possibility of making queries in a programmatic way. Lodovico Coccato gave a demonstration of how to reduce data with EsoReflex, as well as how to use the software Molecfit to remove atmospheric signatures from science spectra. Finally, John Pritchard showed how to modify EsoReflex workflows to tailor them to the user's aims.

One full day of the workshop was dedicated to hands-on sessions. In the first part, on Wednesday morning, three parallel tutorial sessions were held, during which participants were guided in using EsoReflex for three instruments, MUSE, the Ultraviolet and Visual Echelle Spectrograph (UVES) and X-shooter. These instruments were chosen as the majority of the participants expressed an interest in them when registering for the workshop. In each case, after a first step-by-step demonstration, the participants could choose to reduce a set of data provided by the organisers or to work on their own data. Two or three tutors were available for each session, helping and advising the participants in this endeavour.

In the afternoon, participants were able to interact with ESO staff and discuss topics of their choice, including help with data reduction, help with proposal writing, finding information on ESO web pages, installing ESO software, help with observation preparations, and using the Science Archive either to access data or to return reduced data to the archive. At registration, participants were asked to indicate the area of the programme (proposal preparation, observing strategies and tools usage, data reduction) they would like to explore further. Participants were then split into small groups with overlapping interests, or had scheduled one-to-one sessions with the ESO staff member who was best placed to help with their specific topic.

At the end of the workshop, the organisers asked participants to provide feedback, and an extremely large number of people, more than 50% of the attendees, did so. The feedback was unanimously positive with all respondents saying they would recommend such a workshop to their colleagues. A few suggestions for similar future workshops were also received, with opinions differing, depending on the previous experience and knowledge of participants. It is our aim to repeat this workshop approximately every two years to promptly address questions from the continuous flow of new users of ESO facilities.

Acknowledgements

We would like to thank Véronique Ziegler for her help with the practical organisation, Stuart Ryder from the International Telescopes Support Office (ITSO) for setting up the remote participation via Zoom, and Sandor Horvath and the Information Technology (IT) staff for their help during the workshop. We most warmly thank all speakers and tutors for the great effort they made to provide clear and instructive talks or demonstrations and to efficiently help the participants in individual sessions.

Links

[1] All presentations as well as some of the video recordings are available on the workshop web page: https://www.eso.org/sci/meetings/2018/Users-Workshop/program.html

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DOI: 10.18727/0722-6691/5084

Report on the

ESO–NEON Observing School at La Silla Observatory

held at ESO Vitacura, Santiago & La Silla Observatory in Chile, 18 February–2 March 2018

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During the two weeks between 19 February and 2 March 2018, the Office for Science at Vitacura and the La Silla Observatory were the hosts of the second ESO/NEON (Network of European Observatories in the North) La Silla Observing School. Thanks to the generous funding from ESO, the Optical Infrared Coordination Network for Astronomy (OPTICON), and the La Silla Observatory, 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 ESO tutors. The students prepared and carried out complex observations, reduced and analysed the data, and finally presented the results to the ESO scientific community at Vitacura. In addition to learning about the observing techniques that were used during the school, the students also attended several lectures covering the current and future capabilities of the Atacama Large Millimeter/submillimeter Array (ALMA), the telescopes at Paranal, and the Extremely Large Telescope (ELT), as well as talks on what makes a good scientific presentation, time management, effective proposal writing, and career choices.

Over the course of three nights at La Silla, the students used the ESO Faint Object Spectrograph and Camera (EFOSC2) and

