The 10th VLTI School of Interferometry: Premiering a Fully Online Format

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The 10th VLTI School of Interferometry: Premiering a Fully Online Format

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Very Large Telescope Inerferometer (VLTI) schools have nearly a 20-year history and have trained a significant fraction of today's optical interferometrists who use high-angular-resolution techniques on a regular basis. Very early in the development of the VLTI, training was identified by the community as a necessary tool, as the expertise in optical long-baseline interferometry was limited to a few groups in France and Germany (in those early years the UK was not an ESO member state). The first VLTI school took place in Les Houches, France, in 2002 and since then VLTI schools have been organised in several locations (France, Germany, Hungary, Poland, Portugal) roughly every two years, the previous one being held in 2018 in Lisbon. The VLTI schools are funded and coordinated through the European Interferometry Initiative (Eii).

Very Large Telescope Interferometer (VLTI) schools[1] (Garcia, 2009) have been held every two years since 2002, the 9th being in 2018 in Lisbon (Garcia et al., 2018). Here we report on the 10th VLTI school[2], which was organised by the J.-L. Lagrange laboratory in Nice, and had its focus on the latest VLTI instrument: the Multi-AperTure mid-Infrared SpectroScopic Experiment (MATISSE; Lopez et al., 2021). MATISSE is a four-beam combiner operating in the mid-infrared, from 2.8 to 13 microns, with an emphasis on interferometry for planetology. The GRAVITY instrument and other instruments from the Center for High Angular Resolution Astronomy (CHARA) observatory were also presented. It was aimed at graduate and PhD students, as well as postdocs, who wish to learn the theory and practicalities of optical and infrared interferometry. It was originally intended to hold the school in June 2020, in the technology park named Sophia Antipolis, near Nice in France, a beautiful location in a pine forest, just 10 minutes from sandy beaches. However, the COVID-19 pandemic situation forced us to shift the date, first to September 2020 and finally to June 2021. Given the unfavourable evolution of the global pandemic situation in early 2021, we finally decided to switch to a 100% online format with lectures and tutorials.

To adapt to the new situation we had to swiftly reorganise the school schedule, with the expertise and support of the technical group of the Jean-Marie Mariotti Center (JMMC), and we accepted the challenge of hosting 100% online practice sessions with students scattered all over the world. All the school's teachers accepted the added complication of giving their lectures either prerecorded or live (with recorded videos[3]). Finally, to allow students from most countries to attend the school at decent hours, we extended its duration to 2 weeks and limited the mandatory online presence to 4 hours a day.

The school took place online in a specially tailored Gather (gather.town) space for direct interactions (chat, voice and video) and practice sessions, combined with Zoom sessions for the lectures, and the Nuclino live wiki-like environment for the exchange of information and files (see Figure 1). On the technical side, the most challenging part was the setup of 21 virtual machines for the students to run all the practice sessions, the students being typically in groups of three. It was possible thanks to the strong involvement of the JMMC technical group and the resources of the Grenoble Alpes Research Scientific Computing and Data Infrastructure (GRICAD) service.

There were 63 registered students (participating in both the lectures and the practice sessions) plus 59 free listeners (following the lectures only), 45 of whom were MSc or PhD students, including 35 female participants. The registered students originated from 23 different countries (see Figure 2): nine from France, six each from Chile, Poland and the USA, five from Germany, four each from Italy and Switzerland, three from Belgium, two each from Egypt, Great Britain, India, the Netherlands and Turkey, and one each from Brazil, China, Greece, Ireland, Iran, Iraq, Malta, Peru, Spain and Sweden. That balance changes a bit when account is taken of the free listeners, as there was a massive participation from Chile and China at the lectures. The interferometric expertise of the students was diverse, allowing students to learn from each other too. The number of connections to the lectures was around 60 on average with peaks up to 86.

