Camping Under the Stars: The ESO Astronomy Camp 2013

Davide Cenadelli
Osservatorio Astronomico della Regione Autonoma Valle d'Aosta
davide.cenadelli@unimi.it

Cristina Olivotto
Sterrenlab
cristina@sterrenlab.com

Oana Sandu
European Southern Observatory
osandu@partner.eso.org

Lars Lindberg Christensen
European Southern Observatory
lars@eso.org

Keywords
Camps, Spectroscopy, Multicultural, Didactics of Astronomy, Astronomical Observatory of the Aosta Valley

Summary

The end of last year saw the first ESO Astronomy Camp take place, held at the Astronomical Observatory of the Autonomous Region of the Aosta Valley. The aim of this report is to give a short overview of the camp programme and focus on one of its workshops — the stellar spectroscopy laboratory — as a case study.

Introduction

From 26 to 31 December 2013, the picturesque alpine village of Saint Barthélemy in the Italian Western Alps, played host to 56 secondary school students keen to learn more about astronomy. This was the first ESO Astronomy Camp, held at the Astronomical Observatory of the Aosta Valley.

The winter astronomy school explored the theme of the visible and the invisible Universe through lectures, hands-on activities, and night-time observations with telescopes and instruments. One of these activities was a laboratory on stellar spectroscopy which will be further explored through this report, looking at its aims, challenges and achievements.

The observatory

The location of the first ESO Astronomy Camp was chosen based on several factors, with the favourable conditions for night-time observations being among the most important. The sky in Saint-Barthelemy has almost negligible light pollution. The nearby city of Aosta is relatively small and its lights are concealed by the nearby mountains, and the larger but much more distant city of Turin — which lies 70–80 kilometres away — has little effect, as, although it causes some slight light scattering in the lowest atmospheric layers, it is hidden by the 3000-metre peaks in the south-eastern area of the Aosta Valley. The alpine location also means that crystal-clear weather is a common occurrence, especially during the winter season.

The extensive experience of the observatory staff was also a considerable factor. They have developed and implemented educational activities that make use of the seven 25-centimetre reflecting telescopes placed on the panoramic didactical terrace of the observatory. In addition, the location is well connected, with a handy motorway connection running from the international airport of Milan Malpensa to Nus, a town 20 minutes from the observatory.

The participants

The camp brought together 56 students — 29 girls and 27 boys — aged 15 to 18 years and from 18 different countries. Most were from the ESO Member States, but not all. The international aspect was greatly appreciated by the participants who had the opportunity to meet their peers from different countries and cultures with the same interests and passions. The command of

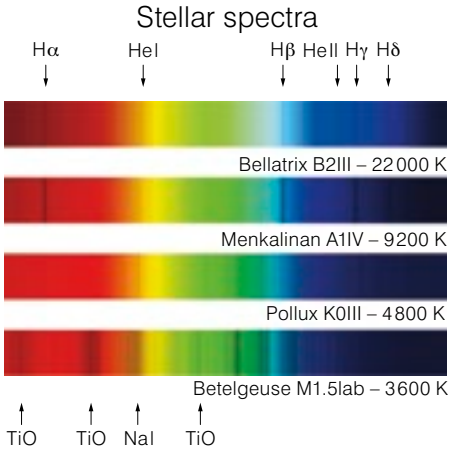

Figure 1. Spectra taken at the Camp arranged along the Harvard spectral sequence. Below each spectrum the name of the star and its spectral classification are indicated. The suffix "I" after the symbol of an element means "neutral", the suffix "II" means "singly ionised". The main lines and bands are highlighted.

Figure 2. The students at the ESO Astronomy Camp 2013.

English as the common language at the camp was quite good and did not pose any problems to the team.

The challenges

The main challenge for the organisers was to tune the level of the activities and lectures to make them enjoyable and challenging for everybody, notwithstanding the different backgrounds with regard to school curricula, age and personal interest. For this reason, students were invited to give continuous feedback to help the organisers to adjust the activities based on suggestions and expectations. Lecturers used appropriate, but simple terminology, provided full explanations of all physical concepts which were introduced — even the most basic ones — and illustrated the concepts with examples from everyday experience.

Visiting astronomers, observatory staff and supervisors spent all their time at the camp with the participants. This meant that the participants with the most advanced knowledge of physics and astronomy could go further with some specific topics and discuss them with the astronomers during lunch or free time.

The programme

The programme aimed to introduce the students to activities related to research processes in astronomy and science in general. Besides leisure and sport activities (about three hours per day), the schedule included:

- Lectures and theoretical exercises led by visiting astronomers and observatory staff: 45%;
- Sky observations with naked eye and telescopes: 25%;
- Data analysis including stellar spectroscopy and measurement of the angular response of an antenna: 15%;
- Laboratory activities for measuring the angular response of an antenna: 10%;
- Group presentations on art and science and the measurement of the angular response of an antenna: 5%.

The theme of the camp, The Hidden Universe, was explored by lectures and activities dedicated to optical, infrared, radio, ultraviolet and X-ray astronomy plus an introduction to the multi-wavelength Universe.

