

THE IMPORTANCE OF OBSERVATION IN ASTRONOMY EDUCATION AND THE NEED FOR CLEAR AND NONPOLLUTED SKIES

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For centuries and centuries humanity looked up to the sky and asked themselves “Where do we come from?” or “Where are we going?” Everybody experienced these special feelings.

At present, if you are living in a big city, you can not see a wonderful sky above your head which causes you to think about transcendental questions. If we ask students in our schools about the previous questions, probably their answers could be “we came from the metro and we are going to the bus stop”. Of course this does not create a special feeling for them.

At the moment in developed countries there is a decrease in the number of students interested in science. Astronomy is probably the most attractive and suggestive branch of science, but the most obvious element which could put people in contact with astronomy is the sky. But unfortunately the sky in developed countries is covered by a haze of pollution.

The sky that our students can observe is not impressive. In the 21st century images are of outstanding importance, the appearance of the sky is awful. From many cities it is not possible to look at the sky, but when we find a space between the buildings to see the sky, the light pollution reduces the full numbers of visible stars to a few. “How can anybody fall in love with this sky?”

Our society needs more and more scientists and more and more technology must be used, but it looks as though we are turning our backs on science. How can this situation be changed? Astronomy can help to solve this problem partially if the sky is preserved and rediscovered by our society.

Why do people not have a positive “feeling” about science? May be it is because they did not have any special experiences that got them emotionally involved. It is normal for all of us to remember good experiences very well, those that produced an intensive emotion in our live: the first time we rode a bike, a special film, an enjoyable book, the first kiss, etc, and why not add to this list, the first eclipse, the first Moon observation through a telescope, seeing the Milky Way or the auroras, etc. One of my friends says “the best shows are free”, and astronomy offers a lot of them, but we need a clear sky to get it.



Participants in the 10th EAAE Summer School enjoying the sunset in “El Roque de los Muchachos” of la Palma.

Clear skies to promote astronomy: several arguments or points of view

Point 1: The non polluted sky for promoting emotions

The EAAE, European Association for Astronomy Education, promotes a course every year for European teachers. Last summer, July 2006, this author organised the 10th EAAE Summer School in Santa Cruz de la Palma. This was a set of general lectures, workshops, working groups and observations that involved about a hundred teachers from 24 countries. This occasion was a special anniversary for us and we decided to celebrate it in the Canary Islands because this special situation on the planet offers us a wonderful, spectacular sky.

Specifically we organised a guided visit to “El Roque de los Muchachos”. Taking up the suggestion of Instituto Astrofísico de Canarias, IAC, we spent some time on “El Roque” at the sunset and we waited for the night in order to carry out an observation with several telescopes from the top. All the participants enjoyed this opportunity immensely. They told me that it was the most spectacular sunset that they had ever seen in their lives. Only a sunset in a “well preserved sky site” could produce such a strong feeling in all of them. I am sure that they will never forget this evening sitting on a stone and looking at the horizon.

We need to preserve a good sky so that everybody can truly enjoy it. Every sunset, each Moon phase, all the comets, these can be special occasions on which we can get significant observations and singular feelings related to nature, that is to say related to science. It is necessary to enhance the social conception of the science of astronomy giving it a positive connotation. But also there are other points to take into account: people love emotion as we have said but they also love adventures.

Point 2: The clear skies for the adventure of learning by doing

Not only the Earth but also other parts of the universe will probably be our future habitat. When Columbus discovered America, he had another objective: he was trying to find a shorter route to India. Currently when astronomers get information from the universe and study the real possibilities of going to the Moon or to Mars, they are planning the future of the generations to come.



An amateur telescope is an excellent resource for primary or secondary schools.

Day by day the Earth is decreasing in relative size because there are more and more people living on it. The distances between two places also seem to be decreasing. During the 19th century it was necessary to spend two or three months to go from Spain to South America, at present we only need half a day. It looks as though our planet is smaller than it was some centuries ago and probably we can consider the possibility of leaving



Students can produce their devices in order to make observations: learning by doing

our planet. Maybe this is a good moment to start thinking about the probability that we will have a new common adventure outside our planet. It is a good proposal to present astronomy related to humanity's future and astronautics. Scientific knowledge changes very quickly in a short period of time. For instance, exoplanets were a non-imaginable concept 50 years ago, now they are a reality: this list constantly gets longer.

