomy. It is estimated that well over 200,000 college students enrol annually in such a course. Surveys indicate that many of the instructors in smaller colleges (both two and four year) have minimal or no formal backgrounds in astronomy. These instructors express great interest in having their backgounds up-dated and gaining information about teaching resources. This year the University of Northern Iowa hosted its third triennial conference for such instructors here in the midwest. These conferences typically attract about 40-50 faculty members. They cover two days and include topic updates, resources, and use of simple equipment. Participant reactions are extremely positive.

Funding is modest. In addition to local resources, funds have been obtained from the Slipher Fund; visiting Shapley Lecturers are employed and a modest registration fee is charged. [The Slipher Fund and the Shapley Lecturers Program are administered by the American Astronomical Society.]

As a model for in-service education for this target audience, this format seems to be making a contribution to a better general education in astronomy.

For additional information, contact me at the following address.

Darrel B. Hoff
Department of Earth Sciences
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Cedar Falls, IA 50614
U.S.A.

GRADUATE EDUCATION IN ASTRONOMY IN THE U.S.A.

The following summary is based on a survey sent out in December 1986. Responses were received from 12 Ph.D. granting departments. Nine of the schools are in the moderate range, two at the small end, and one at the upper end of the size scale. However, even though we are concerned with data which are in some sense comparable, it seemed to make more sense to quote "typical" numbers rather than strict averages.

ADMISSIONS

Most of the schools seem to receive approximately 40 applicants per year with the obvious deviation for the two ends of the size scale. Approximately 25-35% of those applying are offered admission. The major exception is at the top of the scale where the percentage of offers is significantly lower. Approximately 40% of those offered admission accept. This number is essentially independent of the size of the institution. Typically, students take five to six years to finish the Ph.D. degree. The reported data is usually based on a five year period. No question was asked about secular changes in the data and only one person volunteered the information that applications were on the rise.

CURRICULA

Essentially, all the institutions have some set of required courses. Typically, about ten courses are required and these are offered in a rotating sequence. There is apparently some trade-off between the extent to which student progress is monitored and the strictness of the course requirements. Most typically, a school requires a set of core courses plus an optional selection from other courses. Most schools include physics courses among their requirements. Most schools have developed much the same set of "core" courses. These include Stellar Interiors, Stellar Atmospheres, Interstellar Medium, Galactic Studies, Extragalactic Astronomy and Observational Techniques. Titles vary, and occasionally there is some reordering of topics.

With regard to qualifying exams, there are two approaches. One is to stress an early "preliminary" exam, usually in the first or second year. The other is a comprehensive exam (usually based on the core courses). This would usually be in the third year of graduate school. Essentially, all schools require some exam, and a substantial fraction require two.

In terms of other requirements, several schools require a research project either as part of observational experience courses or as a general requirement. Most schools do not have a foreign language requirement, or at least do not mention one.

NOTES: Discussion uncovered that no school requires demonstrated proficiency in computer programming to graduate. There was a general feeling that students "pick up" programming skills. Kochu Menon from the University of British Columbia remakred that he was impressed with the statements of Jim Wertz at the Committee on Manpower and Employment session that the most important skill is the ability to communicate both in writing and verbally. This skill is needed in academic as well as industrial careers. Some departments recognize this need and require students to take a writing course and to practice giving scientific talks and presentations.

John Trasco
University of Maryland

The preceding article was prepared by Dr. Trasco for a department chairpersons' discussion group, held in Pasadena, CA in January 1987, as part of the 169th meeting of the American Astronomical Society. The situation in my university (Toronto) is somewhat different, in that an M.Sc. degree is a prerequisite for a Ph.D. program, rather than a "consolation prize". Also, we require our Ph.D. students to demonstrate a knowledge of at least one appropriate foreign language.

John R. Percy

MEETING ON THE TEACHING OF ASTRONOMY AT THE PRIMARY AND SECONDARY LEVELS

The third meeting on the teaching of Astronomy at the primary and secondary levels was held in Barcelona from 8 to 10 September 1986, under the auspices of the "Departamento de Fisica de la Tierra y del Cosmos" of the University of Barcelona and the "Instituto de Ciencias de la Educacion" of the Polytechnic University of Catalonia (Spain).

