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Report on the

La Silla Observing School 2024

held at ESO Santiago office and La Silla observatory, Chile, 12–23 February 2024

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The La Silla Observing School is a series of training workshops in the use of telescopes and astronomical instruments for students and early-career researchers in astronomy. Following schools in 2016, 2018 and 2020, the fourth La Silla Observing School was held over two weeks in February 2024 and was hosted by ESO's Office for Science and the La Silla Observatory. A total of 20 MSc students, PhD students and postdoctoral researchers from South and North America, Europe and Australia participated. They attended lectures on various observing strategies and astronomical instrumentation, on diversity, equity and inclusion in astronomy, as well as soft skills. For the hands-on part at the observatory, the students were supervised by five tutors. Four small research projects were offered, using three telescopes and four instruments. The students in each research group went through the full process of defining and discussing the observing strategies, conducting the observations, reducing and analysing the data and finally presenting the results to the scientific community at the ESO Vitacura offices. Given the high demand from the astronomical community for such educational programs, ESO is currently exploring the possibility of offering the La Silla Observing School on a yearly basis. Accordingly, the next school is foreseen for February 2025.

Introduction

First held in 2016, ESO has hosted four observing schools at La Silla during the summer break in the southern hemisphere, aimed at senior master's students and early doctorate students. The main goal of these observing schools is to give the participants the opportunity to gain experience of observations, instrumentation background, and the entire cycle from planning observations, carrying them out, data reduction and analysis to the presentation of the results. This is becoming increasingly 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.

The La Silla Observing School 2024[1] (Figure 1) was open to students worldwide; the students were asked to pay for their travel to Santiago themselves, 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 started on Monday

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

12 February with a four-day workshop at the ESO premises in Vitacura. The lectures covered ESO in general, astronomical instrumentation, observing preparation and strategies, and a discussion of diversity, equity and inclusion in astronomy. In addition, on three afternoons the tutors introduced the students to the research projects and prepared the upcoming observations with them. On the Thursday evening, we celebrated the end of the workshop with a barbeque in the garden of the ESO premises.

On Friday 16 February the students and tutors travelled to La Silla by bus, and arrived there just in time for the wonderful sunset (Figure 2). 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 got acquainted with the southern night sky, which most of the students had never seen before. Saturday was reserved for a visit to the 2.2-metre ESO/MPG telescope and final observation preparations, and a small group of students and tutors hiked to the ancient petroglyphs in the valley behind the 3.6-metre telescope (Figure 4). On Sunday afternoon the students visited the NTT and the 3.6-metre telescope (Figure 3), and after sunset they began the observations using the High Accuracy Radial velocity Planet Searcher and the Near InfraRed Planet Searcher (HARPS+NIRPS; Mayor et al., 2003; Bouchy et al., 2017) on the 3.6-metre telescope, the ESO Faint Object Spectrograph and Camera 2 (EFOSC2; Buzzoni et al., 1984) on the New Technology Telescope (NTT) and the Fiber-fed Extended Range Optical Spectrograph (FEROS; Kaufer at al., 1999) on the 2.2-metre ESO/MPG telescope. During the first day and a half the weather conditions were good; however, the last night was mostly lost because of clouds.

On Wednesday 21 February, the students returned to Santiago with happy memories and data in hand. The last days in Santiago were dedicated to data analysis and lectures on career prospects and soft skills, before the students presented their scientific results to the public on Friday 23 February (Figure 5). The successful conclusion of the school was celebrated with wine & cheese in the ESO garden.