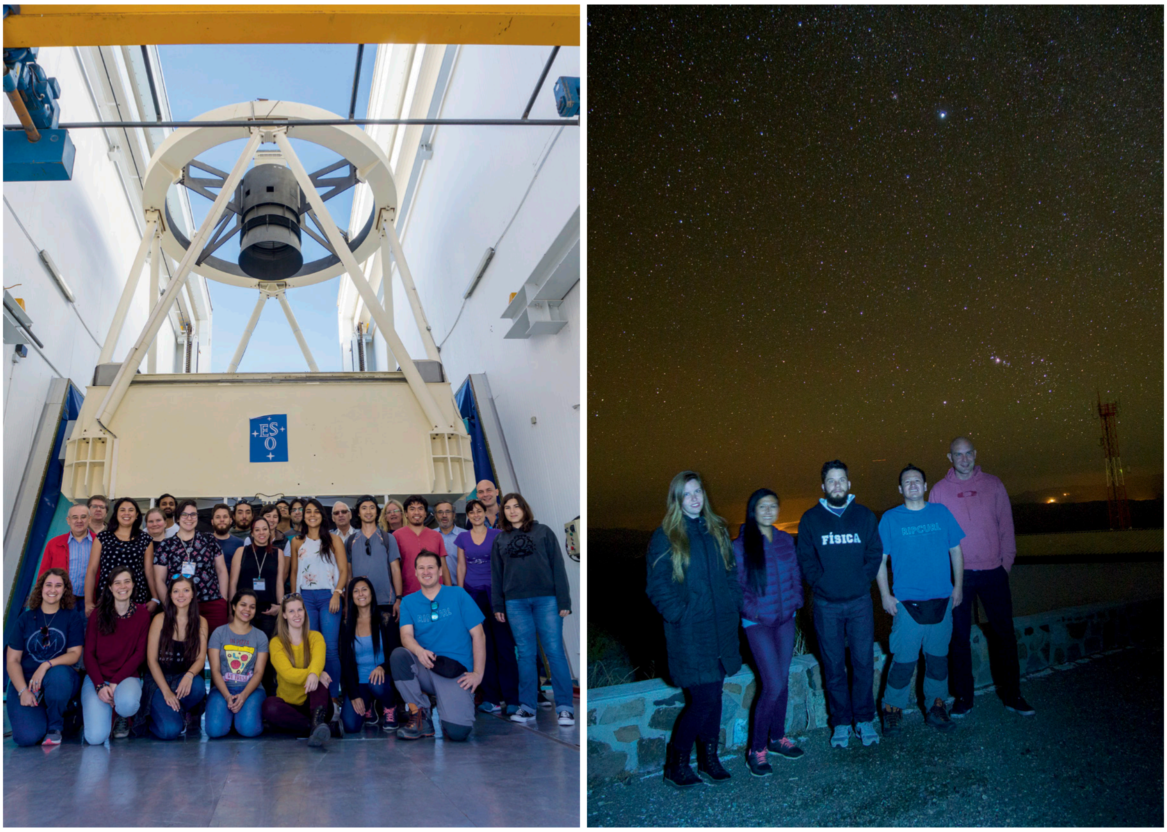

Figure 1. Left: The articipants, organisers, and tutors in front of the NTT telescope. Right: Giacomo Beccari´s group in front of their target.

the infrared spectrograph and imaging camera SOFI attached to the New Technology Telescope (NTT) as well as the Danish telescope, equipped with the Danish Faint Object Spectrograph and Camera (DFOSC). Divided into five groups, the students worked on a variety of astrophysical topics, supported by Heidi Korhonen at the Danish telescope, and by Monica Castillo and Ariel Sanchez at the NTT[1].

Giacomo Beccari guided a group studying Hα-excess sources in the Orion nebula and in Chamaeleon. In particular, the students acquired low-resolution spectra with EFOSC2 to study the equivalent width of the Hα emission line of 12 young T Tauri stars in Orion. Such emission in young stars is typically used to identify ongoing accretion from a protoplanetary disc. The measurements allowed the students to confirm the nature of the accretors in the observed objects spectroscopically. Similarly, DFOSC was used to perform broad-band *V*, *R*, *I* and narrow-band Hα imaging of young stars in Chamaeleon. The images, targeting a number of T Tauri stars with Hα emission studied by the Gaia–ESO

Figure 2. Students getting real-life experience at the consoles of the NTT (left), and the Danish telescope (right).

Figure 3. An interesting part of the school is the scheduling of the different programmes that compete for observing slots. Here the groups are trying to coordinate their observations in the La Silla School "War Room".

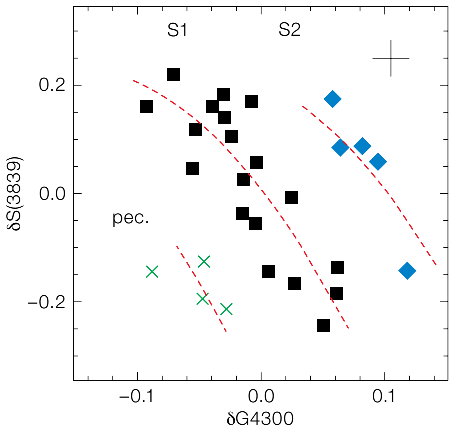

Figure 4. Distribution of CN and CH differential indices for Red-Giant Branch (RGB) stars of the globular cluster NGC 3201 determined by Bruno Dias's group in the 2016 school. Three groups are identified: the main, well-populated sequence 1 (S1); a second, less populated sequence 2 (S2); and a group of CN-weak/CH-weak peculiar stars (pec). Mean error bars are displayed in the top right corner. The dashed line was fitted to S1 stars and shifted by 1 magnitude in CH to match the S2 and pec stars (Dias et al., 2018).

survey[2], were used to confirm their nature photometrically (i.e., whether or not they are accretors).

