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## European Virtual Observatory Schools

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**Abstract.** The European Virtual Observatory (VO) initiative organises regular VO schools since 2008. The goals are twofold: i) to expose early-career European astronomers to the variety of currently available VO tools and services so that they can use them efficiently for their own research and; ii) to gather their feedback on the VO tools and services and the school itself. During the schools, VO experts guide participants on the usage of the tools through a series of predefined real science cases, an activity that took most of the allocated time. Participants also have the opportunity to develop their own science cases under the guidance of VO tutors. These schools have demonstrated to be very useful for students, since they declare to regularly use the VO tools in their research afterwards, and for us, since we have first hand information about the user needs. Here, I introduce our VO schools, the approach we follow, and present the training materials that we have developed along the years.

### 1. Introduction

The European Virtual Observatory (Euro-yVO; <https://www.euro-vo.org/>) is the European network for the Virtual Observatory (VO). It started in 2001, and currently is composed by 5 national partners (AstroGIRD, GAVO, OV-France, SVO, Vobs.it) and one supranational organisation (ESA).

The Euro-VO has been funded by the European Commission with several joint projects. Currently, ESCAPE (The European Science Cluster of Astronomy and Particle Physics ESFRI Research Infrastructures) is the project that is funding the Euro-VO since 2019. This project has received funds from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement no 824064.

ESCAPE is a large project focus on bringing together three scientific continuities which are actually connected: astronomy, astroparticles, and particle physics. ESCAPE tries to identify synergies in the domain of open data management and data systems. On this sense, the Euro-VO is supporting the implementation of VO standards into the European Open Science Cloud.

## 2. The VO schools

One important aspect of the Euro-VO network is the support on the utilization of VO tools and services by the European Astronomical community. One way to do this is by mean of VO schools, that Euro-VO has been offering for many years. Since 2009 we have had 10 VO schools at European level. That is a school each one or two years. In addition, the Spanish Virtual Observatory group regularly organizes VO schools for the Spanish community.

These schools are mainly focus on early-career astronomers (PhD students and early post-doc), although any member of the Astronomical community can assist. One important aspect of the schools is the individual attention. Thus, the numbers of student is limited to 30-50 per edition, depending on the venue, and the number of tutor is among 10 and 12. So typically, each tutor attends 3 o 4 students.

In the past, the VO schools were in person. But due to the pandemic situation, in February 2021 we afforded the challenge of moving it to an on-line format. The selected platforms were Zoom, for guiding the live-on sessions, and Slack, for holding an off-line forum for questions and discussions. The number of participants was similar to the previous editions. The effect of moving to virtual school was positive after all. In fact, we noticed more interaction between students and tutors than in the previous in person schools. The school was very positive evaluated by the students.

This gratifying experience has encouraged us to plan in February 2022 the next ESCAPE VO school with an hybrid format, allowing the participation both in person and on-line, if the pandemic situation permits.

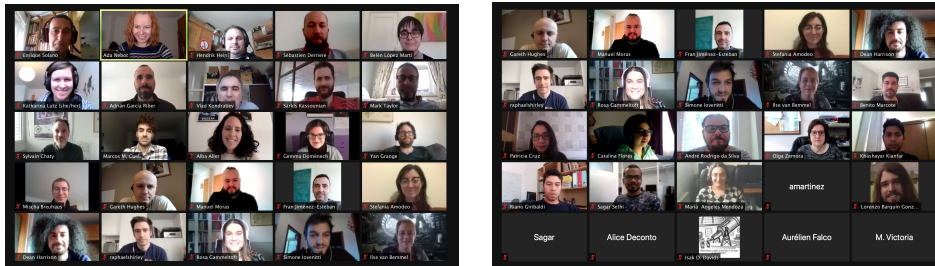


Figure 1. Group picture taken during our last on-line VO school.

## 3. Our approach

The approach we follow is focused on reaching the two main goals of the school: i) expose researchers to the currently available VO tools and services, so they can learn about the functionalities and possibilities that the VO offers, with the final objective that they use them for their daily research afterwards; ii) gather their feedbacks on the VO tools, services, and the school itself.

In order to reach the first goal, the schools have two main ingredients. The first is the hand-on sessions, which actually occupy the majority of the time. Typically, five or six of these sessions are hold during the school. They are based on real scientific cases, and they are supported by a detailed written guide which were prepared in advance by

the tutors. The sessions are driven by one tutor, while 2 or 3 other tutors resolve any individual issue arising to any students.

The second important ingredient is the participant use-cases. Before the schools, participants are encouraged to bring use-cases that may be of interest for their own research. These cases are tackled during the school with the direct guidance of the tutors, and using the new learned techniques.

Finally, to reach the second main goal, retrieve feedback from the students, we survey them on the VO tools and services, and on the tutorials that were used during the schools. In general, students give high rate to the school and to the VO tools and services. In fact, they normally express their intention of using VO in their future research, confirming that we successfully reach the first main goal.

#### 4. Training material

As has been explained above, we use tutorials for the hand-on sessions. The tutorials are based on real science cases which are developed step-by-step following a VO approach. The tutorials are very detailed, so students can follow them with very few or even no help at all.

These tutorials are saved in a public repository where any interested person can access, download them, and trainee in VO by following the exercises. Some of these repositories are listed below:

- <https://www.euro-vo.org/scientific-tutorials/>
- <https://www.asterics2020.eu/tutorials/overview>
- <https://svo.cab.inta-csic.es/docs/index.php?pagename=Meetings>
- [http://vo-for-education.oats.inaf.it/eng\\_download.html](http://vo-for-education.oats.inaf.it/eng_download.html)

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