

## Fellows at ESO

### Gabriela Calistro Rivera

Inspiring educational events and good science teachers can have a transformational impact on students' lives, and my story in astronomy is one of those examples.

One visit to a beautiful planetarium show ignited a spark, and thanks to a good physics teacher the spark turned into a passion. I come from Peru, one of the countries with the most beautiful and clearest skies in the world. However, socioeconomic limitations mean that opportunities to learn about the cosmos, like the ones I had abroad, are not broadly accessible. Working towards changing this, in addition to understanding how galaxies and black holes form and grow across cosmic history, are the goals of my work.

I was born in Huacho, a small fishermen's city a few hours away from Lima, the capital of Peru. At the age of seven, I moved to Lima, a large, vibrant and somewhat chaotic metropolis of around 10 million people. My parents, always prioritising high-quality education, sent me to the Peruvian–German school, where I was educated within a bilingual system with Peruvian and German teachers. In those years, my father, who had studied engineering, sometimes shared with me stories about the enigmatic physical phenomena he had heard of, such as black holes and special relativity. These stories awoke my curiosity about the cosmos from early on, although only in the background, as in most school years I was mainly interested in literature and arts.

In high school I visited Germany for the first time as an exchange student. During a weekend trip to Hamburg, I attended my first planetarium show. It was a show on the Hubble Deep Extragalactic Fields. This show left me in awe about the depth and richness of space, and the power of telescopes. At that point, I could have not imagined that those same images would be my work material one day. Motivated by this experience, once back at home I started paying more attention to physics classes and this was timely aligned with having a great physics teacher that year. In addition to lots of hands-on activities, the teacher motivated and reinforced my curiosity with extracurricular material,

introducing me to the first science magazines I read (*Spektrum der Wissenschaft*) and Physics TV shows (*Alpha Centauri*). Graduating from the German Abitur with a special interest in astrophysics, I then decided to study physics.

Since there is no astrophysics major in Peru, and physics research is extremely limited and well below the Latin American average, right after high school I left my country and moved to Germany to pursue my bachelor's degree in physics. This was possible thanks to a full scholarship from the German Academic Exchange Service (DAAD), given to high-school students selected among German schools from 120 different countries. The international environment I experienced in these meetings for the first time made me particularly fond of cultural diversity, which I cherish and have always looked for in my life. This is also one aspect I love about astronomy. In my career I have always worked in international institutes and, funnily, I now have an international family as well. My little Italian–Peruvian son born in Germany has just turned one year old.

I feel privileged to have worked in some of the main European hubs for astronomy during my career. Before coming to ESO, I did my bachelor studies in the University of Heidelberg, with a thesis project on cosmology at the Institute of Theoretical Astrophysics. For my master's, still in Heidelberg, I joined the Max Planck Institute for Astronomy to work this time on extragalactic observations. To expand the wavelength coverage of my work to the submillimetre and radio for my PhD, I moved to Leiden Observatory in the Netherlands. My PhD thesis focused on the panchromatic emission of star-forming galaxies and active galactic nuclei. As a student, I was able to participate in observing runs at La Silla and La Palma, and to give invited and contributed talks on my research at numerous conferences and institutions across the world.

One of these conferences, the Latin American Regional IAU Meeting in Colombia, was very special, as for the first time I met other Peruvian astronomers. Until this point in my career, I had not met colleagues from my own country, since we are not many and were all trained abroad. With these colleagues we



commented extensively on the large disadvantages that young people in our country are facing in terms of scientific education and the limited access to such an inspiring science as astronomy. These conversations made me realise that it was up to us, the very few national astronomers, to do something to change this situation. With this idea in mind, I started efforts to build up a network of Peruvian astronomers and have a better overview of the community. In 2018 the survey showed that there were around 25 Peruvian astronomers spread across the globe, including PhD students, post-docs and professors.

