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Report on the ESO workshop

La Silla Observing School 2025

held at ESO Vitacura, Santiago de Chile, and ESO La Silla, Chile, 10–21 February 2025

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During the two weeks between 10 and 21 February 2025, the Office for Science at ESO in Vitacura and the La Silla Observatory were the hosts of the fifth La Silla Observing School. A group of 20 students consisting of mostly PhD but also some advanced MSc students from different parts of the world were guided by five tutors. The students prepared and carried out sophisticated observations at the La Silla Observatory, reduced and analysed the data, and finally presented their results to the scientific community at ESO Vitacura. In addition to learning about the observing techniques and instruments that were used during the school, the students also attended several talks focusing on soft skills, what makes a good scientific presentation, and career choices. Given the high demand from the astronomical community for such educational programmes, ESO now offers the La Silla Observing School on a yearly basis, so the next school is foreseen for February 2026.

Introduction

The La Silla Observing School is a series of training workshops on the use of telescopes and astronomical instruments. The main goal of this observing school is to give students and early-career researchers in astronomy the opportunity to gain observational experience, instrumentation background and the entire cycle from planning observations, carrying them out, data reduction & analysis, to the presentation of the results. This is becoming more and more important, given the increasing use of remote and service-mode observations, which denies many students the possibility of having hands-on experience with large, modern observing facilities.

After 2016, 2018, 2020 and 2024, the fifth La Silla Observing School was held over two weeks in February 2025 and was hosted by ESO's Office for Science and the La Silla Observatory. The La Silla Observing School 2025 was open to students worldwide; the number of participants was limited to 20 to ensure the best learning experience. The participants were selected via a competitive selection process; the selected students were asked to pay for their own travel to Santiago, while lodging and transport in Chile were covered by ESO. They were housed in shared flats in the lively district of Providencia, which allowed them to get to know each other in a relaxed environment.

The La Silla Observing School[1] started on Monday 10 February with a two-day workshop at the ESO premises in Vitacura. The lectures covered topics about ESO in general, an introduction to observational ground-based astronomy, astronomical instrumentation,

Figure 1. The enthusiastic participants at the fifth La Silla Observing School.

Figure 2. The students (and tutors) visiting the New Technology Telescope (NTT).

observing preparation and strategies, and data reduction. For the hands-on project work, the students were split into three research groups that were supervised by five tutors.

On Wednesday 12 February the students and tutors travelled to La Silla and arrived there in time for dinner and the wonderful sunset. During the night the students visited the control room of the 3.6-metre telescope, the New Technology Telescope (NTT) and the 2.2-metre ESO/MPG telescope and they got acquainted with the southern night sky, something which most of the students had never seen before. On Thursday afternoon we visited the 3.6-metre telescope and the NTT, and in the evening the students continued preparing their observing runs that started the next night. Observations were taken over three nights with the High Accuracy Radial velocity Planet Searcher (HARPS; Mayor et al., 2003) and the ESO Faint Object Spectrograph and Camera 2 (EFOSC2; Buzzoni et al., 1984), on the 3.6-metre telescope and the NTT, respectively. The weather conditions were good during the three nights; however, during the first two nights technical tests on the NTT affected the observations with EFOSC2 at the beginning of the night.

During the day of Monday 17 February, additional calibrations for the data reduction were taken. The students continued working on the data reduction & analysis, and during the afternoon a group went on a small hiking trip to visit the ancient petroglyphs in the valley behind the 3.6-metre telescope. On Tuesday, the students returned to Santiago with happy memories and lots of data in hand. The last three days in Santiago were dedicated to data analysis, as well as talks and discussions on career prospects, soft skills, equity, diversity and inclusion in astronomy and on ESO's Extremely Large Telescope. The students presented their scientific results to the public on Friday 21 February. The successful conclusion of the school was celebrated with wine and cheese in the ESO garden.

The two weeks of the school were very intense — and immensely rewarding. The amount of work carried out over the two weeks was truly impressive and the organisers are happy to have received very positive feedback from the students.