The purpose of the Commission on the Teaching of Astronomy in Catalonia was to present and to interchange some experiences related to the teaching of Astronomy in primary school and secondary school, and to discuss the present situation of this subject in our country and in other European countries.

Twenty reports were presented and two lectures were given by invited professors: Dr. Roberto Gallino from "Instituto di Fisica Generalle dell'Universita di Torino, Italia" and Dr. Lars Broman from "The Future's Museum" of Sweden. Dr. Gallino told us about the teaching of Astronomy in Italy and Dr. Broman about his experiences which he has related in his book "27 Steps Towards the Universe". There was also a "Round table" to talk about "the planetarium in teaching of Astronomy".

It is impossible to describe in detail all the papers presented, but let me summarize briefly three of the most significant ones.

1.- In "Cosmology at the secondary level", the possibility to introduce the structure and evolution of the Universe at the secondary school was explained. This topic may be explained after the study of stellar evolution, when the students have already acquired some basic knowledge of Astronomy. They know the historical evolution of astronomical thought until the beginning of the 20th Century, they are able to look at the sky and to recognize the constellations, but they do not know the physics of high energies, and Einstein's theory of relativity. Within this framework, a syllabus has been developed which can be summarized in the following points:

- Concise historical view of the evolution of Cosmologic thought.

- Observations and discoveries of the 20th Century.

- Numbers that help us to settle in the Universe.

- Big-bang model; Evolution of the Universe.

- Basic notions about relativity and their consequence in Cosmology.

2.- An astronomical week-end". A program of activities to carry out with children during a week-end was explained. This program has been carried out with children from 12 to 14 years old. It starts one Friday night with nocturnal observation and it ends on Sunday afternoon with a report on the conclusions they reached. Diurnal observation is carried out on Saturday morning and it consists of measuring shadows, building models of Earth-Moon to explain lunar and solar eclipses and lunar phases, sketching of the meridian, etc. On Sunday, among other things, children study the solar system, and a sundial is constructed. Some videos or slides about star evolution or the structure of the universe are shown in order to complete topics which have been treated in an experimental form.

3. - "Planetarium and teaching of Astronomy". When one wishes to carry out the teaching of Astronomy based on observations, difficulties arise because one has to do observations outside the working hours and they depend on climatological conditions. On the other hand, a lot of observations do not consist of looking at the sky from time to time but on following astronomical phenomena for some days. The planetarium resolves these problems because it permits the children to observe the sky in a realistic situation and to reproduce the motion of the celestial bodies in the sky more rapidly. In the "Planetarium Barcelona", programs have been carried out that permit us to introduce the students to the world of Astronomy. They offer a general overview of a specific topic, and they have been worked out in accordance with a fundamental point of view, that is: The explanation has to follow a logical scheme; the scientific rigour has to be respected; the programs have to be very enjoyable: and correct scientific terminology has to be used in order that the students can acquire these relatively new terms.

Mª Asunción Catalá Poch

Departamento de Física de la Tierra y del Cosmos
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THE HISTORY OF CULTURE AND THE TEACHING OF ASTRONOMY

Editor's Note: Professor N. Nikolov (University of Sofia, Bulgaria) kindly sent me a reprint of a paper which he presented at the GIREP Conference. The paper, entitled "The Study of History of Culture by Teaching the History of Astronomy", makes several interesting points, including one or two in common with the Project STAR described elsewhere in this issue. Since the Proceedings of the GIREP Conference have been published elsewhere (ESA SP-253, Nov. 1986), I will give only the Abstract and the Conclusions of Professor Nikolov's paper here.

ABSTRACT

An attempt is made to show how the history of astronomy may help in the study of human culture. The following topics are discussed in this connection: archaeoastronomy, the calendar, the step-by-step achievement of the notion of the structure of the Universe, the harmony of the ideas of astronomy. The possibility of studying culture through the history of astronomy is in accordance with the contemporary tendency toward the integration and humanization of education.