Henri Boffin led a group studying planetary nebulae, using both EFOSC2 and DFOSC to discover the binary stars that lurk at the centre of these majestic and colourful cosmic bubbles. The students were able to obtain the radial velocity curve and the *BVRI* photometric light curves of the binary star inside the planetary nebula DS1, and use these to determine the parameters of the binary. They also tried to uncover new binaries in some other planetary nebulae, providing useful upper limits as well as impressive colour images showing the intricate morphology of these objects. They finally derived the abundances in one of the planetary nebulae.

Valentin Ivanov's group followed the transit of two exoplanets: WASP-43b with SOFI, and WASP-19b with DFOSC. The data were processed and both transits were successfully detected. Light curves were fitted with publicly available transit analysis tools and various parameters of the planets were measured. The students also monitored the behaviour of the binary brown dwarf LUH 16AB over one night.

Eleonora Sani's group used SOFI to obtain the spectra of two quasars falling in the redshift range 2.5–3.5, i.e., at the peak of activity of cosmic active galactic nuclei. The rest-frame optical emission, redshifted into the *H*- and *K*-bands, was observed by means of low-resolution spectra. While the observation of the nearer quasar was affected by technical problems, the quality of the data for the $z \sim 3.5$ source allowed the complex profile of the emission lines to be decomposed into narrow and broad components. The students were therefore able to spot the signature of the broad-line region and to measure its size and the gas velocity dispersion, allowing them to make an estimate of the mass of the supermassive black hole of 2–3 10^8 solar masses.

Linda Schmidtobreick's group worked on the spectral classification of variable star candidates; low-resolution optical spectra of the candidates were obtained with EFOSC2 and cross-correlated with catalogue spectra to obtain the spectral types of the objects. Together with externally provided light curves, the variability type of each object was discussed.

In addition to the above projects, low-resolution spectroscopy of three transient targets was obtained with EFOSC2. Two of these objects were classified as Type Ia supernova and the third one as a galactic nova. The students contributed to writing the corresponding astronomer's telegrams. These observations, together with a specific lecture about the "transient sky", aimed to draw the attention of the participants to this increasingly important topic, given the development of gravitational wave and neutrino detectors and the future arrival of the Large Synoptic Survey Telescope (LSST) in the southern hemisphere.

An interesting aspect of these observing schools is that they can lead to publications, even though this is not a requirement. Bruno Dias was a tutor at the school in 2016, and led a group which carried out multi-object spectroscopy using EFOSC2 to study abundances in globular clusters. He recently published a paper with his students entitled "Galactic or extragalactic chemical tagging for NGC3201? Discovery of an anomalous CN-CH relation" (Dias et al., 2018). Bruno describes the work as follows:

"Globular clusters (GCs) are known to host stars with different light-element chemical abundances, such as C, N, O, Na, Al. In particular, the distributions of