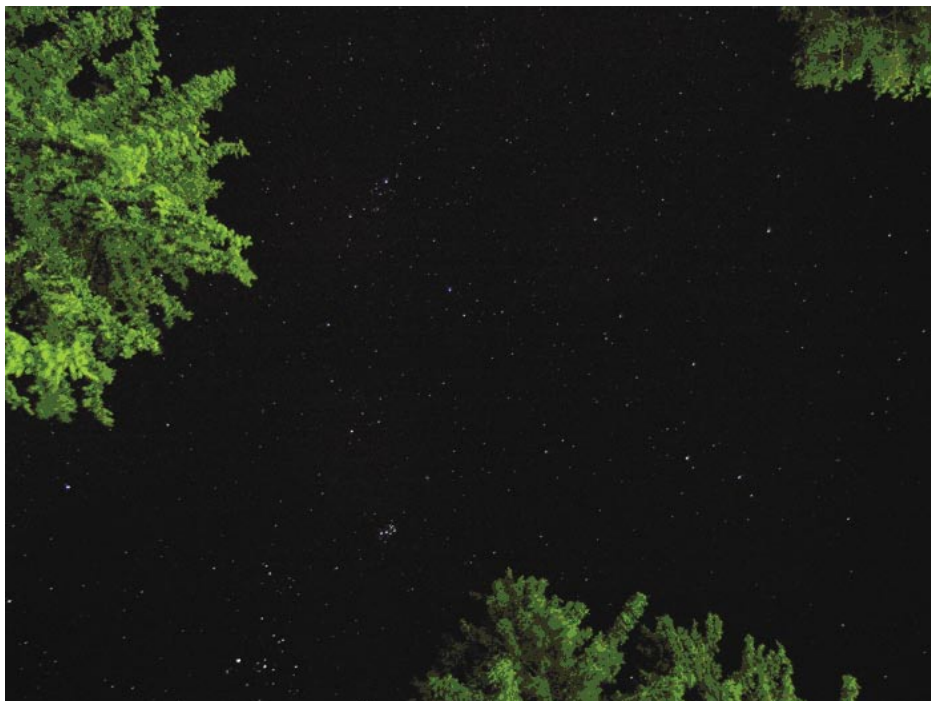
Both mentioned examples - astronautics and exoplanets - are not common in the curricula of our schools. It would be a stimulating idea to

introduce more new scientific concepts in the school programme.

Normally astronomy does not appear in students' curricula as a separate course. Astronomy only appears, partially included, in courses such as physics or geography. In these cases, the astronomical topics presented are from ancient Greece or from two or three centuries ago. The astronomy that appears in newspapers, the current discoveries in the field of astronomy are not in evidence at school.

In general, astronomy is not introduced by means of observational tasks. The majority of students dislike only listening to a traditional lecture from a teacher. They prefer to be active and to take part in a more participative and amusing manner. All the schools have an "astronomy lab": the playground of the school. Then, if they have an astronomy lab, they should use it! It is essential to observe by means of an amateur telescope or binoculars or the naked eye, but their results depend on the quality of the sky. It is a good idea for students to produce simple devices in order to observe and get some information which allows them to take measurements concerning their observations. In our cities the sky only offers a reduced number of visible stars because the level of pollution is very high. Of course it is not possible to observe "deep sky objects", the most they can observe a few planets. This situation limits the number of possible objects to observe and the worst consequence is the reduction of the number of the kind of objects that we are able to observe: for instance, it is not possible to see nebulae, galaxies or clusters. If students only have the chance to always observe planets and stars, they suffer an important restriction and they can not enjoy discovering new objects and face new challenges.

Last 2004 European Southern Observatory, ESO, and European Association for Astronomy Education, EAEE, organised a contest related to the Transit of Venus which was visible in Europe. In Spain this contest was promoted by Real Sociedad Española de Física, RSEF, Real Sociedad Matemática Española, RSME and Fundación Española para la Ciencia y la Tecnología, FECYT with the special cooperation of IAC. The main objective was to motivate students' observations of this phenomenon. Each group of three students and their teacher prepared a report of their experience. In particular, one team from a small village near to Granada wrote: "We discovered that we love to discover" and they added the list of things that they plan to do next year. For this group of students, the Transit of Venus was a "departure point" marking a new way forward. They enjoyed the adventure of science just as a scientist would.



Constellations in the centre of our “non-polluted” cities (photo Veselka Radeva)

Point 3: The clean sky in the big cities: reasons for opening up Public Observatories

The general public does not share the idea that “science is an adventure for professionals”. Astronomers enjoy their work and can feel addicted to their work. It would be nice to show this to everybody because the idea that society has about science is that it is a boring topic and the scientists are a boring people. It is important to change this appreciation in particular if we want to give a more authentic approach to science. It would be good to introduce science in our lives as it relates to our everyday activities and experiences. The observation with a telescope could be a non-sophisticated method to achieve this approach between people and science.

In many Eastern countries “public observatories” exists and are on offer to everybody who is interested in looking at the sky through a telescope. These observatories give people the opportunity to make observations by means of semi-professional telescopes. This is an excellent option to present the idea of “what astronomy really means” to everybody in order to achieve a better understanding of this subject. Of course, the professional observatories can offer - and they already do this - the possibility to visit their facilities during an “open door day”. But a day is not enough. Obviously they can not offer open day sessions very often, because in this case they could not work. A possible idea could be to create “public observatories”, in the countries where they do not exist, or to add an observatory to the planetariums that already currently exist in western countries.

