

ESO Science Ambassadors

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The Science Ambassador project, initiated by ESO Fellows from Garching and Vitacura, is designed to disseminate information about ESO's activities by sending scientists to visit countries across Europe and Chile. The primary goals are: (1) to raise awareness of ESO's mission and its telescopes, with a focus on the Extremely Large Telescope; (2) to transmit the ESO Supernova Planetarium & Visitor Centre experience to schools and the general public; and (3) to promote opportunities at ESO for early-career researchers. The project also provides a long-term legacy through training of local educators and donation of resources.

Motivation and objectives

The last two years have seen a lot of exciting progress at ESO. The construction of the main structure for the Extremely Large Telescope (ELT) — the largest optical telescope ever conceived — is now under way in Chile. ESO facilities have played key roles in recent revolutionary scientific discoveries, including the first ever detection of an electromagnetic counterpart to a gravitational wave event (Smartt et al., 2017) and the first test of General Relativity around a supermassive black hole (GRAVITY Collaboration et al., 2018). Furthermore, 2018 also saw the opening of the ESO Supernova Planetarium & Visitor Centre¹, a facility that showcases much of the fantastic educational and publicity work done by ESO and its partners, including the creation of inspiring exhibition material, planetarium shows and educational workshops.

These recent developments at ESO inspired the fellows to collectively apply for funds that could be used to send ESO

scientists to visit public observatories, science festivals, universities and teachers' conferences to promote these achievements. The project was awarded a grant by the Director for Science to carry out engagement activities in 2018. With some careful budgeting and additional fundraising by the fellows, the project has been carried on into 2019.

The most important concept of the Science Ambassador project is that the Ambassadors should directly engage with audiences who have no familiarity with ESO. While the ESO Supernova is an important way in which ESO can interact with the public, visitors tend to come from Germany or privileged European schools that are able to organise travel to Garching. Indeed, several fellows observed that many people they spoke to in their own home countries had little knowledge of ESO, its telescopes or its scientific achievements. Consequently, the main objective of the Science Ambassador project is to promote ESO's mission in astronomy from several perspectives to a broader audience.

The three key goals are:

1. To raise awareness of ESO's mission of running cutting-edge astronomical facilities (with a focus on the ELT) amongst diverse audiences, including university students, teachers, minority groups and the wider public.
2. To promote and donate educational resources created for the ESO Supernova to teachers and public observatories.
3. To attract exceptional scientific talent by promoting opportunities for early-career researchers at ESO in Garching and Vitacura.

The Ambassadors

The activities have been primarily carried out by a team of Science Ambassadors made up of ESO Fellows and students based in Garching or Vitacura. ESO Fellows and students are a very diverse international group, able to communicate key messages and activities in many different languages. In most cases the Science Ambassadors visit their home countries to carry out face-to-face engagement activities. They use their links to

people in their own countries to find relevant events or groups to engage with and this has the advantage of easing the organisational aspects of the project. Crucially, people find these early-career scientists from their own countries to be fantastic role models, thus effectively making these ESO Fellows and students great international ambassadors for ESO.

The Ambassadors themselves gain many benefits from leading these activities. Engaging with fun audiences that tend to be much less sceptical or critical — at least compared to researchers! — keeps the Ambassadors enthusiastic and inspired about their own research and they are able to hone their communication and teaching skills. In many cases the Ambassadors have the opportunity to promote their own specific research topics during their trips, either to professional researchers or to members of the public.

Events, activities and preparation

The Science Ambassadors lead a range of different types of event to carry out the project's objectives, which include:

- talks / poster presentations;
- hands-on interactive workshops at public science festivals or teacher conferences;
- discussions and Q&A sessions;
- donating educational workshop equipment to educational centres, such as public observatories, and providing training for the local staff.

Events are planned around the interests and availability of the Ambassadors. There are two main types of venue for the events: (a) those based in scientific institutes, which are usually undertaken as part of a pre-planned science collaborative visit or conference; and (2) those based elsewhere, such as at science festivals, public observatories or teachers' conferences. For the latter we make use of the Ambassadors' own local contacts and the ESO Science Outreach Network (ESON) to find appropriate events or venues. In some cases, we are required to write a proposal to put on a workshop or stall at a science festival or conference. To date, these have always been successful, and we have noted considerable

Figure 1. ESO student (Garching), Aleksandra Hamanowicz, discussing the opportunities for women in astronomy at the *Galaktyka Kobiet* (Galaxy of Women) event in Poland.



enthusiasm for having ESO representation at these various events; for example, at *La fête de la science* in France and the *Associazione per l’Insegnamento della Fisica* (AIF) teacher’s conference in Italy.

