

OBSERVATORY AND UNIVERSITY, WHICH RELATIONS? THE CASE OF LILLE'S OBSERVATORY

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Abstract. The astronomical Observatory of Lille is a place devoted mainly to research on the dynamics of planetary system and educational outreach in astronomy. This proceeding is concentrated on this last mission. After showing the administrative structure of the observatory, its missions and presenting its main instruments, we detail the astronomical teachings linked with this observatory: academic astronomical teaching, training courses for teachers, certificate of basic knowledge in astronomy and more generally the ways to allow many people to manipulate the great refractor of the Observatory.

Keywords: teaching, astronomy, refractor, heritage, telescope

1 Introduction

There are in France more than twenty equipments dedicated to observing the universe. For the older of them they have been founded from the 19th century and for others they have been built recently. The most ancient observatories have telescopes such as refractors or reflectors. Each of them has their own history, and shows the scientific past in which it had a role.

These observatories and their instruments are heritage objects used for observational parties intended for the general public or for amateur astronomers. But, often associated to a university, they are the bases for research and teaching activities.

At Lille's university, the research activities are made within the Institut de Mécanique Céleste et de Calcul des Ephémérides (IMCCE). This laboratory is under administrative supervision of Paris Observatory, PSL Research University, CNRS, Sorbonne university and Lille's university. So to focus on the case of Lille, and in order to keep within the topics of the S04 session dedicated to the astronomical education, we present here the teaching activities at the observatory of the university of Lille. In Sect. 2 we show how our observatory in Lille works and its main instruments. So we detail in Sect. 3 what are the astronomical teachings linked with this observatory.

2 Observatory of the university of Lille

The great refractor and other observational instruments

The main instrument is the 32.5cm refractor (Fig. 1). It was founded in 1909 by R. Jonckheere at the same time as the observatory. More details about the history can be found in (Thilliez 2009). Some other telescopes are also used for demonstrations or teaching. The characteristics of the instruments are given in Table 1.

Beside the Jonckheere's refractor there are some other heritage objects such as two theodolites, a siderostat from the end of the 19th century, some astronomical clocks, a spectrograph, a seismograph, ...

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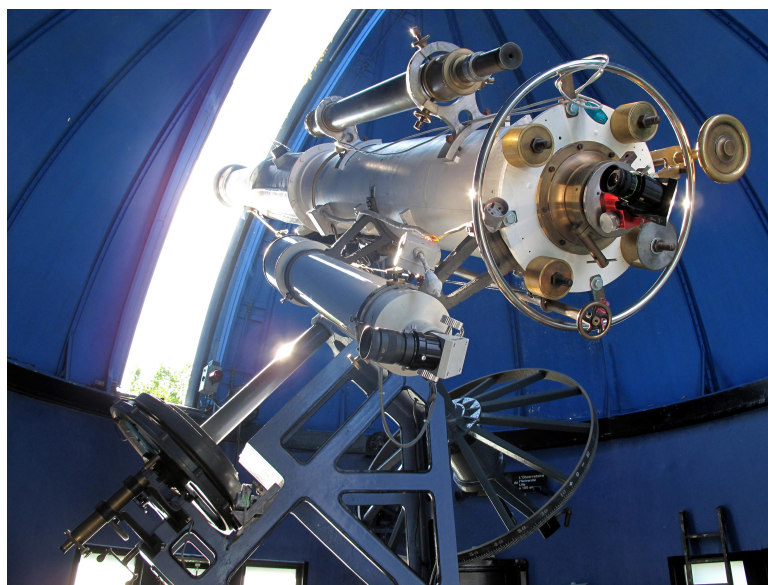


Fig. 1. The 32.5cm refractor of Observatoire de Lille

Table 1. Characteristics of the great refractor and other observational instruments

	Jonckheere's refractor	Celestron CPC1100	Evscope	Solar refractor H_{α}
Acquisition year	1909	2012	2020	2021
diameter (mm)	325.	280.	114.	90.
focal length (mm)	6000.	2800.	450.	800.
longitude	0h 12m 17s E	-	-	-
latitude	50° 36' 57" N	-	-	-
altitude	32m	-	-	-

Maintenance of the instruments

The originality of the Observatory of Lille about the instruments presented just above, compared to others professional observatories, is the presence of an association of voluntary men or women who want to promote the observatory towards all these missions (see just below), specially heritage maintenances and public relations. Its name is “Association Jonckheere - Les Amis de l’Observatoire de Lille”. A convention has been signed between this association and the university of Lille in 2016. It is why all the activities described below can be done with an effective observation of the sky.

Missions

Lille’s Observatory is an astronomical centre where work three professors, an assistant, one or two PhD students and sometime some invited researcher or trainees.

- The research activities are made within IMCCE
- Teaching and educational outreach are made by the academic staff within their service. But they are made also by other involved people. See Sect. 3.
- Valorisation and development of the heritage objects. They are the actions made by the municipality, the university and the association.
- Scientific culture

More details can be found in (Vienne 2013).

For all these missions, the Observatory of Lille works with a director and an orientation council in which all concerned structures are represented: university, laboratory, association, municipality, ... The detail of the administrative working of the observatory as a structure is given in (Vienne 2020).