A few weeks before graduating with my PhD, I got the offer of an ESO Fellowship, one of the dream jobs I had been aspiring to since early in my career. I then spent the free months I had before the start of my appointment at ESO designing the CosmoAmautas programme, a programme which uses astronomy to support equitable scientific education in Peru. Finding like-minded Peruvian colleagues, we applied for an IAU Grant from the Office of Astronomy for Development. Three years after its conceptualisation, CosmoAmautas has now trained 120 teachers from half of the rural regions in Peru and opened 20 Astronomy Clubs in rural high schools. The combined results of this initiative have reached more than 7000 high-school students, in addition to mentoring as well undergraduate physics students, now doing their master's in Europe and the US.

ESO has been a great support to all my professional and personal goals. In addition to supporting my research work with a vibrant scientific atmosphere and collaborations, it has also given me the flexibility to dedicate some of my time to scientific education programmes, as part of the ESO Science Outreach Ambassadors that I co-organise. Additionally, as a fellow and huge fan and user of the ALMA Observatory, working as part of the ALMA Regional Center developing software to mine the ALMA archive and visiting the telescope have been incredible experiences. Astronomy is a unique and fascinating endeavour as it combines inspiring existential questions at its core, with exciting intellectual exercises and beautiful images in the day-to-day work. Additionally, it has the inspirational power to be used as a tool to pursue meaningful social change and improve overall scientific education, which I feel is an ideal complement to my research work. I thus feel very fortunate to be an astronomer and spend these years at ESO.

### Michele Ginolfi

My younger self would have never imagined that one day I would travel around the world to discuss science with my colleagues and talk at international conferences, observe breathtaking night skies from the Atacama desert, or drive huge cars up to 5000 metres on the road to ALMA. But he dreamt of an adventurous life, and, well, an astronomer's life turns out to be quite adventurous. Come on, let's say it, among all scientists, we are what gets closest to James Bond; "A Martini, stirred not shaken", asks the astronomer at the bar.

But how did I become an astronomer?

You would expect the standard "Since I was a kid, I loved wondering about stars" or "I got inspired by that amazing book by Stephen Hawking". No, nothing like that. Mine was a rational choice, fully driven by Curiosity (note that I will be using a capital letter as if Curiosity was a person, a friend). I went to a high school that was very oriented towards classical and humanities studies. It was great. I loved studying literature, history, philosophy, and arts. But at the same time, I realised

that there was a whole portion of the world that I knew too little about. And I was curious about it. So at the time of choosing a university path, I thought I should go for science, trying to expand my comfort zone and broaden my vision of the world. Thus, physics looked like the most natural and stimulating choice, and now I can say that it was the best possible choice as I immediately fell in love with it. In particular, the branch of physics that fascinated me the most was astronomy, because of its unique property of containing a bit of everything else (for example, statistical and quantum mechanics, general relativity, thermodynamics, etc). Moreover, I love the fact that as an astronomer I am used to studying everyday natural phenomena that involve mechanisms working on extremely different scales (by many many orders of magnitude) in space, time, mass, etc. This helps me a lot in improving the way in which I look at the world.

After a BSc in physics and an MSc in astrophysics in Rome, I decided that becoming an astronomer would be a good way to satisfy Curiosity, and I started my PhD in Astronomy, Astrophysics and Space Science in Rome. I did a thesis on "The Baryon Cycle driving Galaxy

Evolution" under the supervision of Raffaella Schneider. Raffaella had the intuition that I would find my dimension by working with both theory and observations. I did not hesitate one second when she proposed that I explore the properties of the interstellar medium in local and distant galaxies by combining analyses of cosmological simulations with multi-wavelength observations. I spent part of my PhD at the University of Cambridge, working in Roberto Maiolino's group on ALMA data of molecular gas in distant galaxies, and MUSE observations of atomic gas surrounding bright quasars. Cambridge was magic. I could breathe science in the corridors of the astronomy buildings and at the same time enjoy the life of a graduate student in a vibrant city full of scholars.

