

Chapter 10

Teacher Training

Training school teachers to teach astronomy is one of the most important steps in improving astronomy education. This chapter discusses the activities of societies and universities in France, the U.S., Mexico, and Italy to train elementary and high schools teachers. It concludes with a discussion of an American society that contributes to astronomy education both schools and universities.

CLEA: AIMS AND ACTIVITIES

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The Liaison Committee between School-Teachers and Astronomers (in French, “Comité de Liaison Enseignants Astronomes” or CLEA) was officially created about ten years ago under its present form, but its story began in 1970. In that time, there was no astronomy at all in French school programs, neither in elementary nor in secondary schools.

A discussion was beginning about introducing physics earlier in the curriculum, with a specific purpose, the main ideas being (i) to avoid too much formalism (and formalism is a strong general characteristic of French science teaching) and (ii) to concentrate on experimentation and on the various representations of natural phenomena.

Of course, astronomy enters these schemes quite well, but several arguments were developed against its introduction. These arguments resulted mainly from (i) strong competition between the various fields of physics and (ii) the ignorance of the school teachers: the large majority of them had never learned about astronomy in their studies.

Anyway, young children and teenagers were obviously considerably interested and we were a few astronomers who decided to push the projects of (i) introducing the teaching of astronomy at school together with (ii) training school teachers well.

A first association, called “Groupe Spécialisé Enseignement,” was then set up in 1970 by the French Astronomy National Committee. It is now a section of the French Astronomers Association (Société Française des Spécialistes d’Astronomie, SFSA).

The importance of meeting school teachers and discussing with them was soon realized, and the first national meeting took place in 1976 in Grenoble, during the IAU General Assembly, under the responsibility of IAU Commission 46, whose president was Dr. D. McNally. The meeting was very successful. It was attended by about 150 school teachers who expressed strongly their need for contact, information, and organization. The extensive report was published and widely distributed; it included, in particular, the following conclusions adopted by the participants:

“A committee including both astronomers and school teachers should be created, its main objectives being the introduction of astronomy in school programs together with the training of school teachers.” The participants underlined the importance of organizing astronomical summer schools, publishing a newsletter, and circulating teaching material.

The first summer school took place in 1977, the first issue of our newsletter *Les Cahiers Clairaut* was published in 1978 and CLEA was born. It has today about 1000 members; Profs. J.-C. Pecker and E. Schatzman are our Honorary Presidents. The 40 members of the Council are mainly representatives of the different French educational districts.

1. CLEA: Main Educational Objectives

CLEA’s main educational objectives are the following:

- (1) to give access to theoretical knowledge through practical activities;
- (2) to increase the mood of observing and experimentation;
- (3) to urge the various kinds of teachers, working at different levels, on different subjects, to exchange their experiments and to hold a dialogue. This is particularly important to overcome the barriers between disciplines and teaching orders;
- (4) to produce and circulate good quality educational material (textbooks, slides, video, scale models. . .) of low cost, easy to use, not too time consuming, and well tested from an educational point of view. The feedback comes from the network of CLEA members.

2. CLEA: Methods and Results

The methods must be appropriate to adult education. We favor a friendly and non-hierarchical atmosphere, and a good mixing of theoretical and practical activities.

We are also open to collaboration with foreign groups with similar activities. This is the case, for example, for the Italian group “Associazione Casa-Laboratorio del Censi”: Nicoletta Lanciano has participated in several CLEA General Assemblies and we have published in *Les Cahiers Clairaut* the French translation of one of their experiments.

Our main results, up to now, concern first the effective introduction of some astronomy at various levels in school programs, at elementary school (ten-year-old children), and secondary schools, for all 13-year-old and for 16- and 17-year-old “non-scientific” students. For the first time, astronomy will be introduced in 1989 for “scientific” 17-year-old students.

The training of school teachers has been developed through astronomy summer schools: up to three different schools have been organized each year, for the past 12 years (see the paper by Gerbaldi *et al.*). A large number of 3- to about 10-day sessions during the year are organized by CLEA members in various educational districts (Appendix 1).