CONCLUSION

In the present paper, we refer to only one aspect of the connection between astronomy and the educational problems arising in the contemporary school. Astronomy can help with other problems as well. For example, in many countries, school authorities note a decline in student interest in many school subjects. Astronomy is undoubtedly one of the most interesting subjects for school children, and may stimulate their interest in a natural manner. There are many ways in which this interest could be transferred to the other subjects - and to education in general. Thus, astronomy could serve an important social function.

Student interest in space is very appropriate for yet another purpose in contemporary education. Society needs more and more non-traditional thinking, combined with constructive and creative reflection by the public. Astronomy is in a position to help. It is the subject which is closest to the wonders happening now in space. It brings students in contact with the space sciences, in which they observe one of the most significant areas of scientific and technological revolution. Thus it brings them closer to today's civilization.

I would like to draw attention to another significant role for astronomy in solving one of the world's contemporary problems. The history of astronomy - and contemporary science - shows the careful balance in which the Universe operates. This is quite opposite to our careless treatment of our environment. The most extreme example is the uninterrupted growth in the destructive power of nuclear arms. If this power were unleashed, it could do away with humanity. In contemplating a problem so fateful for the world, astronomy could also be very instructive.

N. Nikolov

IAU COLLOQUIUM #105: A PROGRESS REPORT

As outlined in the last issue of this Newsletter, the IAU has approved a Colloquium on the Teaching of Astronomy, to be held at Williams College (Williamstown, Massachusetts USA) from July 27-30, 1988, immediately prior to the 1988 IAU General Assembly. A few weeks ago, I spent two pleasant days at Williams College with Jay Pasachoff, Chairman of the LOC, and I can report that: (1) we have indeed chosen a beautiful campus, town and surroundings for our Colloquium and (2) the local arrangements are in good hands. For more information about the Colloquium, please see pages 21-24 of the last issue.

1. I want to emphasize the situation with regard to travel grants. The funds provided by the IAU are helpful but limited. They will most likely be used to supplement IAU travel grants to the General Assembly, to pay the additional costs of attending Colloquium #105. More information about the travel grants to the General Assembly will be provided by the IAU Secretariat, through your Adhering Organization or National Committee. We are presently looking for additional sources of travel funds, but we may not be able to find them.

2. Cambridge University Press has agreed to publish the Proceedings of the Colloquium. Jay Pasachoff and I will be co-editors. We plan to record and publish the discussions following the oral papers, and to edit and retype the papers in a uniform and attractive format.

3. Our present plans are to divide the program into seven sections: (i) introductory and general material (ii) teaching astronomy to science students; the training of astronomers: curriculum, lecture and laboratory material (iii) teaching astronomy to non-science students (iv) teaching astronomy to schoolchildren and schoolteachers (v) present and future technology for teaching astronomy: planetariums, computers, laserdiscs, etc. (vi) teaching astronomy and training astronomers in developing countries (vii) popularizing astronomy and communicating the results and the value of astronomical research. Invited review papers are presently being arranged for by the SOC. Some oral contributed papers will be accepted, but these will have to be limited in number. There is ample room for poster papers and other contributed display material: curricula, lab exercises, lecture demonstrations, equipment, computer programs etc.

4. The local facilities for the meeting, and for accommodation meals, social events and excursions are excellent. The cost, for participants staying in the dormatories, will be about $50 US per day, all-exclusive. We are looking for corporate donations to perhaps reduce the cost further.

John R. Percy
Chairman: SOC

ADDING ASTRONOMY TO THE SCHOOL SCIENCE CURRICULUM

The province of Ontario, Canada, is presently doing a complete reorganization and revision of its school curriculum. Parts of the science curriculum, for instance, have not been revised for two decades. I have had the interesting experience of helping to write astronomy "units" or sections for three of the secondary school courses.