After my PhD, towards the end of 2018, I moved to Geneva (Switzerland) to work as a postdoctoral researcher in the Astronomy Department at the University of Geneva, in Daniel Schaerer's group. I had the chance to work with amazing people. Interacting with them day by day, learning from them, and getting inspired by them, made me a better scientist and a better person. I consider the years spent in Geneva fundamental for my early



development as a scientist. In Geneva, I had the opportunity to work in the ALPINE collaboration, an ALMA large programme that observed the cold interstellar medium in more than a hundred galaxies at redshifts between four and six. ALPINE is a great team, and we have produced several important results. I arrived at ESO in November 2020. I wanted to become an independent scientist and the ESO Fellowship looked perfect. Now, after two years spent at ESO, I can confirm that the ESO Fellowship is the ideal position for young scientists to strengthen their scientific/human skills and improve as independent researchers, thanks to a rare combination of (i) proactive world-top scientific environment and (ii) the possibility of being involved in the functioning and the design of some among the most powerful current and future telescopes. What I like most about ESO is the privileged opportunity to see with my own eyes the full process beyond astronomical observations, starting from how they are conceived, up to how they are taken and distributed.

At ESO, I have been working on galactic feedback in distant galaxies and its impact on the chemical enrichment of the circumgalactic medium. For my functional work, I decided to split my duties into observations with APEX, and assistance in the development of a future exposure time calculator for ESO's Extremely Large Telescope. I learned so many things thanks to my functional duties! When I had the chance to travel several times to Chile to observe with APEX from Atacama, a dream came true. In those magnificent places, together with amazing colleagues, I lived moments that I will never forget and that remind me every day what beautiful work we do.

In November 2022 I started a new adventure in the beautiful city of Florence, where I will teach physics, astronomy, and data science at the university, and will continue my research on galaxy evolution.

I will do my best to share with students the beauty of understanding how the Universe works.

### Julia Victoria Seidel

My journey to ESO can certainly be called the unconventional path within physics. If you look for the inspirational story of a small child with their first telescope, you will be sorely disappointed. But I hope it shows that astronomy has a vast reach and that your path does not have to be pre-determined at a certain age or career stage, but is in the end a rich canvas of serendipitous events meeting an open mind.

My personal journey starts in school in rural Germany, as the ever-curious — read annoying — student with a million questions and with every subject as 'my personal favourite'. I loved it all, biology, art, French, everything. But physics always held a special place. That intersection of the real world that can be explained with the hidden underlying language of maths seemed like magic to school-aged Julia. So much to my father's disappointment that I wasn't going to pursue the arts and my mother's utter shock, I decided that physics was my calling. More specifically, that particle physics and understanding what holds the world together was to be my way in life.

After two years of rigorous education in maths and physics in Germany, I decided that my life had become too confined and I switched to Paris to finish my bachelor's. In retrospect, this was the best decision I have ever taken. Suddenly I was part of a vibrant international research community in a city I fell in love with at first sight. It was that year that set me up for a job at CERN as a programmer soon after. While I loved my experience at CERN and the first cautious steps in the real-world job market, I soon realised that I was not done yet with education and that nuclear physics was confined to important, but few, open questions.

With that change in interest came a round of applications to various institutes worldwide for a master's position, with plenty of rejections. I had almost resigned myself to moving back to Germany to further my education when I got a place at Imperial College. So off I was to London. Little did I know just how expensive the city was and just at the dawn of Brexit my



supervisor came to me with the offer of a lifetime. Would I like to pursue a project on atmospheric physics for my thesis in Colombia? I don't think I can overstate just how elated I was. In that year in Bogota, I traced atmospheric dynamics above the rainforest to track explosions, learned Spanish, and saw more of life than I had in the previous 25 years. Two things became clear to me that year. I wanted to dedicate my life to understanding the climate and I wanted to live in South America again.

So, how did I end up in astronomy of all fields? Opportunity disguised itself as an outreach event while I was visiting friends in Switzerland. The topic: exoplanet atmospheres. And a year later I started my PhD on tracing atmospheric dynamics in exoplanet atmospheres, hoping to add my own piece of the puzzle of Earth's uniqueness in the Universe.