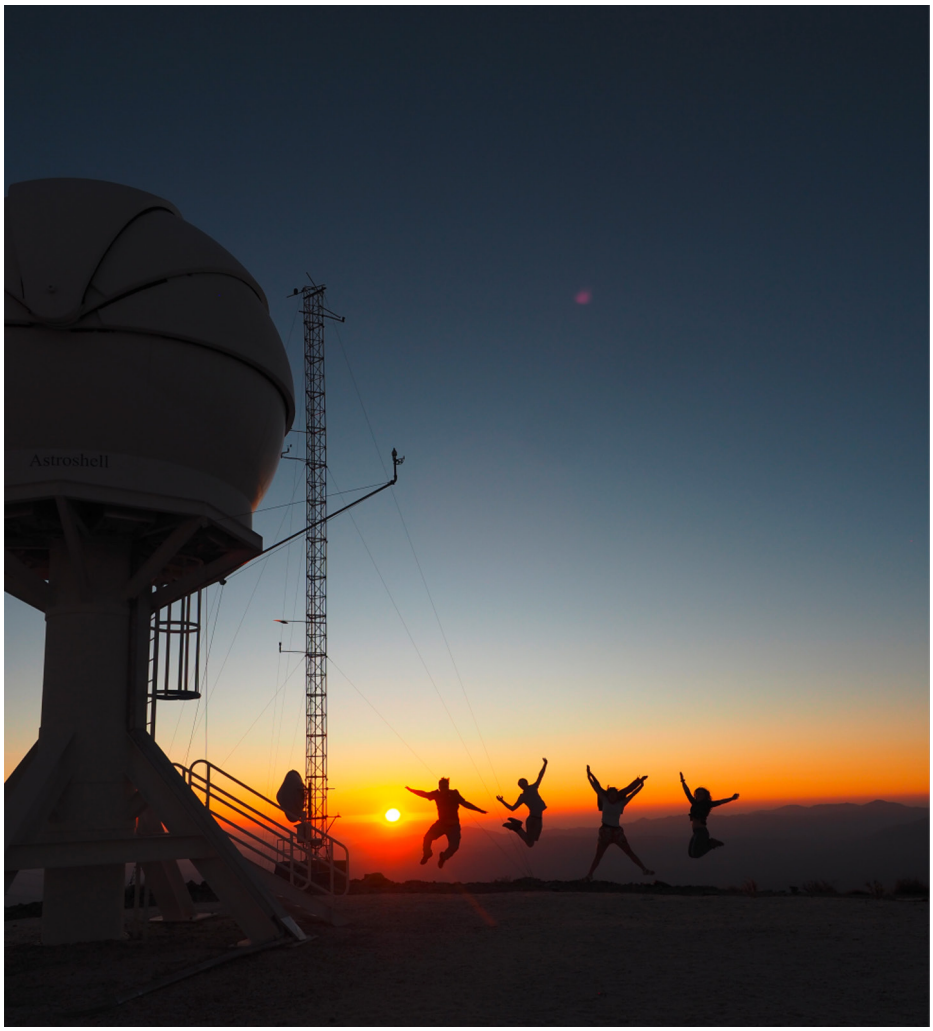

Figure 2. Happy students on La Silla!

The two weeks of the school were intense for both the tutors and students — and immensely rewarding. The amount of work carried out over the two weeks was impressive and the organisers were pleased to receive very positive feedback from the students.

The working groups

Four small research projects were developed by five experienced astronomers working at ESO and at Universidad Diego Portales.

The goal of the project led by ESO staff astronomer Robert J. De Rosa was to measure the light curves and radial velocities of a small number of short-period eclipsing binaries (EBs) using EFOSC2 on the NTT and FEROS on the 2.2-metre telescope. The participants filtered a large catalogue of EBs using the orbital ephemerides to predict the times of primary and secondary eclipse, and the time when the velocity difference is highest. The observations were prepared using the Exposure Time Calculator for both instruments, and an observing plan was drawn up given their time-critical nature. In parallel to taking the observations with EFOSC2 and FEROS, the students developed a pipeline to perform differential photometry on the EFOSC2 data and were easily able to detect the primary and secondary eclipses of the four EBs. Their light curves were then combined with literature data to model the geometry of the systems using the PHOEBE eclipsing binary modelling software. Unfortunately, the four systems

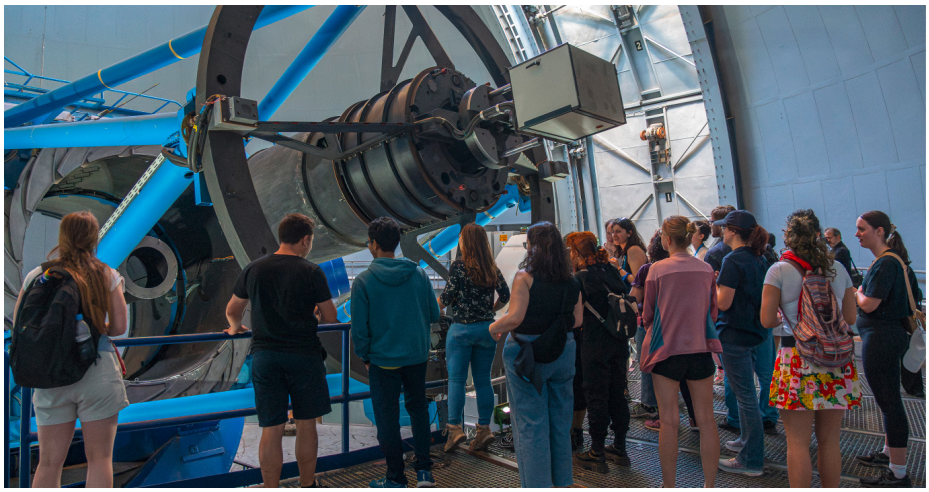

Figure 3. The participants on a tour of the La Silla 3.6-metre telescope.

were very chromospherically active given their short orbital period and it was not possible in the short timeframe available for the analysis to determine their spectroscopic orbits. However, in one system a third component on a long orbital period was discovered thanks to the linear variation of some sharp specral lines evidently not caused by either of the eclipsing components.