Several resources had to be prepared in early 2018 for the various activities. These materials, which are described below, have been created so that they can be continuously reused by ESO scientists during future activities. The Ambassadors were trained on site at ESO headquarters in how to use and deliver the different activities (although in one case last year, for a fellow based in Chile, it took place over a telecon).

Information posters and presentations
Posters and presentations have been developed that cover ESO scientific opportunities (for example, fellowships, studentships and internships) and ESO educational resources (for example, online images, movies and information). These have been translated into different languages, as necessary, for the individual events. They are available to be downloaded and printed by any ESO scientist visiting another institution or conference. Ambassadors have also accompanied their presentations with Q&A and discussion sessions where they can share their own knowledge and experience of the fellowships/studentships. For example, student Aleksandra Hamanowicz held a discussion session during an event to encourage young women into science in Poland (see Figure 1) and fellow Chris Harrison had a discussion about ESO research opportu-

nities with students and postdoctoral researchers at Manchester University.

Hands-on and interactive educational workshops

Workshops developed by the ESO Supernova staff (in collaboration with Haus der Astronomie² in Heidelberg) were presented at various public science festivals, as well as to teachers. The Ambassadors also constructed and donated several workshop kits in the places that they visited.

These workshops are:

a. **Telescope designs:** This workshop uses a series of lenses, mirrors, light-emitting diodes and a “laser cannon” to showcase how refracting and reflecting telescopes work (see Figure 2). The Ambassadors also use this activity to explain the different designs of various ESO telescopes.



Figure 2. Hugo Messias, an ESO Fellow in Vitacura, presenting the telescopes workshop to visitors of the Lake Alqueva Observatory (OLA) in Portugal. The equipment is being kept at the observatory for use by future visitors.

b. **ELT and segmented mirrors:** This workshop uses a series of lasers and small mirrors (with “actuator” screws on the back) to demonstrate how a large mirror can be made from several individual segments (see Figure 3). It also shows how light can be directed to different focus points in a telescope. The Ambassadors use this activity to describe the design of the ELT primary mirror.

c. **Infrared pictures and exoplanet models:** This activity uses webcams adapted to see at infrared wavelengths to look at models of Orion via which you can penetrate through dark clouds of gas and dust. In addition there are models based on real extrasolar planet systems (see Figure 4). This activity is used to explain the benefits of ESO instruments that can see in the infrared (for example, to study dusty nebulae and to directly image exoplanets).

Exoplanet Drawing activity and website
A series of exoplanet information planet cards were created with some key information about these planets (for example, the planet temperatures, sizes and masses). Participants in this activity (usually elementary school children), draw their own impressions of what these exoplanets might look like (see Figure 5). The drawings are uploaded to a dedicated website³ that is maintained by the ESO Ambassadors. We also use the activity to explain the current status and future of understanding exoplanets and ESO’s contribution to this research.



Figure 3 (above). Teachers being trained by Chiara Circosta, ESO student in Garching, in how to use the ELT/segmented mirrors workshop.

Figure 4 (right). Students of a local school engaging with the public at the Celebrate Science festival in Durham (UK) to explain the benefits of using infrared light for astronomy.



Gavin Duthie Photography

Other activities were also performed on an ad hoc basis. For example, during a teachers' conference, ESO Fellow Fabrizio Arrigoni Battaia carried out two Q&A sessions from the APEX control room to give the teachers a close-up view of observing at ESO facilities.

First year of activities and legacy

In 2018 the ESO Ambassadors carried out 20 activities across nine countries. The target countries in 2018 were ESO Member States and Chile. A full list of the events is provided in Table 1 and Figure 6 shows a breakdown of the different categories of audiences. Some notable figures: the Ambassadors engaged directly with ~ 6000 people; 524 different exoplanet drawings were uploaded live onto the project website³. It is also impressive that, in addition to the activities listed in Table 1, which were organised under the umbrella of ESO Science Ambassadors, ESO Fellows and students continued to organise their own additional public engagement events in parallel to this project.

Throughout the project, feedback was collected from the participants of the activities; this was overwhelmingly posi-

tive. For example: a participant at the Manchester Science Festival said, "Wow, (the Ambassadors) really opened up the world of telescopes for the kids"; one of the school students who helped the Ambassadors deliver activities said, "The brilliant activities I helped to carry out for ESO have helped me to find real world applications for the science I have learnt at school" and an undergraduate student, after speaking to one of the current ESO PhD students simply said, "I want to work in ESO!". In several cases the Ambassadors were invited to return the following year to carry out activities again. Of particular note were the organisers of *La fête*

de la science who asked the ESO Science Ambassadors to return in 2019 as part of their bid to secure funding from the relevant French Ministry.

