*Highlights on Spanish Astrophysics X, Proceedings of the XIII Scientific Meeting of the Spanish Astronomical Society held on July 16 – 20, 2018, in Salamanca, Spain. B. Montesinos, A. Asensio Ramos, F. Buitrago, R. Schödel, E. Villaver, S. Pérez-Hoyos, I. Ordóñez-Etxeberria (eds.), 2019*

# The Astronomy & Astrophysics Master Degree at Universidad Internacional de Valencia: the experience of a pioneer model.

**Vicent Martinez-Badenes[1], Nestor Sanchez[1], Lorena Nieves-Seoane[1], and Pere Blay[1]**

[1] Universidad Internacional de Valencia - VIU, C/Pintor Sorolla 21, 46002, Valencia, Spain.

## Abstract

Founded in 2008, the Valencia International University (VIU) started its Master Degree in Astronomy & Astrophysics in 2011, becoming *Master Universitario Oficial* in 2013. This is the first completely online Master Degree in Astronomy in Spain. After having completed 6 editions as *Master Oficial*, it is mandatory to take a look back and compile the most relevant experiences of this challenging model.

## 1 Introduction

VIU is a young university, with barely 10 years of life. Founded as a public, on-line teaching institution, it became private during 2013. From its very beginning, the Master Degree in Astronomy & Astrophysics has been one of its key programs, being the only one in the Science & Technology area until 2016, when the Computer Engineering Degree started. The Sci & Tech area is now rapidly growing at VIU, with 1 Degree, and 8 Master Degrees (2 of them recognized as Master Universitario Oficial).

During these years, the Master Degree itself has undergone an evolution from its original model to the current one, with an increasing number of students and a higher ratio of international demand.

## 2 Organisation and methodology

As part of VIU, the Master Degree in Astronomy & Astrophysics is organised as a completely online learning process. The student is not required to be in Valencia (or any other place) at any moment, for all the learning steps (classes, exams, telescope observations, Master Thesis tutoring and defense) are done remotely.

With the aim of avoiding the coldness derived from the lack of a physical contact with professors and colleagues, online lessons are programmed in the so-called *e-presencial* way. In this method, lessons are planned to be live followed by the students, so discussion and interaction are feasable in real time in the digital platform. Anyway, lessons are recorded, allowing students not only to watch them as many times as required, but also to skip a live session when their schedules do not permit them to be connected at the time lessons are scheduled (tipically 8:00 PM CET/CEST). The feedback provided by the students shows them to have a high degree of satisfaction with this *e-presencial* mode.

The theoretical contents in the Master Degree are organised into 12 subjects (3 ECTS each), covering a wide sample of astronomical topics, and paying attention to both purely astrophysical and technical contents. Subjects are organised within the academic year in 3 periods of approximately 2 months and a half each, according to the following distribution:

Table 1: Distribution of theoretical subjects during the year

| 1st quarter | 2nd quarter | 3rd quarter |
|---|---|---|
| Classical Astronomy and Astronomical Instrumentation | Analysis of Astronomical Images | Optical and IR Astronomy |
| Solar System | Stellar Astrophysics | Radioastronomy |
| Exoplanets & Astrobiology | Extragalactic Astrophysics | High Energy Astrophysics |
| Databases: the Virtual Observatory | Cosmology | Communication of Astronomy |

For each subject, 7 videoconferences are scheduled, each of them expected to last for 2 hours. Within these 7 sessions, there are an opening and closing session (used to present and synthesize the contents of the subject), 2 theoretical lessons, 2 sessions dedicated to guided activities and a Seminar generally used to introduce the frontier science currently going on each field. The final grade is calculated from the synchronous exam mark and the score of the activities asked by the professor.

As part of the formation, the students must undergo the complete process of an astronomical observation. Organised by themselves in groups with up to 6 students, they are expected to follow the same steps a professional astronomer would perform during a scientific research, here summarized as follows:

1. The students choose a workgroup based on the interest on working with a certain instrument or their schedules. Before that, they already know the telescopes and instrumentation available. A professor with observational experience is assigned to each group.

2. Once the group is formed, the students must look for at least one scientific case (choosing at least two is explicitly recommended). The students may ask their professor for advice

at any moment. The professor will, as well, help to fit the original idea to the technical capabilities of the telescope and the instrument. The final proposal (written using a professional template) is sent to the telescope operator 10 days before the observations. The proposal represents 30% of the final mark.

3. The observations are performed remotely for three consecutive nights.

4. Once the observations are done, the students must download the data to reduce and analyze them, following the professor instructions.

5. Finally, the results are presented and discussed in a memo, to be graded by the professor. The memo has a weight of 70% in the final mark.

During the last editions of the degree, the observations have been performed using the Observatorio de Aras de los Olmos (Observatori Astronòmic de la Universitat de València), the T150 telescope at Observatorio de Sierra Nevada (IAA-CSIC) and the IAC80 at Observatorio del Teide (IAC).

The year is completed with the Master Degree Thesis or *Trabajo Fin de Master* (TFM), with an academic load of 18 ECTS. The TFMs are supervised by professional astronomers, either related to the University or not, who send their proposals. Students are also encouraged to suggest a specific project if they contact an advisor by themselves. The TFM is finally presented to a panel of 3 astronomers, who grade them. The ratio of TFMs that, with some extra work, become published in peer-reviewed journals is increasing year after year.

Since 2017, there are two editions of the Master per year, starting in April and October, with the number of students rising up to 90 during 2018.

## 3 Staff and student profile

The subjects in the 2 editions of the Master Degree are taught by 4 full-time professors and 9 professors which are developing their scientific careers out of VIU. The staff is completed by the advisors and operators associated to the observations and the TFM advisors (42 during 2017-18 academic year), most of them collaborators from other institutions. All but one professor have a PhD in astronomy, and so the TFM advisors have.

The student profile is slightly different from the on-site alumni. Apart from showing a higher average age, the ratio of them aiming to start a research career with a PhD is generally low, with only 3 to 5 students per edition. Apart from this, there are two main reasons that lead the students to start the Master Degree. One is purely professional, with technic, high-profile workers, from fields related to astronomy such as aerospace industry, willing for an upgrade in their capabilities and professional prospects. The other is the mere passion for astronomy. Even considering that PhD candidates are a low fraction of the students, we already have some TFM advisors that got their PhD after completing the Master Degree on its first editions. The ratio of students from Latin America is increasing, being around 1/3 of the total number.

## 4 Conclusions

The increasing number of students in the VIU Master Degree in Astronomy & Astrophysics shows that there was a need of an online option in this field of education, with the feedback from the students being usually very good. It becomes clear that this Master Degree does not collide or compete with the already existing, but just complete the scene, offering an option for those students who cannot follow an onsite course for any reason. The response of the Spanish astronomy community is being very positive, making the Master Degree possible.