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

Moon labelled with the names of all the craters and plains (*mares*); posters with all the constellations visible from the northern hemisphere; and a lot of fluorescent star and planet-shape stickers with which I covered the walls and ceiling of my bedroom, creating my own illuminated sky during the night.

During my whole childhood I grew up reading about astronomy in books and watching documentaries. One Christmas, I got a telescope and that changed everything! We could not afford to buy a car so I could not go far with it but I will never forget the first time I saw the Moon through that telescope. From that moment, I knew what I wanted to do in my life.

I read about all the steps required to become an astronomer and started to take decisions. There was no astronomy or physics at the local university but there was a good faculty of physics on the other main island of the archipelago. My parents and relatives supported me at every step, and when I was 17, I took my suitcases and moved alone from Gran Canaria to Tenerife.

It was not easy. We did not have the economic resources to sustain my adventure of living abroad so I had to work and get grants in order to pay for my university years. But it was totally worth it. During my final year I applied for the "resident" PhD grant at the IAC and I was one of the selected candidates. That was a major achievement for me because of the large number of applicants and the reputation of that grant.

I started to work with Jorge Casares and Ignacio González on X-ray binaries, interactive binary systems formed by a black hole which is accreting material from a companion star. The project was exciting and my supervisors were great. From the very beginning, one of our main goals was to find more systems harbouring black holes. At that point, only 17 had been confirmed after more than 50 years of X-ray astronomy! Transient X-ray binaries are detected by X-ray satellites when they go into outburst, but to obtain the dynamical solution of the system, we need to observe them at optical and infrared wavelengths.

During my PhD we were able to identify two new systems containing black holes, increasing the number of systems known. One of the major handicaps in this field is the difficulty of detecting new systems. So far this is only possible when they enter into outburst. However, this happens randomly across the sky and in time, so it is not very efficient. Thus, our understanding of the properties of these sources as a whole is very limited. On the other hand, dynamical confirmation requires the system to be in quiescence, but this is also when the system is fainter. Since the vast majority of sources are locatedin the Galactic plane, the reddening added to the faintness of the low-mass star companion (which dominates the optical/infrared spectrum in quiescence) is also a limitation in the field of transient X-ray binaries.

During my PhD, we addressed these two issues, trying to develop new techniques that can help us unveil new systems, and using current instrumentation to confirm the nature of already known sources. Thus, I spent a significant fraction of my PhD observing on La Palma (Canary Islands), South Africa and Chile, where I learned a lot about carrying out observations. By the end of my PhD I had nearly 120 nights of observational experience behind me, using all kinds of telescopes, instruments and observing modes.

When I finished my PhD I started to look for postdoc positions everywhere; Chile was at the very top of my list because of the large number of observatories hosted in the country, and the excellent conditions for observational astronomy. During my search for a postdoc, I met Franz Bauer from the Pontificia Universidad Católica de Chile (PUC) who suggested that I apply for a Fondecyt Postdoctoral fellowship, which we got in 2013. This led to me packing again, this time for a larger jump over the Atlantic.

I was at PUC for almost three years before joining ESO as a fellow, with duties in Paranal, and where I have now been working for more than two years. Coming to ESO was an easy transition for me — from the very beginning I felt totally integrated at ESO. I started my training at UT1, becoming the *K*-band Multi-Object Spectrograph (KMOS) fellow, but also taking care of the other two instruments mounted at the telescope, the Nasmyth Adaptive Optics CONICA System (NACO) and the FOcal Reducer/low dispersion Spectrograph 2 (FORS2). More recently, I extended my duties to support UT2 as the X-shooter fellow, also taking care of operations on the Fibre Large Array Multi Element Spectrograph (FLAMES) and the Ultraviolet and Visual Echelle Spectrograph (UVES).

During these years I have learnt a lot. Although I had considerable observational experience as an astronomer thanks to my work on surveys, the way of carrying out operations at Paranal is completely different. I love working at the observatory; I am always learning something new and there are always a lot of new things to do and problems to solve. I find it challenging and stimulating and we never get bored. I also like the working environment; it is great working with the team of engineers, scientists and operators during a shift which could last as long as 14 days! We get the opportunity to be involved in small projects to improve the efficiency of the instruments and keep in touch with the day-to-day activities.

In October I will finish my third year as an ESO Fellow and will conclude my duties in Paranal. I still do not know where I will be in a year's time, but I am pretty sure that I will miss Paranal and my colleagues at ESO.