The Science Ambassador project aims to create a legacy so that the engagement with ESO is not limited to one-off events. In 2018, this included the manufacture and delivery of ESO Supernova workshops to Vitacura and the donation of these workshops to four different educational centres across Europe. Furthermore, around 200 local teachers or student ambassadors were trained to carry on delivering our messages about the

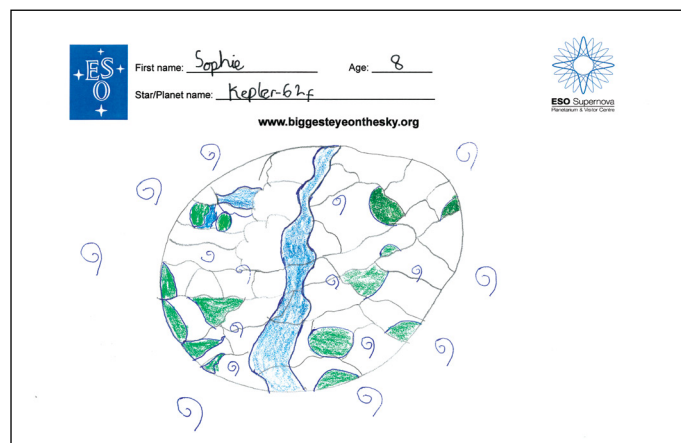


Figure 5. An example of an artist's impression of an exoplanet system drawn by one of our young participants. Similar artists' impressions can be found on the project website³.

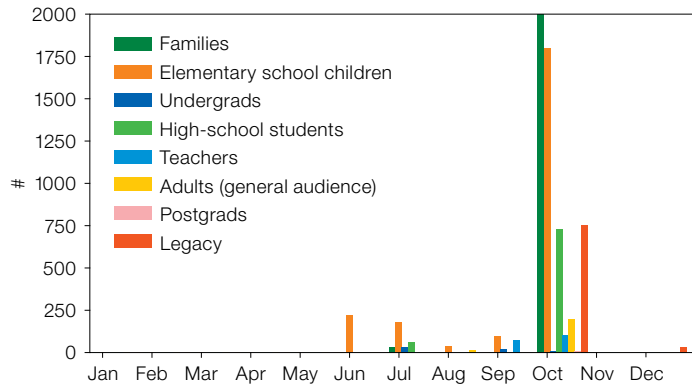


Figure 6. People engaging in activities led by ESO Science Ambassadors during 2018 divided by category (as explained in the legend). In red we highlight the number of people contacting the ESO Ambassadors after the events (for example, visits to the website, teacher's asking us to organise trainings in 2019, etc.).

related to IAU Symposium 356, which takes place in Addis Ababa in October.

To date, the team of Ambassadors has consisted of 19 ESO Fellows and students. These Ambassadors have been supported by an additional 38 scientists, school students or teachers who were recruited to help with presenting the activities locally. An additional 19 ESO staff, fellows, students and interns have also been involved in the project by providing various levels of support, for example by developing activities, translating documents, or assisting with organisational aspects.

Based on the resources that have been developed and the experience and knowledge already gained (for example, how to be involved in various science festivals), we foresee that Science Ambassador activities should be able to continue well into the future.

The ESO Science Ambassador project has been a fulfilling and gratifying experience. It has really highlighted the wonderful team spirit between ESO students

ESO mission, long after the Ambassadors had left. The project website also enables members of the public to interact after the Ambassadors have left and provides a portal to the main ESO website.

Next steps

The Science Ambassador project is continuing into 2019. This has been possible

thanks to careful handling of the initial funds from the SSDF. For example, when activities are carried out alongside existing science trips the overall cost to ESO is low. Furthermore, additional funds have been obtained by the ESO Fellows. In particular, funds were awarded by the International Astronomical Union as part of an IAU100 project so that activities could be carried out in a few non-ESO member countries: Croatia, Bulgaria, Hungary, Ukraine and Slovakia. The Ambassadors also plan to work with local schools in Ethiopia as part of activities

Table 1. Events and activities of ESO Science Ambassadors in 2018.