While in Geneva in David Ehrenreich's group, I got much more than I bargained for. What started out as the academic pursuit of understanding our atmosphere in the wider context of planetary studies soon became a fascination with astronomy as a whole. Geneva is one of the European instrumental powerhouses, involved in spectrograph design since the days of CORALIE all the way to ESO's

flagship high-resolution spectrograph ESPRESSO at the VLT in Paranal. As part of my PhD, I was sent to observe with the Swiss Euler telescope in La Silla in northern Chile and the first glimpse I got of the real night sky is something I will never forget. In the end, it was astronomy that led me to love the stars instead of the night sky leading me to astronomy. At the same time, I realised that astronomy is the gateway to STEM for the general public. This ambassadorial role in science communication is something I take very seriously, especially in the subfield of exoplanet studies. We are the bridge between climate science and sceptics to truly drive the most important message home: there is no Planet B.

Now, at ESO, all the different parts I loved most during the past years have come together: the night sky, studying our own atmosphere and exoplanets, a strong commitment to science education, and my personal love for South America.

I love working at an observatory — this bimodal world of extreme pressure observing and fixing problems on the fly to glimpse singular events in the sky but also experiencing the absolute silence and peace of the desert under the vast night sky is unlike any other job. I work with UT1 and UT2 of the VLT in Paranal and focus my work on the ESPRESSO spectrograph, the workhorse for my own science. In that context, I work with a mix of scientists, engineers, and operators, and not a day goes by when I don't learn something new.

I don't know what the future will hold, but I will always remember my time as a fellow as one of the big highlights of my career. I hope my path will somehow always link me to observatories, be it as an astronomer, a climate scientist, or a science communicator — opportunities present themselves to those welcoming them!

### Michael Abdul-Masih

For me, astronomy was never part of 'the plan'. Growing up, I had always been interested in astronomy, but I never thought of it as a potential career option. Sure, being an astronaut would be super cool, but what kid doesn't want to be an astronaut

at some point? In my head, I always thought of astronomy in the same way that I thought of reading or playing video games: a hobby that I enjoyed in my free time, but not something that I would ever do professionally. It wasn't until the end of my bachelor's degree that I began to see astronomy as more than just a hobby.

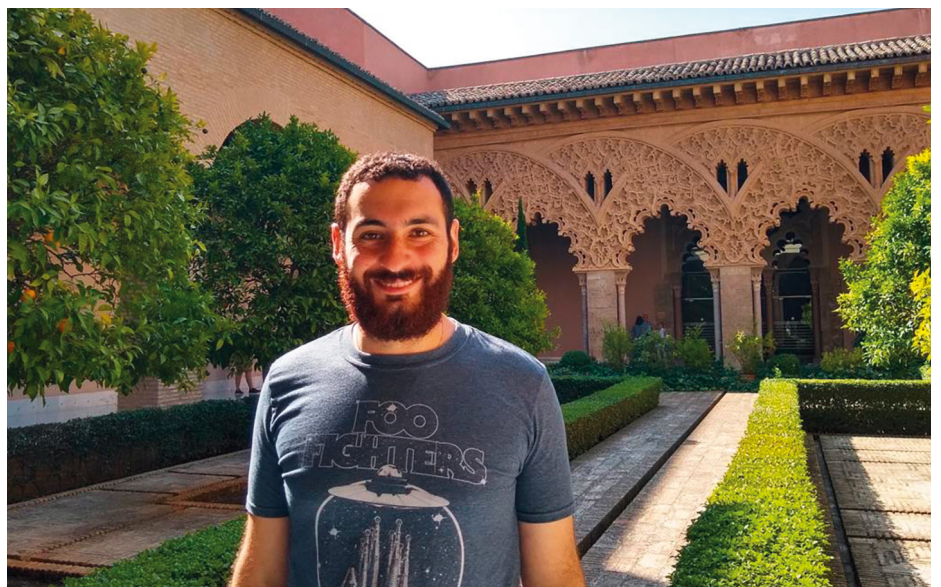
From a young age my parents stoked my interest in space. My mom was an avid space fan and when she saw that I was also interested in it, she made sure that there were plenty of space-related activities for me to enjoy. I have fond memories of our family trip to Huntsville, Alabama where we spent a week at the US Space and Rocket Center attending space camp. But perhaps my favorite astronomy-related memory from childhood was setting up our hammock in the front yard so that we could watch the historic 2002 Leonid meteor shower in the early hours of the morning with a thermos full of hot chocolate to keep us warm.