Claudia Agliozzo

I grew up in a town at the foot of Mount Etna in Sicily, Italy. When I was 11 years old, I joined the Scouts and we used to go camping. During the hot Sicilian summers there can be a few nights when the Tramontane wind clears away the hot sultry air and brings respite. From the Nebrodi mountains, far from light pollution, you get the chance to see the Milky Way. My friends designated me the astronomer in the group, and that became one of my specialities as a scout.

Those were also the years after the Maastricht Treaty. I wrote an essay about it for the final exam at middle school; I had absorbed all the enthusiastic feelings

Claudia Agliozzo

of my parents and my teachers. I would have been very excited to hear that one day I would become an astronomer and work in an international organisation such as ESO.

Later, I attended a classical lyceum, with many hours of literature, Latin and Ancient Greek, but my favourite class was that of my enthusiastic physics teacher. After my school years, with no hesitation at all, I signed up to study Physics at the University of Catania.

During my undergraduate studies I grew interested in different topics in physics, but by far my favourite course was the one on radio astronomy, held at Catania's INAF observatory by Corrado Trigilio. I was motivated to learn radio interferometry while working on my first research project for my master degree thesis — a study of the radio emission of the rapidly evolving protoplanetary nebula CRL618 using data from the Karl G. Jansky Very Large Array. I presented this work at the Young European Radio Astronomy Conference in Portugal. This was the first time I met colleagues from different parts of the world, with different astrophysical interests and backgrounds. I understood that this was another attractive aspect of scientific research, and at that point I decided to gain further experience in research. I enrolled in the PhD programme at the University of Catania and continued to work with the radio astronomy team, this time on a study at radio and infrared wavelengths of the ejecta of luminous blue variable stars (LBVs) in our Galaxy, supervised by Grazia Umana. These are blue supergiant stars that experience enigmatic violent episodes of mass loss during the final stages of their evolution, before core-collapse and their subsequent supernova explosions.

During the first year of my PhD programme I spent some months at Caltech in California, where I learned to analyse data from infrared space telescopes for my study and also worked on another project involving Australia Telescope Compact Array (ATCA) data of a nearby star forming region.

On returning to Italy, I had become experienced with ATCA data and wished to expand my study of LBVs to lower metallicity environments, similar to the early Universe. The best laboratory for this study is the Magellanic Clouds, which can only be observed from the southern hemisphere, and the only interferometer available to observe them at that time was the ATCA. My first observations were truly an experiment and finding LBV sources in the data was very exciting.

I defended my PhD thesis in 2013. My first postdoc brought me to Chile. I joined the Supernova team at Universidad Andres Bello (UNAB) in Santiago and I was encouraged by my advisor, Giuliano Pignata, to follow up my study of Magellanic LBVs with ALMA to address their role as dust producers at low metallicities. For the first time I went to Narrabri in Australia to perform observations of my favourite sources myself.
At that observing site, you get to operate six radio telescopes, collect the data and bring them home. Meanwhile, I got observing time with ALMA, which I wanted to visit. I am grateful to Becky Vega and Richard Hills for having organised a special tour for me of the ALMA antennas and the Operations Support Facility; it was here that I got a taste of working life in a big observatory.

At the end of the same year I was awarded a three-year Fondecyt fellowship and continued to work at UNAB. I was involved in observations for supernova searches and follow-up programmes, including the CHilean Automatic Supernova sEarch (CHASE) and the Public ESO Spectroscopic Survey for Transient Objects (PESSTO), during which I had the opportunity to carry out observations with telescopes at Cerro Tololo and with the New Technology Telescope at La Silla. Visiting the ESO facilities was my dream as a kid and I felt very lucky to have fulfilled that.

I particularly enjoyed carrying out observations, both for myself and for others, and what I wished to experience next was working in a big facility such as ALMA. At the conclusion of the four-year period of my position at UNAB I applied for an ESO Fellowship in Chile. I joined ESO as a fellow at the end of 2017 and did my duties at ALMA. Here there are 10 times as many antennas as at ATCA and substantial team effort is necessary to make the observations possible. My most common role is "Astronomer on Duty", which involves participating in the science operations at the OSF. I have also coordinated a large observatory project with the 7-metre and total power antennas, working on evaluating stars as potential high frequency calibrators for ALMA.