In the old science curriculum, astronomy was an optional topic which could be taught for about 15 hours in one year at the intermediate level (grade 7 to 10). When the revision of the science curriculum began in 1983, it appeared that astronomy would be dropped. Several astronomers petitioned the Ministry of Education to retain astronomy in the curriculum, but we were unsuccessful. Looking back, I realize now that the Ministry was so busy writing 27 new science courses that it did not have time for a rather difficult topic like astronomy.

Last autumn - quite by chance - some staff members of the McLaughlin Planetarium in Toronto happened to be meeting with officials of the Ministry, and pointed out the lack of astronomy. This time, the Ministry was sympathetic, and soon it approved the writing of three new units on astronomy. The "writing teams" for each unit consisted of four people, mostly teachers with a special interest in astronomy, with myself as chairman. The situation demonstrates that regular contact between astronomers and teachers and education officials is likely to be beneficial in many ways.

THE STRUCTURE OF THE SCHOOL CURRICULUM

The curriculum is organized, of course, by grade level: primary (grade 1 to 3), junior (grade 4 to 6), intermediate (grade 7 to 10) and senior (grade 11 and 12). At the upper grades, courses are also divided as follows: basic, general and advanced, based on the ability and area of interest of the students. The courses include the core subjects: Biology, Chemistry, Environmental Science and Physics. There are applied courses for technologically-oriented students, and two general courses called Technological Science, and Science in Society.

ASTRONOMY IN THE ELEMENTARY SCHOOLS

Emphasis is now being placed on the teaching of science in the elementary schools in Ontario. The new elementary school science curriculum, released only a few weeks ago, requires that the following astronomical topics be covered. At the primary level: (i) observe and describe the changes in the pattern of a shadow as it relates to the sun (ii) become aware of devices used to record the apparent movement of the sun (iii) develop an awareness of the movement of the earth that results in day and night (iv) make simple observations about the sun, moon, earth, and stars in space (v) develop an awareness of the devices that people use to learn about the moon and other bodies in space. At the junior level: develop an awareness of (i) the movement of the earth that results in

seasons (ii) the earth, moon and sun, and the phenomena of phases and eclipses (iii) the problems of travel in space, and the devices which are used to deal with these problems. There are also some general objectives having to do with measurement, distance, time and speed, and using time as a variable in an experiment or observation.

THE STRUCTURE OF THE INTERMEDIATE AND SENIOR UNITS

In the revision of the science curriculum, the Ministry adopted a rigid format for each unit: (1) course/grade/level/ unit title/time allotment (2) preamble/prerequisite background/ division of unit into topics (3) objectives: attitudes, skills and knowledge (4) student activities (5) applications and societal implications of the material (6) methods of evaluation of student achievement (7) safety considerations (8) possible "extensions" for the better students (9) teaching suggestions.

SCIENCE, GRADE 10, ADVANCED LEVEL

This course is designed for good students, especially ones who are planning to continue the study of science. We decided therefore to emphasize the idea of astronomy as an observational rather than an experimental science. We also decided to survey the main areas of astronomy, since many students would have no further astronomical training in school. The topics included: (1) motions of the sun and moon (2) the solar system (3) the sun and stars. The unit included the following activities: (1) keeping an observing log (2) building and using a sundial (3) observing and explaining moon phases (4) observing and recording the westward motion of the sky (5) determining compass direction by day and night (6) using a star map to locate stars and planets (7) constructing a scale model of the solar system (8) studying photographs of the moon and planets (9) library research on solar system objects (10) observing seasonal changes in the stars (11) observing stars, clusters, nebulae and galaxies (in the sky or in photographs) and doing library research on their properties.

SCIENCE, GRADE 10, GENERAL LEVEL

The advanced-level unit was enthusiastically received by the Ministry, and we were then asked to produce a similar unit for the general level. Since this course would normally be taken by students who were not planning to specialize in science, we decided to modify the advanced-level unit in two ways: (1) less emphasis on observation as a mode of gathering scientific data (2) more emphasis on interpreting current developments in astronomy as reported in the media. We retained the survey approach to astronomy, and retained most of the observational activities - stressing observation as a pleasurable activity. We added two new activities: (1) reading, analyzing and understanding a newspaper or magazine article on a current development in astronomy (2) preparing an oral or written report on a current development in astronomy.