Fig. 1. Milky Way gossip, by G. Paturel.

A large number of astronomical clubs and educational projects are developed by teachers, and astronomical educational material has been produced at low cost and is circulating among CLEA members (slides, video, written material, stellariums, scale models...).

3. Les Cahiers Clairaut

Les Cahiers Clairaut are named after the French mathematician Alexis Clairaut, who measured with Maupertuis the length of the terrestrial meridian in Lapland and thus confirmed Newton's view. We chose his name because he has written in the foreword of his book "Éléments de géométrie": "J'ai pensé que cette Science, comme toutes les autres, devait s'être formée par degrés; que c'était véritablement quelque besoin qui avait fait faire les premiers pas et que ces premiers pas ne pouvaient pas être hors de la portée des Commençaans, puisque c'étaient les Commençaans qui les avaient faits." We have the strong feeling that the best way of teaching astronomy in particular and science in general, is to go step by step, following the steps of discoverers, which is a good way to simplify the problems.

Four issues of *Les Cahiers Clairaut* are published each year, each of them being published at the beginning of each season. The contents include:

- book reviews (G. Walusinski, A.M. Louis...),
- CLEA activities (G. Walusinski),
- letters from the readers,
- scientific news and notes: “Milky Way Gossip” (Fig. 1) (L. Bottinelli),
- history of astronomy (a large effort is made in this field, for which school teachers have marked their strong interest, and many astronomers have contributed; examples include not only Dr. C. Iwaniszewska but also several school teachers, G. Walusinski, J. Ripert, J. Vialle),
- astronomy and computer science (M. Toulmonde, J.C. Allard, C. Dumoulin...),
- interpretation of an observation (J.P. Rosenstiehl, G. Paturel, F. Suagher...),
- astronomy at elementary school (L. Sarrazin, V. Tryoën, A. Delavergne, D. Val-larché...),
- astronomy at secondary school (J. Ripert, B. Sandré, J. Chappelet...),
- making an observation (D. Bardin, J. Heidmann...),
- physics (H. Gié, J. Dupré, M. Gerbaldi, B. Leroy...),
- astrophysics: (many astronomers are contributing: P. Léna, A. Brahic, E. Schatzman, J. Schneider, D. Alloin, E. Gérard, S. Collin, R. Hakim, H. Andri-llat, A. Acker, P. Boissé, J.P. Parisot, J.P. Zahn, C. Vanderriest, A.C. Levasseur-Regourd, L. Celnikier, L. Nottale, and many others...),
- constructing an instrument (D. Toussaint, D. Bardin, J. Ripert, M. Jonas, A. Dargencourt...),
- constructing a scale model (B. Sandré, C. Dumoulin, J. Ripert, C. Piguet, J.L. Fouquet, V. Aguerre, A. Delavergne...).

4. Examples of Demonstrations Made by CLEA Members

Celestial sphere

This big sphere (Fig. 2) helps to illustrate celestial coordinates and the various celestial motions. It was first constructed by C. Piguet, who published the plans in *Les Cahiers Clairaut*. Two of them, constructed during summer schools, are circulating: they can be used in a classroom, because of their large size. However, they are rather expensive (about 200 U.S. dollars); much smaller ones (9 cm in diameter) have been constructed by B. Sandré, at a very low cost of about 5 dollars.

The star box

Constructed by J. Ripert, who published the plans in *Les Cahiers Clairaut*, it is a “light box” which helps to recognize the constellations.