I recently moved to ESO in Garching for the remainder of my fellowship, and I work with the ALMA Regional Centre to support the European ALMA community. Both ESO offices in Garching and in Vitacura attract scientists from all over the globe for collaboration and on observing trips. Every day is an opportunity to learn more science and meet more people. As a fellow, you get the opportunity to benefit from different trainings to improve your professional skills and you can always find somebody eager to give you advice, both for your work and your career. I feel particularly privileged to be spending my time at the ESO offices and facilities.

Richard Anderson

In hindsight, there were clear precursors for my later career as a professional astronomer, such as trying to photograph Comet Hale-Bopp with my father's film SLR camera when I was a kid, or my interest in *A Brief History of Time* soon thereafter. However, the adolescent me was much more interested in acting than academia, even though I chose to enroll in a physics undergraduate degree at Augsburg University for the presumably more stable job prospects. Joking aside, my path to becoming a professional researcher at ESO, the world's most productive ground-based astronomical observatory, has been an exhilarating journey and I am grateful for the amazing opportunities I was offered, the profound experiences I had, and the wonderful people I interacted with along the way. I love being an astrophysicist.

Moving to Lund, Sweden as an ERASMUS exchange student was perhaps the best gut decision I ever made. Lund was transformative for my development thanks to excellent instructors, highly motivated peers, and the life experience of leaving my comfort zone. After the exchange, I moved to Göttingen, Germany, where I pursued interests in both high-energy particle physics and astrophysics and seized opportunities for research internships at DESY in Zeuthen, Germany, at ASIAA in Taipei, Taiwan, and the Sudbury Neutrino Observatory group at Carleton University in Ottawa, Canada. In a dream, I eventually realised that astrophysics was my favorite subject, and this was cemented by seeing Saturn's rings through the University's 50-cm rooftop telescope. Having found my academic *raison d'être*, I started on my year-long *Diplomarbeit* to measure stellar magnetic fields in Ansgar Reiners' Emmy Noether research group.

For my PhD I moved to Geneva Observatory in Switzerland, where I specialised in the astrophysics of classical Cepheid variable stars, under the supervision of Laurent Eyer and Nami Mowlavi in the group that leads the variability processing effort for the ESA space mission Gaia (launched 3 days after my thesis defense). As a member of Gaia's Data Processing and Analysis Consortium I was able to contribute to this huge project while conducting the majority of my research in smaller collaborations. Connecting with members of different research groups across Geneva observatory, I soon collaborated with stellar evolution experts (notably Georges Meynet and Corinne Charbonnel) on the effects of rotation on the evolution of Cepheids and learned about high-precision radial velocity measurements from the Geneva exoplanet team.

Following my interest in precision radial velocities, I initiated the Geneva Cepheid Radial Velocity Survey (GE-CeRVS), which I am currently working to complete. Since 2011, GE-CeRVS has gathered more than 19 000 observations using two "small" (1.2-metre) telescopes, one in each hemisphere, namely the Mercator on La Palma and the Euler at ESO's La Silla Observatory. Of course, I gathered a large fraction of these observations myself over the course of 264 unforgettable nights. However, GE-CeRVS would not have been possible without the invaluable contributions of numerous colleagues and friends made who helped out with observations, provided technical assistance, and allocated telescope time or other resources (Thank you all!). Thanks to an unprecedented combination of precision (as good as 2 m s^{-1}), dense phase coverage, and multi-year baselines of more than 270 Milky Way Cepheids, GE-CeRVS data have uncovered new aspects of the variability of Cepheids and provide unique insights into stellar pulsations and distance measurements.

GE-CeRVS also acted as a catalyser for establishing a fruitful and enriching collaboration with interferometry experts (notably Pierre Kervella, Alexandre Gallenne, and Antoine Mérand). With them I led two successful Very Large Telescope Interferometer proposals for the Precision Integrated Optics Near-infrared Imaging ExpeRiment (PIONIER), which took me to ESO's Paranal observatory as a visiting astronomer. What a privilege to have so much freedom to explore and follow my curiosity!

In my current functional work as an ESO Fellow, I continue to pursue my interest in high-precision spectroscopy by contributing to the data reduction pipeline development of the Echelle SPectrograph for Rocky Exoplanet and Stable Spectroscopic Observations (ESPRESSO) — the most stable spectrograph ever built. ESPRESSO will be a game changer in the search for, and characterisation of, rocky exoplanets, while bringing us closer to directly measuring the expansion of the Universe via the Sandage-Loeb test.