The project led by Evelyn Johnston, a professor at Diego Portales University, aimed to explore the properties of galaxies along the Hubble Sequence. The students selected five galaxies with elliptical, lenticular and spiral morphologies, and observed these galaxies with long-slit spectroscopy and multi-waveband imaging using EFOSC2 on the NTT. Once reduced, they binned the spectra and measured the kinematics along the major axes of each galaxy. They saw that the spiral and lenticular galaxies showed clear rotation curves while the elliptical galaxies had little or no rotation, as expected. This result then led to discussions of the dark matter content within galaxies to explain the rotation curves. With the imaging data they saw how the galaxies change in different filters, such that the bulges of spirals and lenticulars are more prominent in the redder filters while the discs and spiral arms dominate in the blue. This finding led to discussions of the stellar populations in different galaxies and their components.

The project led by ESO fellow Francesca Lucertini and ESO staff astronomer Luca Sbordone aimed at deriving stellar atmospheric parameters and detailed abundances in FGK stars from high-resolution spectra. The targets were selected from Gaia photometry. The two groups of four students determined the best exposure times, and prepared and executed the observations with HARPS/NIRPS and FEROS. Fourteen targets were observed with both instruments with a typical signal-to-noise ratio between 50 and 100. Owing to an issue with the FEROS pipeline, only the HARPS spectra were used in the data

Figure 4. One of the highlights was a hike to the ancient petroglyphs of La Silla.

Figure 5. On the last day the different groups presented their work to the audience at ESO Vitacura.

analysis. The students then derived atmospheric parameters and detailed abundances using the MyGIsFOS code. The targets turned out to be mostly moderately metal-poor ([Fe/H] ~ –0.5) K giants, with a few G dwarfs. The most metal-poor star had [Fe/H] = –1.4. All primary nucleosynthetic channels were represented with abundances for about 30 ions. The students then compared the derived abundances with available literature trends for the different elements, and discussed the implications of their findings.

In the exoplanet atmospheres project group led by ESO staff astronomer Elyar Sedaghati, the participants first searched for extra-solar planets with primary transits occurring on either of the two observing nights allocated on the 3.6-metre telescope. Of all the possible candidates two systems were deemed to possess atmospheres extended enough to be detectable. The transit events on the two nights were observed with the HARPS and NIRPS high-resolution echelle spectrographs. The data were reduced using the dedicated ESO pipeline recipes, run on the esoreflex platform. After correction for the radial velocity variations in the stellar spectra due to the reflex motion of the star around the centre of mass of the system, the out-of-transit spectra were combined to create a stellar template. This was used to remove the stellar signature, and then the residuals were shifted to the planetary rest-frame. These were then combined to create the planetary transmission spectrum. The group inspected this spectrum, cross-matching any possible absorption lines with atomic and molecular databases. They also detected a surprisingly polar orbit for one of the systems, via the modelling of the Rossiter-McLaughlin effect.

Demographics

The school was open to students and early-career postdocs worldwide. We received a total of 140 applications evenly distributed between male and female applicants, of whom nine were MSc students, 114 PhD students and 17 postdoctoral researchers. Students applied from institutes based in Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Chile, Czechia, Denmark, Estonia, France, Germany, India, Iran, Italy, Kazakhstan, the Netherlands, Poland, Spain, Sweden, the UK, and the USA. As part of the application, the students were asked to provide a summary of their background in astronomy, their motivation to participate in the school, and a reference letter from their supervisor.

The selection committee did not have personal information about the applicants, such as gender, nationality, etc., and the applications were evaluated purely on the basis of the students' background in astronomy, their motivation to participate in the school, their potential career gain from participating in the school, and in a later step, on the reference letters provided by their supervisors. Individual requests for financial travel support did not have any influence on the selection process. The final selection resulted in 18 female and two male students based at institutes in South America, Europe and Australia; one of the students was a senior MSc student, 18 were PhD students and one was a young postdoctoral researcher who had just defended their thesis.

Acknowledgements

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Links

[1] Workshop programme: https://www.eso.org/sci/meetings/2024/lasilla_school2024.html