Fast forward a few years to the end of high school; 'the plan' was in motion: I was going to be a medical doctor. I had just been accepted at Villanova University and it was time for me to choose what I would be studying for the next four years. There sitting at the top of the list of potential majors was Astronomy & Astrophysics. I distinctly remember the jolt of excitement when I saw that, but, alas, cooler minds

prevailed and I ended up selecting biochemistry as my major as it made much more sense for someone who was planning on attending medical school later. Nevertheless the thought of being able to take some astronomy classes remained at the back of my mind all summer.

By the time August rolled around, I had decided that I would see if I could take some astronomy classes to fill my elective slots. During my first week at Villanova, when we were selecting our classes for the semester, I went to speak with the head of the Astronomy Department to inquire about taking classes and by the end of the meeting I was signed up for my first astronomy class. I absolutely loved it! So much so, in fact, that I ended up taking another two classes the next semester and another one the following semester.

I couldn't get enough! It was around this time that I made my first big purchase with the money that I had been making from working at the ice cream shop on campus: an Orion Skyquest 8-inch Dobsonian telescope. I dragged all of my friends out at night to show them the moons of Jupiter, the rings of Saturn, the Orion Nebula, etc. It was also around this time that I had taken enough classes to have completed the astronomy minor. Instead of feeling proud of my accomplishment, I remember feeling incredibly sad at the thought of being finished with my astronomy journey.

