

Astronomy in the City for Astronomy Education

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Abstract. Astronomy is part of our culture. Astronomy cannot be isolated in a classroom, it has to be integrated in the normal life of teachers and students. “Astronomy in the city” is an important part of NASE (Network for Astronomy School Education) (Ros & Hemenway 2012). In each NASE course we introduce a “working group session” chaired by a local expert in cultural astronomy. The chair introduces several examples of astronomy in their city and after that, the participants have the opportunity to discuss and mention several similar examples. After this session all participants visit one or two sites proposed and introduced by the chair.

After more than 5 years using this method we visited and discovered several examples of astronomy in the city:

- **Astronomy in ancient typical clothes.**
- **Archaeological temples oriented according to the sunrise or set.**
- **Petroglyphs with astronomical meaning.**
- **Astronomy in monuments.**
- **Sundials.**
- **Oriented Colonial churches.**
- **Astronomy in Souvenirs.**

In any case, teachers and students discover that Astronomy is part of their everyday life. They can take into account the Sun’s path when they park their car or when they take a bus “what is the best part in order to be seat in the shadow during the journey?” The result is motivation to go with “open eyes” when they are in the street and they try to get more and more information about their surroundings.

In summary, one of the main activities is to introduce local cultural aspects in NASE astronomy courses. The participants can discover a new approach to local culture from an astronomical point of view.

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1. Introduction

Astronomy is part of our life and our culture. It is important to introduce this idea in schools if we want humanity to recognise their past from an astronomical point of view and also to discover the relation between this past and the current kind of life. We want to offer to secondary and primary school teachers several examples that they can use in their classes with their students. The main goal is to introduce the proposal that teachers

with their students try to discover different evidence of cultural astronomy in their cities, and the most important thing is that they enjoy doing it as a “detective investigation”.

We will propose several examples in a very open approach. In any case we need a serious contribution from local astronomers and scientist in general that can give support to teachers in order to work in an appropriate way.

The Network for Astronomy School Education (NASE) is a Working Group of IAU Commission 1, created at the 2009 IAU General Assembly. NASE organises courses for secondary and primary school teachers and creates a team of teachers—a Local Working Group (LWG)—who will work with us during the visit by NASE members and will give continuity to the astronomy activities when the visitors leave the country. All NASE activities are organised in the language of the country. As of August 2015 NASE has 28 Local Working Groups in 20 different countries, involving more than 290 volunteers who help to organise courses, prepare materials, organise visits and create guided tours (see www.naseprogram.org).

2. Astronomical Visits

After more than 5 years using this method, we visited several places and discovered several ways to teach “Astronomy in the City”. During these years we organized 70 courses mainly in Central and South America and the main number of examples are in these locations. The following examples show different approaches to this activity.

- *Archaeological temples oriented with sunrise/sunset.* In 2010 during a course organized in Lima, Peru, with the Universidad de San Marcos, we visited Cieneguilla and we had the opportunity to visit the Huaycan site with the archaeologist who works on this site. In one of the walls of the site we could see a set of 12 circles that are considered a Sun-Moon calendar and we observed a sunset not far away from the December solstice. For more information see <http://www.arqueologiadelperu.com.ar/huaycan.htm> and <http://www.cultura.gob.pe/es/tags/huaycan-de-cieneguilla>.

- *Petroglyph with astronomical meaning.* We visited “Sitio Polanco” in Capira, one of several little-studied petroglyphs not far from Panamá city. Several drawings on this big stone may be a rain calendar connected with the Moon; we hope that the University of Panamá can give more details about this in the near future.

- *Astronomy in pottery.* In Ecuador, for several courses, we visited the Archaeological Museum of “Museo del Banco Central” guided by a well-known local archaeologist from San Francisco University, Quito, and had the opportunity to observe several different objects. To give one example, on several ceramics from the “Tutamonos” culture, Orion appears as a monkey constellation. Stars and monkeys appear in the sky for inhabitants of the jungle. See <http://revistas.arqueo-ecuatoriana.ec/es/apachita/apachita-19/270-de-estrellas-y-monos-en-la-cultura-pasto>.

- *Astronomy in monuments.* In Ecuador, there is a monument to recognise the Equator line named “Mitad del Mundo”. On its top appears a “Parallel Earth”, accurately placed, that offers the visitor the opportunity to see the day-night line or sun-shadow line on the sphere of the monument as it would appear on the real Earth. This phenomenon gives a similar vision to that which could be seen by an astronaut from outside the Earth (see Fig. 1).