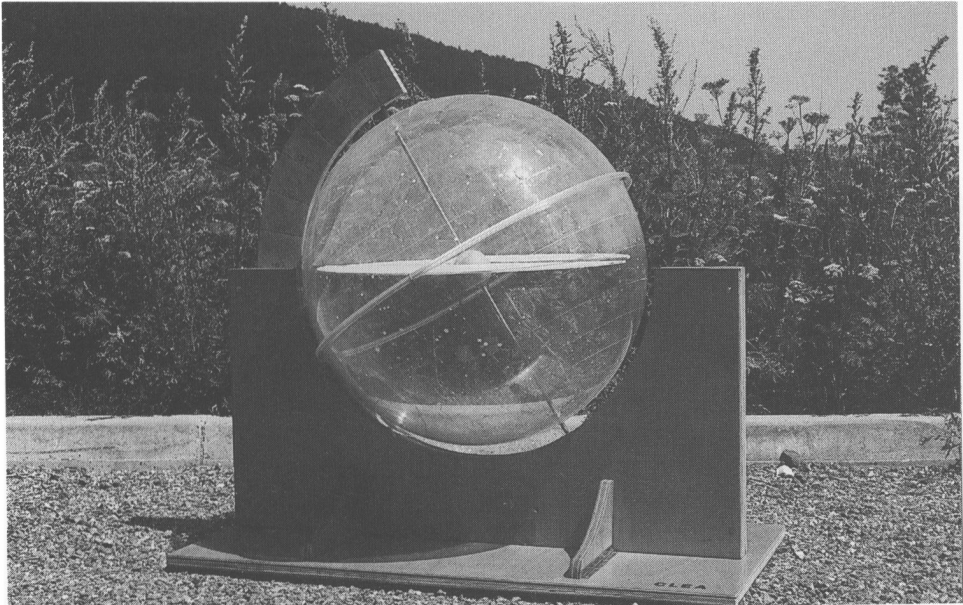
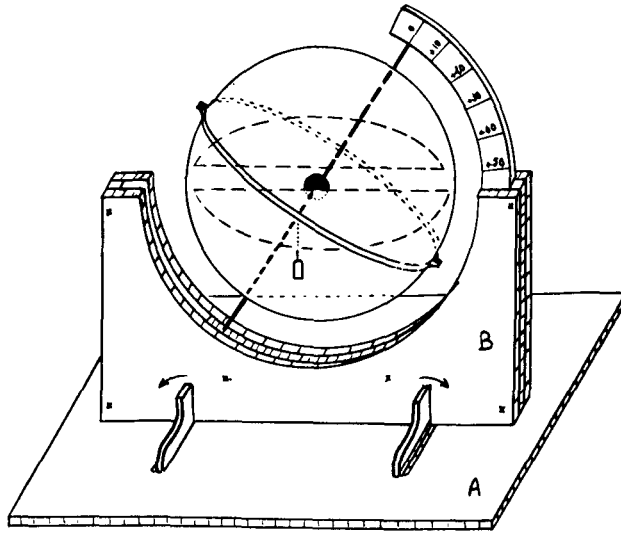


Fig. 2. A big celestial sphere: (a) the plans; (b) the realization

An armillary sphere

Constructed in cardboard according to the plans made by J.L. Fouquet, in about 6 hours (Fig. 3).

Movable viewgraph illustrating the motions of the moon

Designed by J. Ripert, it needs 4 sheets of viewgraph and 6 snaps; it illustrates the rotation of the Earth, the motion of the moon around the Earth, and the fact that the same face of the moon is seen from the Earth because the moon is also rotating, the phases of the moon; and the solar and lunar eclipses. It is distributed by CLEA and costs about 10 U.S. dollars.



Fig. 3. An armillary sphere under construction

5. Financial Support

Teaching astronomy from a practical point of view is one of CLEA's major objectives; however, this requires some material. Many efforts are being made for developing low cost (but good quality!) educational material and giving a chance for the teachers to get this material, or to be able to make it themselves. Some financial support is thus needed. *Les Cahiers Clairaut* is self supported, but all the practical work, including typewriting, is done free of charge by G. Walusinski, a retired school teacher. The educational material is sold at cost.

The summer schools and the annual sessions are supported mainly from the French Department of Education and from the Astronomy National Committee. They are warmly acknowledged.

Appendix 1

Examples of CLEA activities in the various educational districts

Besançon (J.P. Parisot, F. Puel, F. Suagher...): production of videotapes, slides, annual sessions

Dijon (R. Hernandez): various conferences

Grenoble (A. Omont, A. Richelme, C. Barathon, M. Bonneton...): circulating planetarium, annual sessions

Limoges (L. Sarrazin, C. Dumoulin...): annual sessions, videotapes...