In 2014, I secured a postdoctoral fellowship from the Swiss National Science Foundation to work with Nobel laureate Adam Riess and members of the team working on the Supernovae and H_0 for the dark energy Equation of State (SH0ES) programme in Baltimore, USA. Those three years were amazing, and I am particularly grateful to Stefano Casertano, who quickly became a friend and mentor to me. At Johns Hopkins University, I began shifting my focus from better understanding the stellar physics

Richard Anderson

of Cepheids to improving the accuracy of Cepheid-related distance measurements. Specifically, I collaborated with Adam and Stefano to quantify parallax errors due to orbital motion and bias produced by stars physically associated with Cepheids.

Meanwhile, the SH0ES team significantly improved the accuracy of the extragalactic distance ladder and established an intriguing discord between late- and early-Universe values of Hubble's constant, H_0. This so-called "Hubble tension" — which now figures at a significance of $4.4\,\sigma$ — leads to the exciting possibility of an imminent breakthrough in fundamental physics, as the difference between late- and early-Universe H_0 values suggests that the ΛCDM Concordance Cosmological Model may be incomplete. However, before new physics can be credibly invoked to resolve the Hubble tension, known and unknown error sources must be critically assessed and further reduced, and independent, high-accuracy (1–2%) H_0 measurements pursued.

I am highly motivated to further elucidate the Hubble tension via my experience in the stellar astrophysics of Cepheids and the calibration of the cosmic distance ladder, and to this end I am currently working with Martino Romaniello and PhD candidate Sara Mancino to characterise the effect of chemical composition on Cepheids and the Leavitt law. Mentoring and advising graduate students has been a particularly rewarding experience for me, and I look forward to leading a research group of my own because this will allow me to continue pursuing my research ideas while improving the chances of contributing to a major breakthrough. In any case, I will surely have a blast trying!

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Gustav Andreas Tammann (1932–2019)

Bruno Leibundgut [1]

[1] ESO

Gustav Andreas Tammann died in January 2019, after a long and successful astronomical career. He made seminal contributions to extragalactic astrophysics and cosmology and is best known for his work to determine the Hubble constant and the use of supernovae as cosmic distance indicators. For many years he was the leading extragalactic astronomer in Europe. Tammann also had a long association with ESO and was instrumental in convincing the Swiss government to join the Organisation in 1982.

After a degree from the University of Basel, Switzerland, Tammann spent time as a Research Associate at the Mount Wilson and Palomar Observatories in Pasadena, California. After his return to Europe he first held a professorship in Hamburg, and was then Director of the Astronomical Institute in Basel from 1977 until his retirement in 2002.

While in Pasadena, Tammann and Allan Sandage initiated a research programme resulting in a collaboration lasting over four decades, aimed at establishing the distance ladder and ultimately measuring the value of the Hubble constant. They carefully investigated every rung of the distance ladder until they reached distances in the Hubble flow to establish the current cosmic expansion rate. Tammann strongly advocated the use of supernovae as distance indicators and in other cosmological applications, for example, using time dilation to test general relativity. He was vindicated by the successful use of Type Ia supernovae to provide a reliable last rung into the Hubble flow, and ultimately to produce evidence for accelerated cosmic expansion. The exact value of the Hubble constant remains a matter of intense debate, but the local expansion rate is now almost exclusively measured by Type Ia supernovae (calibrated by Cepheid stars), the most accurate distance indicator available for cosmology to date.

Tammann received many distinctions, including the Karl-Schwarzschild Medaille of the Astronomische Gesellschaft, the Albert-Einstein-Medaille of the Einstein Gesellschaft Bern and the Tomalla-Preis by the Tomalla Foundation. He served as president of the Astronomische Gesellschaft from 1981 to 1984 and was an elected member of several academies.

Gustav Tammann had a close association with ESO for nearly 40 years. He was an ESO research associate from 1975 until 1993 (together with Philippe Véron, Franco Pacini and Jean-Pierre Swings), supported the then Director General Lodewijk Woltjer in scientific matters and helped build a science group at ESO headquarters. He worked with the Swiss government to enable the accession of Switzerland to ESO as the seventh Member State and served as the Swiss representative on the ESO Council from 1992 until 2002.