Country	Month	Event	Activities
Portugal	June	Noites do Observatório, Navy Planetarium	Public talk: <i>Um Universo com ALMA</i> and stargazing
Spain	July	XIII Biannual Meeting of the Spanish Astronomical Society	Poster on "ESO Opportunities for Early-Career Scientists"
Portugal	July	Lunar Eclipse event, Lake Alqueva Observatory (OLA)	Public talk. ESO Supernova workshops, presented and then donated.
Portugal	July	<i>Ser Cientista</i> (To be a Scientist)	Workshop for high-school students. ESO Supernova workshops in action.
France	July	<i>Soirée étoilée avec Toulx-et-possible</i>	Public talk on ESO's facilities: emphasis on ELT as mirror segments being built close by.
Italy	August	<i>A spasso tra le stelle</i> (for people with disabilities)	Mix of interactive lectures, videos, activities, exoplanet artists' impressions
Poland	September	<i>Galaktyka Kobiet</i> (Galaxy of Women)	Public talk on opportunities for women in astronomy, Q&A session
Poland	September	Physics teacher conference	Teacher training, advertisement of the ESO Supernova materials
Poland	September	Nationwide conference of undergraduate astronomy students	Public talk & poster about ESO and possibilities for early-career scientists at ESO
France	October	Festival Atmosphere (<i>La fête de la science</i>)	ESO Supernova workshops and exoplanet artists' impressions for schools and the general public
UK	October	Durham Science Ambassadors training session	Training and donation of ESO Supernova workshop equipment for teachers and pupils
UK	October	Celebrate Science Festival, Durham	ESO Supernova workshops and exoplanet artists' impressions for the general public
UK	October	Durham University	Q&A session for early-career researchers
UK	October	Manchester Science Festival, Manchester	ESO Supernova workshops and exoplanet artists' impressions for the general public
UK	October	Manchester University	Q&A session for early-career researchers
Italy	October	<i>57 Congresso Nazionale Associazione per l'Insegnamento della Fisica</i> (AIF)	Workshops for teachers on the ESO Supernova workshops. Q & A sessions with ESO Fellow observing at the APEX telescope.
Netherlands	December	Leiden Old Observatory	Donation of ESO Supernova workshop equipment.
Chile	December	ESO	Delivery of ESO Supernova workshop equipment.
Czech Republic	December	Astronomical Institute in Ondrejo and University in Brno	Talks and Q&A sessions for early-career researchers.
Poland	December	Almukantarat Astronomy Club	Donation of ESO Supernova workshop equipment.

and Fellows and the fantastic support from the wider ESO staff. The Ambassadors noted in particular how they enjoyed engaging with people from their own countries and observing how inspired they were by the ELT project. They also report how rewarding it has been to showcase the amazing resources of the ESO Supernova, and to help search for the next generation of ESO Fellows and students. We believe that a positive link with society is fundamental for the development of increasingly challenging astronomical programmes — we hope that the ESO Science Ambassador project will continue to achieve this for years to come.

Acknowledgements

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References

GRAVITY Collaboration et al. 2018, A&A, 615, L15
Smartt, S. et al. 2017, Nature, 551, 75

Links

- ¹ The ESO Supernova Visitor Centre and Planetarium: <https://supernova.eso.org/>
- ² Haus der Astronomie: <http://www.haus-der-astronomie.de>
- ³ The ESO Science Ambassador website: <https://www.biggesteyeonthesky.org>
- ⁴ The webpage for the International Society for Optics and Photonics, SPIE: <https://spie.org>

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Fellows at ESO

Jesús Corral-Santana

Like many of my colleagues, my love for astronomy began when I was a child. In my case, it really was a vocational calling. I do not remember the first time I started to think about it, but I do remember asking my parents about astronomy and the possibility of going out during the night to observe the stars. I am originally from the Canary Islands where there is a strong astronomical community thanks to the good quality of the skies. For that reason, there was a lot of information in the local media about new discoveries and scientific results produced with the telescopes installed there.

I remember watching a series of documentary tapes released by a local newspaper and produced by the Instituto de Astrofísica de Canarias (IAC) about astronomy and being fascinated by all the

things I did not know (including planetary nebulae, clusters, black holes). I specifically remember the tape where they talked about the first dynamical confirmation of the first black hole ever found by Jorge Casares — at that time a PhD student at the IAC.

During summer breaks, I used to visit my grandmother in Madrid and ask her or my aunt to take me to the planetarium. That was simply awesome for a 10-ish year old kid; I was fascinated by the shows while my aunt snored next to me. I could not understand why she was not thrilled about the show! For me, every summer visit to Madrid meant a visit to the planetarium and a suitcase full of posters and merchandising.

Back at home, I started to fill my bedroom with all of that stuff: a luminescent clock which had the visible side of the



Jesús Corral-Santana