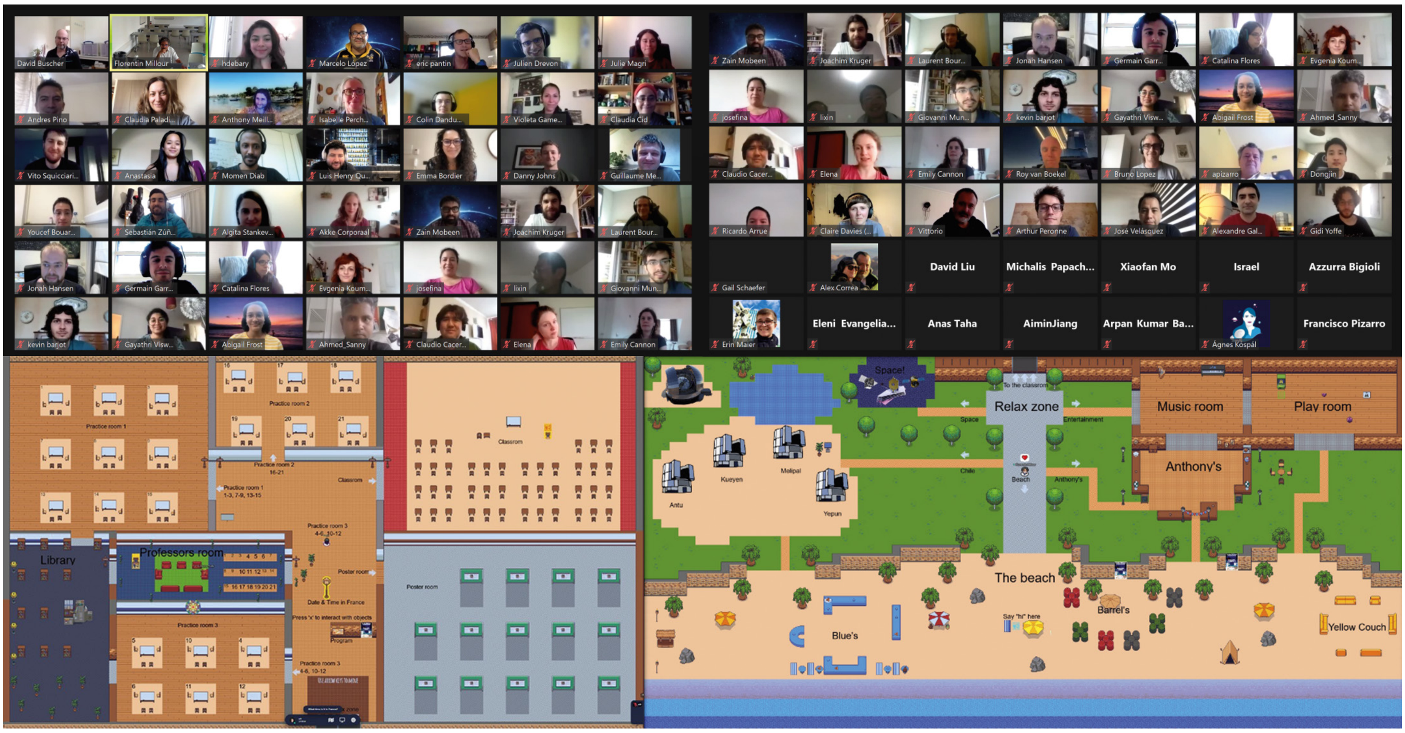
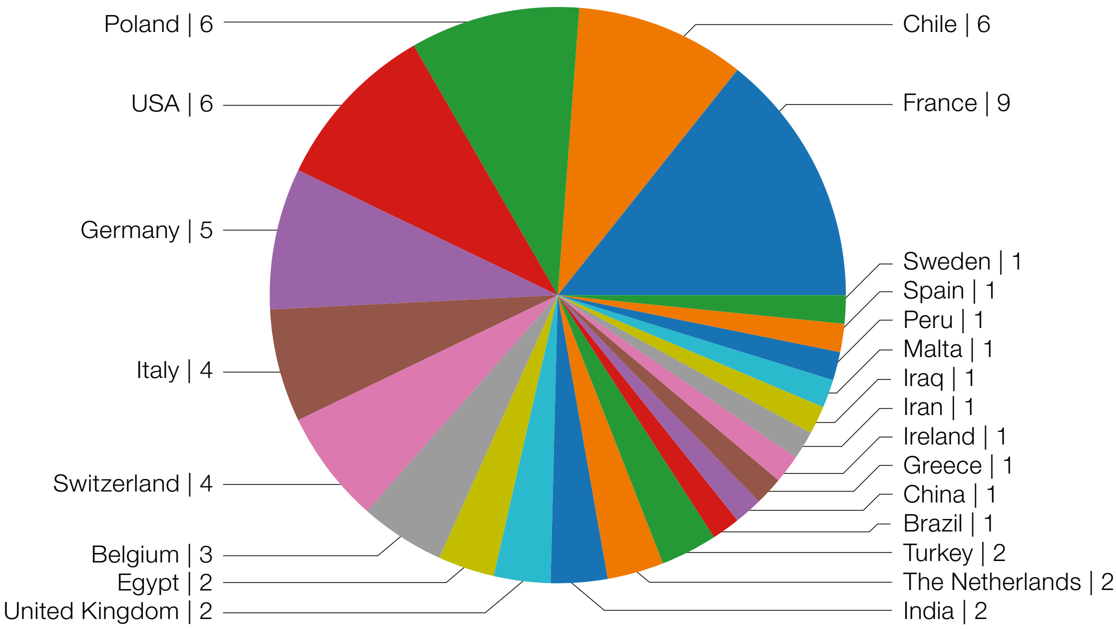


Figure 1. (Above) Top row: The Zoom school picture (featuring 67 of the participants). Bottom row: The Gather school places: on the left are the workspace with a classroom, rooms for the practice sessions with shared whiteboards, a library (collection of links to useful resources), and a poster room; on the right is the relax zone with many split rooms used for informal or group discussions.