The stellar spectroscopy activity

The stellar spectroscopy laboratory covered the topic of optical astronomy from different perspectives: theoretical, including simple calculations and exercises; practical, through night-time observations with telescopes and use of a spectrograph and associated software; data analysis and discussion of errors. The objectives of the laboratory were to introduce the students to the importance of spectroscopy in astrophysics and to learn both how to take a spectrum and how to extract information about the star's temperature by analysing its spectral lines.

Stellar spectroscopy is strictly related to stellar colours and so can be appreciated at the telescope and, to some extent,

Figure 3. Telescope observations at the observatory.

Figure 4. The astronomical observatory of the Aosta valley at night.

even with the naked eye. So, the laboratory began with the observation of late autumn and winter constellations, identifying stars of different colours. Students were then organised into small groups and instructed how to operate a spectrograph and a CCD camera attached to one of the didactical telescopes. They could then capture the spectra of several "favourite" stars, among which were Aldebaran, Betelgeuse, Dubhe, Mirphak and Sirius.

These spectra were wavelength-calibrated thanks to the prominent Balmer lines visible in the spectrum of one star — Menkalinan in the constellation of Auriga — used as a calibrator. The students could appreciate the differences between spectra and learnt to pick out diagnostic lines in order to relate them to stellar temperatures.

The morning after the observation was devoted to the stellar classification contest. Teams of students competed to classify the spectra according to the Harvard Classification Scheme. There were no awards for winners, except for the deserved acknowledgement, but instead there was a special prize for the team finishing last — the so-called Antares prize. The award involved the losing team taking the spectrum of the red supergiant Antares, which by the end of December rises a couple of hours before sunrise. In the end the prize was not awarded, even though some of the more enthusiastic students would have loved to wake up in the night for this very special observation.

Conclusion

The first ESO Astronomy Camp had some very positive outcomes. There were 170 applications from 24 countries, the informal and formal feedback from participants and their families has been very good, as were the lecturers' comments. We feel that the camp has been a highly formative learning experience for the participants, facilitated by the enthusiasm of the students, the excitement of the international environment and the quality of the social and sporting activities.

Students greatly appreciated the variety in the professional staff, both visiting and resident, and of the activities, which were not limited to face-to-face lessons and simple telescope observations. We feel as well that the number of practical activities and sky observations should increase, and the challenge for future similar experiences will be to reduce the number of hours of theoretical lessons — which are nonetheless fundamental to appreciate and actively contribute to practical activities — and invest in technical equipment to work in smaller groups, thus giving everybody the opportunity to spend more time on the instruments.

We hope that future camps will build on the success and lessons learnt from this first case. The ESO Astronomy Camp 2014 is already being planned and will take place from 26 December to 1 January 2015 in Saint Barthelemy, Italy. The theme of the camp will be Distances in the Universe.

Acknowledgements

Besides the main organisers ESO (www.eso.org), Sterrenlab (www.sterrenlab.com) and the Observatory of the Aosta Valley (www.oavda.it), several partners contributed to the success of the camp by offering bursaries to selected participants: Instituto Nazionale di Astrofisica and University of Milan (Italy), Polish Astronomical Society and Urania — Postępy Astronomii and Urząd Marszałkowski Województwa Kujawsko-Pomorskiego (Poland), Ciência Viva (Portugal), Sociedad Española de Astronomía (Spain) and Université de Gèneve (Switzerland).

Special thanks go to the camp supervisors: Emily, Koen, Lorenzo and Mariona; to the camp resident and visiting astronomers: Davide Cenadelli (Astronomical Observatory of the Aosta Valley), Enzo Bertolini (Astronomical Observatory of the Aosta Valley), Lars Lindberg Christensen (ESO), Andrea Bernagozzi, Paolo Pellissier and Paolo Recaldini (Astronomical Observatory of the Aosta Valley), Anna Wolter (ESO/INAF), Juan Fabregat (University of Valencia), Aniello Mennella and Paola Battaglia (University of Milan); and the 56 students who impressed us with their motivation, intelligence and enthusiasm.

Links

Sterrenlab website: http://www.sterrenlab.com/camps/eso-astronomy-camp-2014/

Biographies

Davide Cenadelli graduated in physics and was awarded a PhD at Milan University. His interests span stellar astrophysics, spectroscopy, and the history and philosophy of science. He is currently part of a research group at the Astronomical Observatory of the Autonomous Region Aosta Valley. The group is involved in the quest for exoplanets around red dwarfs in the galactic neighbourhood.

Cristina Olivotto graduated in physics at the University of Milan and was awarded a PhD in the history of physics. After graduation, she started to work in the field of science communication and education at the Astronomical Museum of Milan and as a lyceum teacher of physics and mathematics. She worked at the European Space Agency for four years before founding Sterrenlab in 2011.

Oana Sandu works as the community coordinator for ESO's education and Public Outreach Department (ePOD). She is responsible for the promotion of outreach products or events and the social media presence of both ESO and ESA/Hubble. With a degree in Communication and Public Relations and a Master's Degree in Marketing, she worked for two years in a leading PR agency in Eastern Europe.

Lars Lindberg Christensen is a science communication specialist, who is Head of the ESO education and Public Outreach Department (ePOD) in Munich, Germany. He is responsible for public outreach and education for the La Silla-Paranal Observatory, for ESO's part of ALMA and APEX, for the European Extremely Large Telescope, for ESA's part of the Hubble Space Telescope and for the IAU Press Office.