Lille (M. Laisne, C. Mossler): annual sessions for elementary school teachers

Lyon (G. Paturol, C. Piguet...): annual sessions, educational material

Marseille (M.F. Duval, J. Donas, D. Bardin...): slides, circulating planetarium, annual sessions, and summer schools

Montpellier (H. Andrillat, H. Reboul, A. Cordoni, F. Gleizes, M.O. Mennessier...): educational material, annual sessions

Nice (J. Chappelet, J.L. Heudier, J. Ripert, V. Tryoën...): planetarium, annual sessions, educational material

Paris (L. Bottinelli, M. et M. Bobin, A. Brahic, A. Dargencourt, J. Dupré, M. Gerbaldi, L. Gouguenheim, E. Hadamcick, A.C. Levasseur-Regourd, A. et M. Rivière, B. Sandré, C. Vignon, G. Walusinski...): annual sessions and summer schools, circulating planetarium, educational material

Poitiers (J.L. Fouquet, J. Gagnier, J. Vialle, J. Vallantin...): annual sessions, educational material

Reims (D. Toussaint, G. Bazin...): planetarium, annual sessions

Rennes (F. Dahringer): circulating planetarium, annual sessions

Strasbourg (A. Acker, E. Legrand, J.M. Poncelet...): production of slides, videotapes, educational material; planetarium, annual sessions, and summer schools; a large activity is being developed around Strasbourg planetarium

Toulouse (J.P. Brunet, Talon, S. Vauclair...): circulating planetarium, annual sessions

Discussion

J. Fierro: *Is there any way one can get Les Cahiers Clairaut? and/or any of the materials (simple ones) by mail?*

L. Gouguenheim: The CLEA secretary is: Mr. G. Walusinski, 26, Bérengère, 92210 Saint Cloud (France). Any information concerning *Les Cahiers Clairaut* or CLEA publications can be obtained either from him or from me.

A. Fraknoi: *I found this talk very interesting. In the U.S., we are some years behind our colleagues in France. The U.S. professional societies began a newsletter for teachers only in 1984, but the first year we received 12,000 requests for the newsletter from teachers. Today, we have over 20,000 readers, with more coming in. Naturally, since we provide these newsletters free, we are concerned about the ongoing cost of the program. Thus I am interested in how CLEA and Les Cahiers Clairaut are funded?*

L. Gouguenheim: The funds that we receive from either the French National Astronomical committee or from the Ministry of Education are used mainly for Summer

Universities. The school teachers pay a subscription of 60 French francs (≈ 10 U.S. \$) a year (4 issues).

D. McNally: *I recommend Les Cahiers Clairaut highly. Although they are written in French, they are written clearly, so that readers with a limited knowledge of the French language can still understand.*

AN EXAMPLE OF CLEA ACTIVITIES IN THE TRAINING OF SCHOOL TEACHERS

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Various simple activities are being developed by the French Comité de Liaison Enseignants Astronomes (CLEA) in the training of school teachers. We give in the following one example of a very simple instrument which we call "Alphonse's box," after Alphonse Delavergne who invented it. It is also called a *heliograph*. This very simple and inexpensive instrument enables (1) the plotting of the daily apparent path of the sun, (2) the determination of the duration of sunlight, and (3) the determination of the declination of the sun. The following description is due to Maryse Jonas:

Material

1. photosensitive paper (used by architects) that can be handled in semi-darkness; its sensitive face is yellow and it is developed by the vapor of an ordinary ammonia solution in about ten minutes;
2. a simple can, with a cover that will shut tight; approximate dimensions: diameter 10 cm, height 15 cm, with a hole about 0.5 mm in diameter on one side;
3. two pieces of wood, 15 x 15 cm and 15 x 20 cm; one butt hinge; one threaded rod with two nuts and two washers.

Orientation of the Box

The first piece of wood is horizontal, and the second one is in the equatorial plane. The axis of the box is in the direction of the polar axis, so the angle α between