

Thanks for your introduction. I will present in my talk the activities in relation with the collection of scientific instruments belonging to the faculty of physics of the Complutense University. This collection has a long story of vicissitudes related with the movements of the University to different campuses. As it can be seen this work was done in collaboration with people from the National Science Museum and two professors belonging to the Faculty of Physics.

The Complutense University is one of the oldest universities in Spain. Founded by Cardinal Cisneros in 1508 in the city of Alcalá de Henares, close to Madrid, it was moved to this city definitively during the reign of Isabel II in 1836. It was set up provisionally in a former Jesuit Novitiate and finally in the present campus in the forties of the XXth century. The picture is a portrait of the cardinal with the appealing motto of my University which is also in the cardinal's coat of arms.

The Faculty of Physics of the Universidad Complutense has a good collection of equipment and machines mainly for didactic and demonstration purposes. The origin of this collection has been deeply investigated by Leonor González de la Lastra and Rosa Martín Latorre from the MUNCYT who wrote the whole story in "Instrumentos Científicos para la enseñanza de la física" published by Ministerio de Educación. Briefly, most of the instruments came from Royal studio or other institutions, some were purchased to improve the experimental aspects of the physics curriculum, or finally, some of them have been made in the mechanics workshop of the University. The oldest item is an iron mounted magnetic stone dated back to 1775, and the collection extends to nowadays.

After moving to the present campus in 1940 (+-) the didactic interest of the collection started to decline, due in part to the growing interest in new physical phenomena, and also due to the fact that the professors' activities were more



THE PHYSICS FACULTY OF THE UNIVERSIDAD COMPLUTENSE COLLECTION

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Cardenal Cisneros

(Francisco Jiménez de Cisneros)

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The oldest piece: an iron mounted magnetic stone. Dated 1775



focused on research. The collection, which had been set up in a showroom, became covered by a thick layer of dust, and finally, due to the pressing needs for new laboratories, was stored in the cellar of the building. The adverse conditions had a disastrous effect for some of the collection items that became severely damaged or ruined. In the picture we can see the state of the items while in the cellar, and after restoration. First picture is a Wimshurst electrostatic machine, and the second one is a Hemholtz siren.



Due to the needs to rebuild the Physics Faculty building we had to clear the cellar in 1990 (+-) and the dean at that time, Prof. Francisco Tirado took the decision to deposit most of the equipment in the MUNCYT. About 800 items were transferred to the MUNCYT for study and cataloguing. This activity was subsidized by the Research and Development (I+D) National Program from the Ministry of Education. The MUNCYT gathered all the information of about 350 items in the book mentioned above, which includes beautiful pictures.



It seems that the publication of this book changed some mentalities in the faculty staff that started to realize the importance of preserving our heritage. Particularly we have to acknowledge the understanding attitude and help of our present Dean Prof. Maria Luisa Lucía, who encouraged us to pursue our activities in this field.

Glass cabinets



Apart from the equipment in the MUNCYT we have gathered other 500 pieces dating back from to the end of the XIXth century to the seventies of the XXth century. The most important or representative ones are currently on display in 17 glass cabinets in different places all around the building. Here we have some of these glass cabinets. The purpose of this exhibition is multiple.

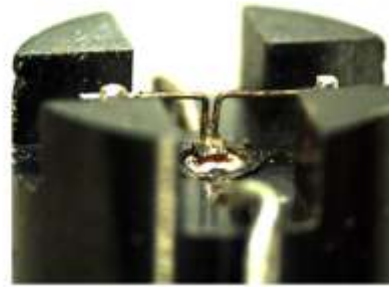
Glass cabinets



First of all, we tried to pursue a didactic goal. The benefit for the students is to recognize the story of different areas of physics and to understand the difficulties in experimental physics. It is frequent, when one teaches a subject, to observe students neglecting the importance of a

discovery arguing that the phenomenon could be easily observed. Of course they are thinking about all the equipment (mostly electronic) that they have at their disposal in the laboratory nowadays, but when you explain that it was proved using the experimental apparatuses shown in the glass cabinets (or similar ones) they change their mind and recognize the geniality of the ancient physicists. As an example we have here a very primitive transistor (in fact the device was not yet so named) probably from the fifties. It is really amazing that the present technology was proven in such a tiny piece of semiconductor with two sharpened wires pressed against its surface. Really, Bardeen Brattain and Shockley deserved the Nobel Prize.

A very primitive transistor. On display in the "History of Electronics" cabinet



Nobel prize winners 1956

John Bardeen William Shockley Walter Brattain



Another didactical benefit is to show the transverse character of knowledge. The student can realize that the same technique with the appropriate scaling and the same equations could be used to measure, for instance, the resistivity of a semiconductor, or to make an electrical prospection of the ground. In this picture we present the equipment used in electrical prospection and in to measure semiconductor resistivity. In both cases we contact with needles the object to be measured; of different sizes, because the ones used to measure the underground currents are steel rods about 50 cm long, and the ones for the semiconductor are just needles about 300 micron. But the equations are exactly the same. Another curious fact is the presence of cases in the exhibition. Those are for carrying the equipment on donkey backs probably. Not all physics belongs in the laboratory!

The transversality of knowledge



The diary (1896) and a signed piece (1899) by prof. J.G. Martí



The exhibition also pays homage to former professors. We are showing some diaries, one of them dated in 1898, in which the day by day activity of a professor is narrated. Other former professors are remembered in pictures, or in different pieces of equipment they used, or in some case designed and signed. In the picture, a page of the diary of prof. J.G.Martí where he relates the measuring of the density of a meteorite fallen in Madrid in 1896, and also an electric apparatus signed by himself. Next slide shows prof. Cabrera in his laboratory. The

electromagnet is preserved honoring one of the best Spanish scientists of the first quarter of the XXth century in the field of materials science.

Some glass cabinets have their items ordered according to scientific topics, as for example measurement apparatuses, mechanical calculators and computer science, vacuum science, geophysical science, and electronics. We have a glass cabinet dedicated to life at the university in the years when the building was put up, showing a classroom clock, a typewriter, a desk lamp, and, in general, the former decoration in the building, which was nice Art Deco. Also, in the picture is one of the oldest “new line” didactic technology improvements ever existing. All lessons on electromagnetism were hand-written in different colors on glass. To preserve the written side, another glass was used. Incidentally, the lessons were written on reused photographic glass plates without emulsion.

The last goal is to present the evolution of technology. We have several proofs, but I chose a very astonishing one. In the picture you have an image sensor of the forties and a sensor belonging to a smartphone. The first one is black and white, while the second is color and has a much higher resolution. This explains the Nobel Prize in 2009 to Boyle and Smith.

To document all this effort one of us (retired professor B. de A) has been devoting hundreds of hours to create a web page with a picture of each piece in the collection, not only the ones housed in the faculty building, but also the ones preserved in the MUNCYP. He took thousands of photos and made a card file for each apparatus including a description and an approximate date of manufacturing.

Up to now, about 70% of the pieces are included in the data base of the virtual museum, which can be visited at “<http://museo.fis.ucm.es>”. We really would like to encourage the audience to visit this page.

Thank you very much

The electromagnet of prof. Blas Cabrera



The evolution of technology



<http://museo.fis.ucm.es>