PHYSICS, GRADE 12, ADVANCED LEVEL

In this unit, we restricted the content to some topics related to the sun, stars and stellar evolution: (1) the sun (2) spectra and spectroscopic analysis (3) telescopes (4) parallax and the inverse-square law (5) physical properties and classification of stars (6) physical structure and energy sources in stars (7) nucleosynthesis and supernovae. These topics followed logically from two other units which appear earlier in the course: geometric optics, and nuclear physics. The activities in this astronomy unit are related to observing the brightness and colour of stars, projecting the sun's disc and spectrum, laboratory spectroscopy, parallax and the inverse-square law, and the Hertzsprung-Russell diagram. Surprisingly, we found that the Ministry was reluctant to mention the term "stellar evolution", because it offended people of fundamentalist religions!

OTHER ASTRONOMY UNITS

In addition to the units written by us, and the astronomy material in the primary and junior level, there is some astronomy elsewhere in the science curriculum (and perhaps in the geography curriculum). The grade 10 science, basic level course contains units on "outer space" - rockets, orbits, satellites and a trip to the moon - and on "worlds beyond" - using the telescope and the microscope to extend our senses. There is also a compulsory unit on "extraterrestrial geology" in the grade 12 geology, advanced level course. This course will probably be taught in only a few schools. There is also the possibility of custom-designing an astronomy unit, or even a whole astronomy course. Very few teachers are likely to do this.

THE NEXT STEP

The new science curriculum is now being implemented in the schools. Since few teachers in Ontario have any training in astronomy, there is a need to develop resource material, and to give in-service workshops. Much of this will be done by the McLaughlin Planetarium in Toronto, but many other astronomers will be involved. For instance, I am presently writing astronomy chapters for one of the textbooks to be used for the new science curriculum - a new and interesting experience for me.

I would be pleased to provide more information about these astronomy units to anyone who is interested.

John R. Percy

THE UNIVERSITY OF TORONTO MENTORSHIP PROGRAM

The University of Toronto Mentorship Program is intended for talented senior secondary school students who are interested in enriching their school studies by assisting University of Toronto faculty members in their research and laboratory work. The goal of the program is to support and enhance exceptional abilities in the sciences. There are plans to expand the program into the social sciences and humanities as well. Students are recommended for the program by their school teachers and principal, and are selected and assigned to a project on the basis of a detailed application by the student and interview with the supervisor. Although the university gives no credit for participation in the program, many schools give a credit in "Co-operative Education". Students are not paid for their work or time spent in the labs.

This year I supervised a student, Mohamed Dattu, and found the experience interesting and worthwhile for all concerned. His work consisted of two parts - both related to variable stars. First, he did extensive reading on the topic, and used this background to write an article on variable stars, directed to school science teachers. The article included both factual information and simple activities for secondary school students. While writing this article, he gave two presentations to science teachers and students in his school. I expect to publish his article in a teachers' magazine in the near future. This is a rather novel way of increasing the contact between astronomers and teachers!

The second part of his work was an analysis of visual and photoelectric observations of the variable yellow hypergiant Rho Cassiopeiae. He compiled 10 years of observations, wrote computer programs to plot these, and to carry out a simple period analysis using a string-length algorithm. He wrote a final report on his project, and ably and enthusiastically presented the results at the 1987 General Assembly of the Royal Astronomical Society of Canada. His teacher and his family were proud members of the audience. Canadian astronomy writer Terence Dickinson was sufficiently impressed by his presentation that he mentioned it in his weekly astronomy column in Canada's largest newspaper. It was the only presentation at the meeting to be mentioned. Mohamed joined the RASC at the beginning of the year, and participated in its regular meetings as well as its General Assembly. This certainly added to his astronomical education in a very positive way.