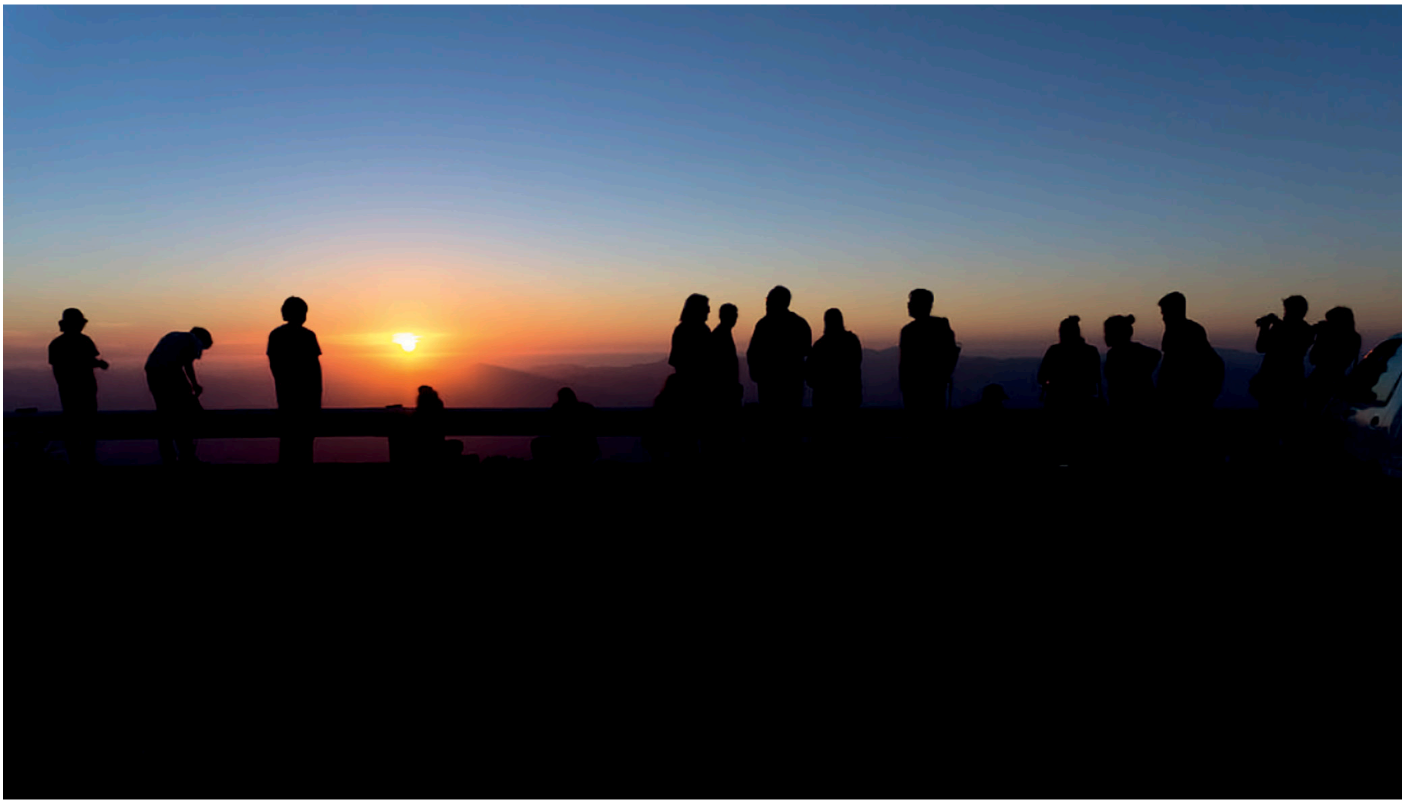

Figure 5. The students at the school, waiting for a green flash at the end of the first day.

C-N, Na-O are anti-correlated in typical GCs. A few anomalous clusters present multiple sequences of CN-CH anti-correlation, a proxy for C-N. These special GCs also share a few other odd characteristics; this is often interpreted as these GCs having originated in dwarf galaxies that were captured and destroyed by the Milky Way. Our results show that NGC 3201 presents multiple sequences of CN-CH, however it does not show other anomalous characteristics. We have therefore discovered the first GC that is neither completely typical nor completely anomalous, which means that the extra-galactic origin scenario needs revision, and likely requires new stellar evolution models that can better explain how the CN-CH anti-correlation forms."

The spirit of the school was accurately summarised by an email from one of the students at the school, Gabriela Navarro from Universidad Andrés Bello (UNAB) in Santiago:

"I want to thank the organisers and tutors of the summer school. Both the talks and the research projects were tremendously interesting, and I am sure they will be very useful in the future. I also want to mention what was said among the students, that despite the level of stress generated, the school exceeded the expectations. This type of school is extremely useful for any astronomer regardless of the area chosen in the future. All the activities, from the talks to the visit to the observatory motivate us even more than we already are to continue doing research in our PhD."

It was intense and exhausting but we all feel that the process was well worth the effort. With this and the previous version of the school we have reached a total of 40 students who are now familiar with the way ESO does astronomy at the observatories in Chile. More importantly, we have been able to share our passion and, hopefully, helped the next generation of astronomers.

Acknowledgments

We would like to express our gratitude to ESO's Director General, the La Silla Paranal Observatory (LPO) Director and the Director for Science, without whose unconditional support this school would not have materialised. We would also like to thank the invited speakers at the school: Michele Cirasuolo, Alain Gilliote, Pascale Hibon, Yara Jaffe, Bruno Leibundgut, Adele Plunkett, Alain Smette and Frédéric Vogt. Hans Zinnecker was a special contributor to the school, first with a lecture on star formation, and second, contributing to lively discussions and debates about the different topics covered — heartfelt thanks to him! The logistical aspects of the school were handled by Paulina Jirón and María Eugenia Gomez, to whom we extend our deep gratitude.

References

Dias, B. et al. 2018, arXiv:1803.05124

Links

[1] ESO–NEON Observing School: https://www.eso.org/sci/meetings/2018/lasilla_school2018.html
[2] Gaia–ESO Survey: https://www.gaia-eso.eu/