- *Oriented colonial churches in Central America.* In Tegucigalpa, Honduras, we organise a visit to three churches in the colonial area of the city. Two of them—San Francisco, the oldest, a small church whose construction began in 1592 and the nearby Cathedral named of San Miguel Archangel, constructed in 1765—are oriented in the East/West direction as was common in the colonial period, while the third, Los Dolores, has a



Figure 1. The “Parallel Earth” on top of the “Mitad del Mundo” monument in Ecuador. The picture was taken on the equinox and the day-night line is seen to be crossing the South Pole.

different structure, different decorations, and—according to the tradition prevailing at the end of 17th century—was the church for native habitants of ancient Tegucigalpa. This native church is oriented in the North/South direction.

- *Native People’s Solar Observatory.* In Brazil, the government moved the “Yetore” tribe to a new site, named Ekerua, some years ago. They recreated their ancient village and in particular they reproduced the Solar Observatory that gives them the position of the Sun during the year (especially sunrise and sunset at the solstices and equinoxes. We have the possibility of visiting this tribe and listening to their explanations about the new observatory that they have now. There are other similar observatories in different places and all of them are used to recognise the seasons and to give calendrical information.

- *Sundials in the Forbidden City.* During the NASE course in Beijing with the Planetarium of Beijing we did not visit the “Forbidden City” because this would have needed an additional full day. But in fact, our participants knew the monument and we took the opportunity to teach them about the different kinds of sundials found there. The participants felt excited to understand something of the monuments that had not been understandable when they had visited them in the past.

- *North/South- and East/West-oriented streets in Mendoza.* A visitor arriving in Mendoza, Argentina, may be surprised to find a cardinally oriented street grid with streets numbered from the centre to the North, South, East or West. This structure originated when the Spanish arrived and created the Plaza de Armas in the form of a rectangle with its sides oriented North/South and East/West. All the streets in the foundational area are oriented cardinally—we used the compass to verify this at several locations—but not so the newer part of the city, constructed after the big earthquake of 1861. It is structured as a grid but there is an error in the orientation.

- *Zero point in Managua city.* In Managua, Nicaragua, we visited the old part of the city that was planned at the beginning of the 19th century. This area is structured as a grid with the streets oriented more or less North/South and East/West, each with names and numbers. We decide to visit this zone and try to locate the “zero point” in this structure. The majority of buildings in this area were destroyed in the earthquakes of 1931 and 1972. We found a circle of stones at the location of the “zero point” but did not discover its purpose (Fig. 2).



Figure 2. A group of teachers at the circle of stones found to mark the “zero point” of the street grid in Managua, Nicaragua.

- *Mistakes in Sundials.* In several courses we visited sundials constructed in public squares of cities. We found a lot of them with mistakes. This suggested a very interesting exercise: to try to discover if the sundial was well made or not. It is a good opportunity to test if the course participants really understand the information that they have been given. Two examples of sundials with mistakes are the Horizontal Sundial in Argentina, in a park in Santa Fe, whose North-South direction deviates significantly from the 12-hour line, and the Equatorial Sundial of Paraguay, in the main entrance of the Instituto Geográfico Militar de Ecuador in Quito, whose plane is significantly inclined to the ground, which it should not be for a location close to zero degrees latitude. A legend on the sundial explains why: it was a present to the Paraguayan Army and so, of course, was calculated for very different latitude.

3. Conclusions

After the working group and the astronomical visit, teachers understand that Astronomy is part of their everyday life and think that it could be possible to discover some astronomical aspects in the city with their students. Our main goal is to motivate people to walk with open eyes when they are in the street so that they try to get more and more information about their surroundings. They can also use knowledge of astronomy in their current activities, for example taking into account the Sun’s path when choosing a shady place to park their car or a seat that will remain shady during a bus journey.

We know that teachers cannot learn archaeology in one hour. We are interested in offering a new approach to astronomy by means of cultural heritage—ancient cultures or oriented buildings or monuments. Astronomy is part of people’s lives and we would like them to discover it. The most interesting part of the activities consists of promoting discussion and the exchange of information between participants: the chair and guide of the session is only a promoter of this exchange of ideas.

References

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