Mohamed learned a wide range of scientific skills in this program: scientific computer programming, writing articles and papers, giving presentations for a variety of audiences. Most of all, he has struggled (along with me) to understand the behaviour of a very interesting and complicated star. The one-on-one contact with a scientist was extremely beneficial to him. It was time-consuming but stimulating for me. Obviously it could not be done for every secondary student, but I feel that it is a worthwhile investment to make for the very best students. I will cheerfully participate in this program again.

John R. Percy

THE ASTRONOMER'S DRINKING SONG

"Who'er would search the starry sky,
  Its secrets to divine, sir,
Should take his glass---I mean, should try
  A glass or two of wine, sir!
True virtue lies in golden mean,
  And man must wet his clay, sir;
Join these two maxims, and 'tis seen
  He should drink his bottle a day, sir!

"Old Archimedes, reverend sage!
  By trump of fame renowned, sir,
Deep problems solved in every page,
  And the sphere's curved surface found, sir:
Himself he would have far outshone,
  And borne a wiser sway, sir,
Had he our modern secret known,
  And drank a bottle a day, sir!

"When Ptolemy, now long ago,
  Believed the earth stood still, sir,
He never would have blundered so,
  Had he but drunk his fill, sir:
He'd then have felt it circulate,
  And would have learnt to say, sir,
The try way to investigate
  Is to drink your bottle a day, sir!

"Copernicus, that learned wight,
  The glory of his nation,
With draughts of wine refreshed his sight,
  And sawy the earth's rotation;
Each planet then its orb described,
  The moon got under way, sir;
These truths from nature he imbibed
  For he drank his bottle a day, sir!

"The noble Tycho placed the stars,
  Each in its due location;
He lost his nose by spite of Mars,
  But that was no privation:
Had he but lost his mouth, I grant
  He would have felt dismay, sir,
Bless you! he knew what he should want
  To drink his bottle a day, sir!

"Cold water makes no lucky hits;
  On mysteries the head runs:
Small drink let Kepler time his wits
  On the regular polyhedrons:
He took to wine, and it changed the chime,
  His genius swept away, sir,
Through areas varying as the time
  At the rate of a bottle a day, sir!

Poor Galileo, forced to rat
  Before the Inquisition,
E pur si muove was the pat
  He gave them in addition:
He meant, whate'er you think you prove,
  The earth must go its way, sirs;
Spite of your teeth I'll make it move,
  For I'll drink my bottle a day, sirs!

"Great Newton, who was never beat
  Whatever fools may think, sir;
Though sometimes he forgot to eat,
  He never forgot to drink, sir:
Descartes took nought but lemonade,
  To conquer him was play, sir;
The first advance that Newton made
  Was to drink his bottle a day, sir!

"D'Alembert, Euler, and Clairaut,
  Though they increased our store, sir,
Much further had been seen to go
  Had they tipppled a little more, sir!

Lagrange gets mellow with Laplace,
  And both are want to say, sir,
The pholosophe who's not an ass
  Will drink his bottle a day, sir:

"Astronomers! What can avail
  Those who calumniate us;
Experiment can never fail
  With such an apparatus:
Let him who'd have his merits known
  Remember what I say, sir;
Fair science shines on him alone
Who drinks his bottle a day, sir!

"How light we reck of those who mock
  By this we'll make to appear, sir,
We'll dine by the sidereal clock
  For one more bottle a year, sir:
But choose which pendulum you will,
  You'll never make your way, sir,
Unless you drink---and drink your fill,---
  At least a bottle a day, sir."

1 He lost it in a duel with Manderaplus Pasbergius. A contemporary , T.B. Laurus, insinuates that they fought to settle which was the best mathematician! This seems odd, but it must be remembered they fought in the dark, "in tenebris denus"; and it is a nice problem to shave of a nose in the dark, without any other harm --- A.De.M.

2 As great a lie as ever was told: but in 1800 a compliment to Newton without a fling at Descartes would have been held a lopsided structure ---A.De.M.