The research groups

The project led by ESO Fellow Michaël Marsset aimed at observing asteroids, as they are ideal targets for training in observational astronomy — from non-sidereal tracking and time-series photometry to low-resolution spectroscopy. The students used EFOSC2 in both imaging and spectroscopic modes to study the rotation, shape, and surface composition of several asteroids. A highlight was 2024 YR4, the 'killer asteroid', which back then had a roughly 3% chance of impacting Earth in 2028 (now excluded, although a 4% chance of lunar impact remains at the time of writing!). The objectives of this project were to obtain rotation lightcurves and reflectance spectra of asteroids. Through comparisons of their data with laboratory spectra, they matched (4) Vesta with basaltic HED meteorites, (170) Maria and (847) Agnia with ordinary chondrites, and (324) Bamberga with hydrated carbonaceous chondrites. These results allowed the students to infer that Vesta, Maria, and Agnia likely formed inside the Solar System’s original ice line, while Bamberga originated beyond it. In the case of the infamous 2024 YR4, poor seeing, high airmass, and a nearby bright star conspired to prevent our spotting it. Nonetheless, our courageous planet defenders now have all the tools they need to help protect Earth from future threats from outer space!

The goal of the project led by ESO staff astronomers Monika G. Petr-Gotzens and Robert J. De Rosa was to measure the lightcurves and radial velocities of a small number of short-period eclipsing binaries. In this research project, the students were tasked with observing and analysing the radial velocities of eight bright stars. Each one of these stars was known (but not to the students) to display a periodic wavelength shift in their observed spectral lines caused by the gravitational pull of an orbiting companion. Using the HARPS echelle spectrograph the students acquired several spectra per target, following a nightly observing schedule that the students had worked out together based on the visibilities of the target stars during the nights. From these data the students measured the radial velocity of each star several times per night and investigated its variation over the three nights. This revealed the presence of another body around each of the observed target stars. Some found a subtle radial velocity shift (in the case of an exoplanet), others displayed a significant radial velocity shift indicating the presence of a more massive stellar body. Finally, the students fitted the radial velocity curves with an orbital motion model to infer the orbital elements of the system (for example, orbital period, component mass, eccentricity). Additional archival data were added for some targets to further constrain the fit. All the students successfully identified a two-body system, ranging from exoplanet companions to stellar companions on very eccentric orbits.

The goal of the project led by Alejandra F. Rojas Lilayú, a professor at the Federico Santa María Technical University in Santiago, and ESO Fellow Ana Maria Jímenez Gallardo, was to study local active galactic nuclei (AGN) — supermassive black holes (10^6–10^9 $M_\odot$) accreting material from an accretion disc at the centre of their host galaxies. Using the EFOSC2 spectrograph, the students observed a sample of three local AGN mergers ($z < 0.07$), where one of the two components is a confirmed AGN and the other is a galaxy of unknown nature because of the lack of optical spectra. The project aimed to confirm or reject the dual AGN nature of these systems. The students learned about visibility plots, how to create an observing plan and observing blocks for both calibration and science data, and how to reduce the data using ESO Reflex, and became familiar with typical AGN features in optical spectra. As a result, the students were able to confirm the AGN nature of the second member in one of the mergers and rejected the AGN nature of the second member in the other systems. In addition, the students acquired the optical spectra of two interesting AGN: a ‘super-Eddington AGN’, which is accreting material at high rates, and an AGN with powerful outflows observed in the X-ray. These different cases gave the students ample opportunity to learn about AGN science and interpret the results in a scientific context. Finally, the students obtained EFOSC2 imaging data in three different filters to produce colour images of nearby, visually beautiful galaxies that will be used for outreach.

Demographics

The school was open to PhD and advanced Master’s students worldwide. We received a total of 170 applications, evenly distributed between male and female applicants, demonstrating the high demand from the astronomical community for such educational programmes. As part of the application, the applicants were asked to provide an anonymised summary of their background in astronomy, their motivation to participate in the school, and a letter of reference from their supervisor.

Figure 3. La Silla!

Figure 3. Getting ready for the hike to the petroglyphs.

The student selection was done by the tutors; the first round of the selection of the participants was a blind process, meaning that the tutors were not provided any personal information about the applicants, such as their names, gender, nationality, etc. Instead, the applications were evaluated purely on the basis of each student's background in astronomy, their motivation to participate the school, and the potential gain for their career from participating in the school. In a second round, the reference letters provided by their supervisors were considered for the highest-ranked candidates. Individual requests for financial travel support did not have any influence on the selection process. The final selection resulted in a diverse group consisting of 12 female and eight male students based at institutes in Argentina (3), Austria (1), Brazil (3), Chile (2), Germany (2), Ireland (2), Mexico (1), Portugal (1), Spain (1), the UK (2) and the US (2).

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References

Buzzoni, B. et al. 1984, The Messenger, 38, 9

Mayor, M. et al. 2003, The Messenger, 114, 20

Links

[1] Workshop programme: https://www.eso.org/sci/meetings/2025/lasilla_school2025/program.html