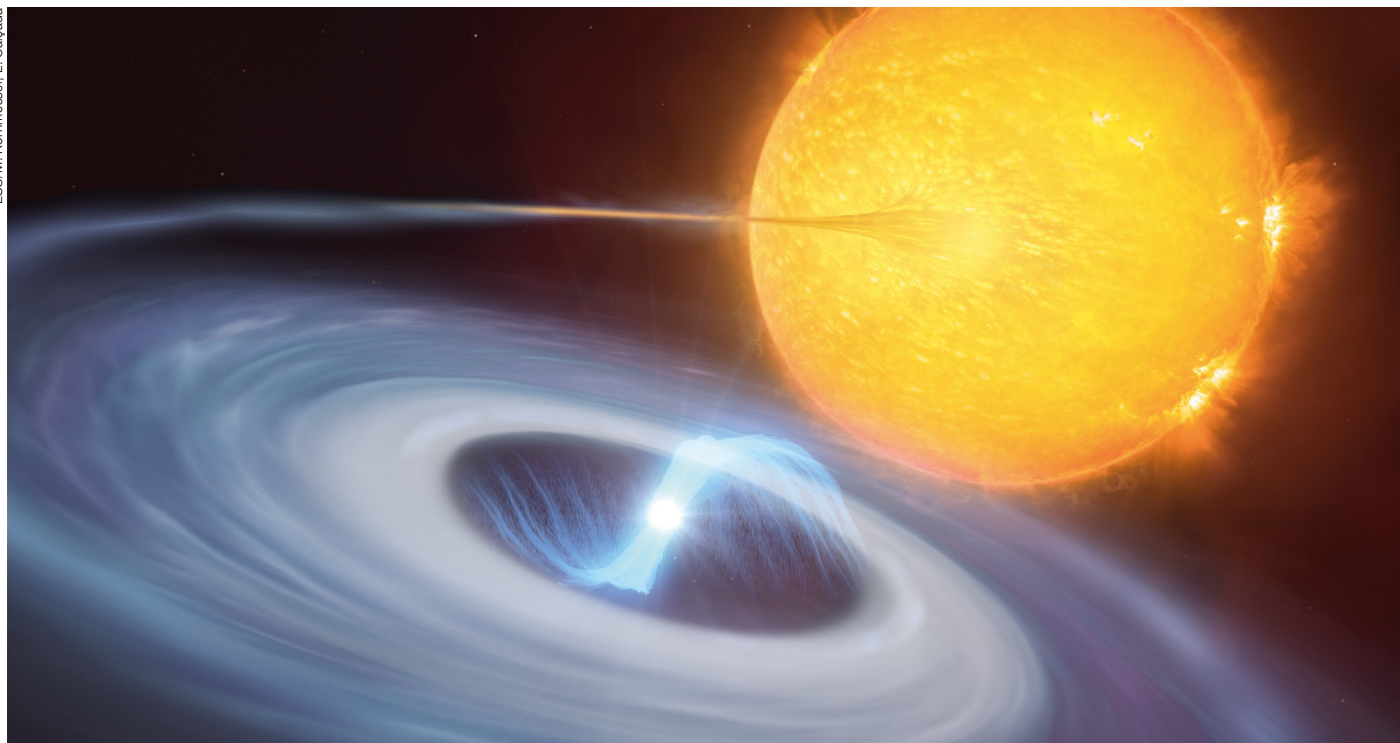


After quite a bit of moping, I decided I wasn't done and I that I would see if it was possible to continue. I spoke with the heads of both the Astronomy and Biochemistry departments and after a bit of finagling, I managed to come up with a schedule that would allow me to finish both the biochemistry major and an astronomy major on time. The day that I submitted the form to officially declare the astronomy major was one of the happiest of my life. The rest is history. During the final year of my bachelor's, I decided that I would try to continue in astronomy and applied for a few master's programmes. I was accepted at Rensselaer Polytechnic Institute and started in September and graduated with my master's a year and a half later. From there, I accepted a PhD position at KU Leuven, where I spent the next four years. I defended my thesis in 2020 and now I can say that I am officially a doctor, albeit a different doctor than I originally planned!

As with my life plan, my interests in astronomy have evolved quite a bit over the years. During my bachelor's, I was primarily interested in astrobiology and how life on other planets might look, bridging my interests in biochemistry and astronomy. By the time I was applying for my master's, I was more interested in planetary science and the detection of exoplanets. During my master's, however, I worked with eclipsing binaries and realised that I really enjoyed stellar astronomy. Continuing in that direction, my PhD focused on a particularly interesting class of eclipsing binaries known as overcontact binaries. The stars in these systems are so close to each other that they are actually touching and sharing material, making them roughly peanut shaped. Recently, my interests have broadened a bit and I have begun working on other classes of non-spherical stars such as rapidly rotating stars and semi-detached binaries.

Working at ESO has been a dream come true. When showing my friends the moons of Jupiter through my 8-inch telescope, I never imagined that 10 years later, I would get to point a telescope 40 times bigger at those same moons. I feel truly lucky to have the opportunity to work at one of the largest and most advanced observatories in the world. Being able to meet world-leading experts from around the world, getting to interact with new cutting edge instruments, and seeing how a world-class observatory operates behind the scenes has been an eye-opening experience. On a more personal level, working at ESO has only enhanced my love for astronomy and the night sky. I am still an avid stargazer and the night sky on a Moonless night at Paranal is unrivalled. From time to time, I will grab a mug of hot chocolate and go out to the platform in the hopes of catching a meteor or two. The only thing missing is a hammock.

ESO/M. Kornmesser, L. Calçada



This artist's impression shows a two-star system where micronovae may occur. The blue disc swirling around the bright white dwarf in the centre of the image is made up of material, mostly hydrogen, stolen from its companion star. Towards the centre of

the disc, the white dwarf uses its strong magnetic fields to funnel the hydrogen towards its poles. As the material falls on the hot surface of the star, it triggers a micronova explosion, contained by the magnetic fields at one of the white dwarf's poles.