Of course, planetariums are sited in big cities. Then these “public observatories” should be in the important cities where the light pollution is a serious problem. If we want people to observe at least some celestial objects, it is necessary to reduce light pollution.

Also it is important to mention that amateur associations promote observations in several countries. Some of them have an onsite telescope. It is significant to encourage its use in order to invite everybody to enjoy the sky. The idea is that the people can feel the excitement of making observations using a telescope. It is not possible to love something that you know nothing about. It is difficult to feel curiosity for something that you can not see.

Point 4: Non-polluted skies aid the observing of special astronomical events

General audiences are easily attracted to special astronomical phenomena. It was easy to promote the observation of the Transit of Venus several years ago. The people shared the significant feeling recognising that this was a historical occasion and realising that they were observing a very especial event. In particular a group of students, in the relevant contest, referred to previously, stated: “Nobody living today has ever observed a Venus Transit”. So they had a feeling of being unique to be present on this occasion.

It is easier to promote and to carry out observations of eclipses in many zones around the world and also auroras in more restricted areas. Both are spectacular phenomena and share a point of surprise. This kind of occasions stimulates an important impression on all those present. It is imprinted on their minds for years to come: this will be a special “memory”. The first time experience of observing auroras borealis was unbelievable for the author of this paper. Of course previously I had the opportunity of seeing several photos, slides and films, but the reality of it was absolutely mind blowing. The whole sky was dancing and changing colours. Any artificial “light and sound show” was pale in comparison with the natural auroras. At soon as we saw the aurora while driving in the car, we switched off the light and we enjoyed the vision. Of course the sky in Lapland was wonderful and transparent. The action of the car head lamps plunged us into pitch black darkness: only the aurora produced the light.



Auroras in Lapland
(photo Sakari Ekko)

Point 5: Good skies for combating the threat to our common heritage.

Some centuries ago the sky was more present in the everyday life of humanity. Ancient cultures based most of their mythology and beliefs on the sky. This is our common luggage, our common shared culture. Sky is a scientific subject for schools, but it is also an important reference for our cultural heritage. It is important to educate pupils in this field and it is especially interesting to take into account this aspect in order to offer an interdisciplinary approach involving astronomy and ancient cultures in the school.



The stories that our ancestors found in the sky can offer us different points of view. The same group of stars can be the main character in the same mythology stories for several countries. For instance, Orion is the same romance for all the European countries. But depending on the constellation or the place, the same group of stars can be the central point of several mythological legends. For example the three stars of the Orion belt have a different meaning for Aztecs, Mexicas and Mayas. In any case this richness should be used in order to captivate the interest of pupils in their past and in their future in the field of astronomy.



At present our children can observe the "rabbit" in the Moon just as Mexicas did.

It would be a good idea that families and schools invest time to explain stories to children about our common cultural past. Of course these situations promote imagination and creativity in all the children but it is absolutely necessary to enjoy a clear and non polluted sky. The beauty of the skies is essential in order to offer the backdrop for this entire incredible world. It is difficult to feel the charm and beauty of something that is covered by thick smog.

Point 6: Clear skies for astronomy education

From my personal point of view there are, at least, three reasons to promote clear skies in order to teach astronomy at schools:

1) Emotion

It is important that our students feel emotions in the school. Positive emotions connected with science. They must feel that science is not boring and they can enjoy and feel very active participating in scientific experiences or trying to investigate the reasoning behind and to discover the causes of several scientific phenomena.

2) Adventure

People do not believe that science is an adventure for scientists. In general, the people think that a scientist is a boring and absent-minded person. He is living in another world only vaguely connected with the normal world in which we live and he is interested in very strange things. The students normally do not imagine that science is a part of their lives and they do not think that astronomy can be very important for their future. Of

course it is necessary to introduce more astronomy in the schools and much more current contents that motive all students.

3) Observation

We mentioned previously that all schools have an “astronomy lab”. They must use it. If the school does not have observation instruments, they can be produced easily. They can also contact an amateur association in order to organize one or two observations, per year, using their telescopes. Amateurs are helpful to teachers and they can suggest possible programs in order to carry out observations. This is a simple solution useful for everybody. Students and teachers can observe and amateurs have an interested public which enjoy their explanations.

These three points can also be interesting for general audiences, not only for schools.

As we know, the best things in life are free, and astronomy illustrates the beauty of nature as long as we have a clear sky to look at the universe.

Conclusions

In summary humanity needs to preserve the sky in order to:

- Enjoy the sky and feel emotional about it.
- Promote positive feelings towards astronomy and towards science in general.
- Help people to discover and taste the adventure of a new knowledge by means of simple observations using the naked eye, binoculars, amateur telescopes or public observatories.
- Impress upon humanity the beauty of natural phenomena.
- Look at the sky to rediscover the stories of our ancestors.

We can not destroy something so wonderful. We must maintain it for future generations.