3 Astronomical teachings at Lille's University

3.1 Academic teaching

Introduction à l'Astronomie / Introduction to Astronomy

This course concerns the first year students from Licence in general science. It contains 20 hours of lectures, 30 hours of tutorials and an observational session at the observatory. About 100 students follow this course.

The aim is to give a general description of the Universe (structure, composition, size, evolution, ...) and to understand the methods allowing to measure the Universe.

So they study the light, the distances and celestial mechanics. Then we can present the astronomical objects such as the sun, the stars, the solar system, the exoplanets, the formation processes and the Universe.

Astronomie fondamentale / Fundamental Astronomy

This course, named also "Positional Astronomy", concerns the second year students from Licence in mathematics, physics and chemistry. It contains 20 hours of lectures, 30 hours of tutorials and several observational sessions at the observatory. About 30 students follow this course.

The aim is to describe and explain the motion of celestial bodies both in the space and on the local sky. It includes some everyday life applications such as the time, the seasons, calendar, settings, ...

This course is not so common in French universities. We don't know similar course at this level. Probably it is because this ancient topic used of the spherical trigonometry. In fact we need here only to reason on the celestial sphere (local sphere and sphere of fixed stars). From a pedagogical point of view it is very interesting and appreciated because students have to think differently but have many daily and practical examples. Of course it is also interesting for understanding the celestial coordinates as we use at the great refractor of the observatory.

Teaching for teachers

A similar course is also given for second year students, not only scientific ones, who want to become schoolteacher. Similarly, an adaptive version of this course is given to students who want to become fully-qualified teacher.

Mécanique du système solaire / Solar system mechanics

This course concerns the third year students from Licence in mathematics and physics. It contains 20 hours of lectures, 30 hours of tutorials and an observational session at the observatory. About 15 students follow this course.

With this course we want to give the backgrounds of celestial mechanics and their applications to the solar system. We use the mathematical and numerical tools to study this dynamic. More precisely, the content is: the formulation of the N-bodies problem, the sphere of the gravitational influence, the resolution of the 2-bodies problem, the spacecraft trajectories, computation of ephemerides from orbital elements, some notable equilibrium positions of the N-bodies problem and some practical numerical works on computer.

Mécanique Hamiltonienne et Astronomie / Hamiltonian mechanics and astronomy

We have given lectures about this course over two years only. We mention it to illustrate the difficulty to propose teaching astronomy at this level. The reason for Lille, is the proximity of Paris which prevents to have specific specialization in astronomy. For "Hamiltonian mechanics and astronomy", the course was proposed as option to students from the master research in mathematics.

3.2 Specific teachings at the observatory

We gather here the teachings for which the whole course must be located at the observatory.

DU L'Univers et sa mesure / DU The Universe and its measure

The observatory of the university of Lille has set the DU (Diplôme d'Universitaire) named "L'univers et sa mesure". Accessible to most of people, this certificate allows to obtain basic knowledge in astronomy and astrophysics and to reveal the different current research with their issues.

Lectures are given at the observatory near the great refractor which allows students to get familiar with the place in order to be able to observe celestial bodies during the week of practical works in February (5 days from 14h to 23h). The lectures, three hours once a week on evening from september to june, are given by expert from University of Lille and Paris' Observatory. The Local Education Authority (named Rectorat), the association AJAOL and the local planetarium are also associated to the DU.

This year the DU can be split into two parts (CU for Certificat d'Université).

Atelier astronomie / Working group in astronomie

Inside IREM (Institut de Recherche en Enseignement des Mathématiques) of the university, we lead and participate to a working group for which the aim is to think and produce educational sheets allowing pupils of secondary school to see why answer to some astronomical questions need the use of mathematics.

This working group gathers 8 teachers mainly from secondary school.

Each year the Rectorat offers to teachers from the region some educational courses over two days. Our group offers one course on astronomy for about 25 teachers. The educational aim, is to acquire the fundamental knowledge in astronomy in order to understand the place of the Earth in the Universe, and to use astronomy as a field to apply mathematics.

La main dans les étoiles / Take the stars

The group "La main dans les étoiles" is also a group of secondary school teachers supervised by the observatory. This times, they use directly the great refractor to make discover astronomy to pupils of their own class or other class. This group exists since 2010 and has been certified by the Rectorat in 2016. Every year, about 100 pupils put their hands in the sky to take stars.

Observations astronomiques

Our observatory offers some observational parties to students, teachers and agents of the university of Lille. These observations are managed par one of the three professors of the observatory. Generally they occurs between november and march. They represent opportunity for a non-specialised public to gain an observational experience. There are about 24 nights per years. This number includes the nights with bad weather.

3.3 Others teachings

L'Astronomie dans l'apprentissage des Mathématiques / Astronomy in Mathematics Learning

Mathematics and astronomy have always been closely related. Both sciences developed simultaneously and enhance each other. Thus, the idea of using the Universe as a source of concrete examples to support mathematics learning. Teachers at the Paris Observatory and the University of Lille believe this to be an excellent way to increase the student interest. Bearing this in mind, they decided to offer the Astronomy in Mathematics Learning online module. This module has been built between 2007 and 2013. The link is <https://media4.obspm.fr/public/AAM/>

Educational outreach

At last, as many university teachers and scientists, we have many activities of educational outreach for which the corresponding times is not counted officially in our teaching service: interviews, patronage of class, visits, ... But considering the attraction of astronomy, and considering our small team, we are very often requested.

References

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