Figure 2. (Below) Registered participants' countries. We note the presence of students and free listeners from developing countries (Peru, Iraq, Iran, Egypt etc.), who were able to access the school thanks to its 100% online nature. Finally, we note a newcomer to the field of optical interferometry, China, that may be a sign of exciting new developments!



All the lectures and scientific presentations are now available to anyone who wants to follow them at their pace[2].

The school was designed to be very practical, introducing the students to many tools commonly used in VLTI observation preparation and data reduction. The Gather space was central as it was used to connect to the lectures of the school through Zoom sessions. Moreover, it was also used to allow interactions between the students and the teachers during the practice sessions on the virtual machines, as well as for the "coffee breaks" and informal discussions.

The lectures were exhaustive and varied, with a thorough introduction to long-baseline interferometry, presentations of facilities (the VLTI and CHARA), of instruments (MATISSE, GRAVITY, Stellar Parameters and Images with a Cophased Array [SPICA], the Michigan InfraRed Combiner-eXeter [MIRCX] and the Michigan Young STar Imager at CHARA [MYSTIC]), introductions to data reduction, model fitting, image reconstruction, and radiative transfer for astrophysical modelling, and also several science courses on young stellar objects, exoplanets and asteroids. These courses were backed up by practice sessions on the basics of interferometry and observation preparation, a MATISSE data reduction session, model fitting and image reconstruction sessions, and for the first time a practice session on radiative transfer. Finally there was a proposal preparation homework that lasted throughout the school, starting with a presentation of the principles of telescope time application, and ending with the students' proposal presentations in front of a mock observing programme committee.

When polled after the school, the students were very satisfied with the quality of the lectures and the practice sessions. Of course, the 100% online format of the school complicated the organisation and the interactions. Fortunately, however, the Gather platform, with its persistent space including video chatting, helped a lot to allow frequent interactions between students and teachers during the practice sessions and outside the opening hours. The lecturers and teachers were very impressed by the professionalism of the students, especially during the proposal preparation session.

In conclusion, we hope that the 10th VLTI school will have provided the participants with all the skills and knowledge they need to make successful proposals and to publish, in the near future, astonishing scientific results using optical interferometry.

School environmental impact

The environmental impact of astronomical meetings is an increasing concern (Burtscher et al., 2020). To compare the impact of a VLTI school held online and one held in person, we compared the impact of this school with the impact of the 2018 school in Lisbon. A relevant metric is the equivalent tonnage of CO_2 produced by an activity; we can use the numbers provided by Burtscher et al. (2020). The VLTI schools have a similar attendance composition to the European Astronomical Society Annual Meetings (EAS, formerly known as EWASS). Such an in-person meeting produces 1.5 t CO_2e per capita, essentially from travel (1855 t CO_2e for 1240 participants in the 2019 meeting), whilst an online meeting produces 328 g CO_2e per capita (582 kg for 1777 participants at EAS 2020). Translated into VLTI schools, the 2018 Lisbon school (52 participants in person) produced an equivalent of 75 t of CO_2, mainly the result of transportation (by plane or train). On the other hand, the 2021 online school produced an equivalent of 48 kg of CO_2, mainly from the activity of the computer servers dedicated to the school. In addition, we mailed goodies to the students that account for ~ 950 kg CO_2e, including manufacturing (300 kg CO_2e, the manufacturer being in France) and mailing (650 kg CO_2e), raising the total impact of the 2021 school to roughly 1 t CO_2e. This therefore confirms that conducting such a school in a 100% online format, even with goodies sent to the students at home, reduces by a tremendous amount the environmental impact compared to a normal in-person school.

Acknowledgements

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Burtscher, L. et al. 2020, Nature Astronomy, 4, 823
Garcia, P. 2009, The Messenger, 135, 50
Garcia, P. J. V. et al. 2018, The Messenger, 173, 49
Lopez, B. et al. 2021, accepted for publication in A&A

Links

1. List of all the previous VLTI schools: http://www.jmmc.fr/english/training
2. 10th VLTI school website: https://vltischool2021.sciencesconf.org
3. Course videos: https://pod.univ-cotedazur.fr/vlti-school-2021
4. European Interferometry Initiative: https://european-interferometry.eu