DOI: 10.18727/0722-6691/5224

Fellows at ESO

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Just as the moon waxes and wanes, my childhood was full of a constant flux of interests. While my maths and science skills came easier to me than those in writing and social sciences, nothing in school really grabbed me. Growing up in "northern" Canada (near Edmonton, Alberta), I had access to beautiful skies, and often looked up and wondered about what was beyond Earth. It wasn't until my teenage years that I started to follow up these thoughts about the Universe. During my first physics class, I was struck by the elegance of applying maths to describe the Universe. Fortuitously, this occurred at the same time I was reading about the moons of Jupiter and the potential of Europa's harbouring life.

At that point I became determined to study planetary science and focused my studies on physics, maths, and geology when I started as an undergraduate at the University of Victoria in Canada. My interest in astronomy slowly migrated out of the Solar System as a result of the strong cooperative education programme that provided me with research-related work experience even as an undergraduate. Through the programme, I was fortunate to spend time on diverse projects at four research institutes. At the Joint Astronomy Centre in Hawai'i, I reduced spectroscopic data from the UK InfraRed Telescope (UKIRT) to study massive star formation. In Lethbridge, Canada, I spent time developing visualisation software for a Fourier transform spectrometer instrumentation lab responsible for building spectrometers for the Space Infrared telescope for Cosmology and Astrophysics (SPICA), the Herschel Space Observatory, and the James Clerk Maxwell Telescope. I compared the mass-size relation of bulges with ellipticals in the "local" Universe at the Herzberg Institute for Astrophysics in Victoria. And, finally, I searched for boron in quasar absorption line systems 3 Gyr after the Big Bang at the University of Victoria. This progression to higher redshifts led to my continuing my research in Victoria. I completed both my MSc and my PhD with Dr Sara Ellison, with whom I studied the use of intervening absorption lines imprinted on quasar spectra to reveal various facets of galaxy evolution. My research made heavy use of ESO's Ultraviolet and Visual Echelle Spectrograph (UVES) and the X-shooter spectrograph, as well as Hubble's Cosmic Origins Spectrograph.

In light of my experience with various instrumentation groups and ESO spectrographs, I recognised that being an ESO Fellow in Chile would be the prime postdoctoral experience for me — providing first-hand experience supporting telescopes I used heavily in my graduate studies, as well as nights of observing (an increasingly rare opportunity for young astronomers). I was very fortunate to be selected for one of the fellowship positions and joined ESO in October 2018. This was just in time to get involved as the Instrument Fellow for the Echelle Spectrograph for Rocky Exoplanet and Stable Spectroscopic Observations (ESPRESSO) on the Very Large Telescope (VLT), where I support the instrument operations team to make ESPRESSO observations easier. Currently, my duties for ESPRESSO lean towards developing software for quality control analysis, as well as preparing to test an upcoming mode of ESPRESSO meant for observing faint targets (like quasars) with a single Unit Telescope (UT). During the night, I am a support astronomer for UT2 (Kueyen), which primarily has been observing with UVES, X-shooter (now replaced by the VLT Imager and Spectrometer for mid-InfraRed, VISIR), and the Fibre Large Array Multi Element Spectrograph (FLAMES). Every time I see the night sky from Paranal, I am still in awe at how much detail one can see with the naked eye! On top of all these duties, I am also one of the developers of SCUBA, a software common to all instruments at Paranal for inspecting and assessing the quality of fresh data. While it is often a challenge balancing science and duties, it is refreshing to always have something on the go, as well as being exposed to excellent instrumentation and scientific research beyond my field.

My research to date focuses on the gas within the interstellar, circumgalactic and intergalactic media as probed by absorption seen along quasar sightlines. My recent work has made use of the XQ-100 legacy survey (a set of 100 $z \sim 4$ quasars observed with X-shooter) to study the contribution of damped and sub-damped Lyman-α absorbers to the neutral gas and metal budgets of the Universe, and to look at how we can use these systems as tracers of galaxy evolution. I am keenly interested in chemically peculiar systems, searching for interesting absorbers associated with the products of either the first generation of stars (such as carbon and oxygen), or the most chemically enriched systems (such as boron, manganese, and zinc) to understand the underlying stellar populations and galactic processes that can reproduce these effects. My PhD work also focused on studying the effects of active galactic nuclei on the gaseous reservoirs surrounding a galaxy. While we expected to see hotter or less dense gas, owing to feedback from the supermassive black hole, we instead found the opposite (at least for neutral gas). This puzzle still intrigues me and am currently seeking further evidence on the underlying processes to explain this apparent contradiction.

Beyond the night sky, I take every opportunity I get to relax at the curling club, on the golf course, or lost in nature while kayaking or hiking — typical hobbies for a western Canadian. The hiking in Chile is amazing, from hiking up to glaciers to ascending active volcanoes. Unfortunately, curling does not exist in Chile, so the large hole in my spare time has now been filled with playing tabletop games and exploring an eclectic mix of new hobbies: sculpting miniatures, learning bass guitar, and reading philosophy.

Álvaro Ribas

Like many others, I was fascinated by the night sky as a child. I remember filling up notebooks with space-related facts that I would read in books and coming up with my own (at the time, very reasonable) explanations for some of those incredible things that existed out there. However, astronomy was not the only thing that captured my attention, and I would also spend a lot of time reading about dinosaurs, or ants, or collecting rocks and minerals. I probably matched the stereotype of the kid who is always asking questions, and I am truly grateful to my parents for always fostering that curiosity.

I grew up in Salamanca, a beautiful city near Madrid with one of the oldest universities in Europe. My list of interests also grew and by the time high school was over I was quite unsure about what I wanted to study, the options extending from philosophy or literature to computer science or physics. I finally decided to go with the last of those, and I studied the first three years of the degree in physics at Universidad de Salamanca before moving to Madrid to continue with a specialisation in astrophysics at Universidad Complutense de Madrid.

My first encounter with real research came during the last year of my degree, when I had the opportunity to do a European Space Agency (ESA) traineeship at the European Space Astronomy Centre (ESAC) in Madrid. There I worked on processing and analysing far-infrared observations of protoplanetary discs from the Herschel Space Observatory. Not only did this experience get me quickly interested in planet formation, but I also immediately fell in love with scientific research and its collaborative, international environment. Getting to hear about cutting-edge science daily was a dream come true. Luckily, I was able to continue working at ESAC (testing the software used to process Herschel observations) during my master's degree, which also allowed me to continue my research projects there.

I did my PhD at ESAC with Bruno Merín and Hervé Bouy, aiming to improve our understanding of protoplanetary disc evolution. The evolution of these sources plays a key role in planet formation, but it occurs over some millions of years so it needs to be studied indirectly. During my thesis, I gathered ancillary photometry (from the ultraviolet to the mid-infrared) for a large sample of young stars in different star-forming regions and determined how many of them showed an infrared excess (produced by dust in the discs) at different ages. This information can be used to measure the typical lifetime of protoplanetary discs, which limits how much time gas-giant planets have to form. The sample was large enough that I could also break it into smaller pieces to study the impact of stellar mass on disc evolution. I also used Herschel data to characterise the outer regions of some discs with gaps, maybe carved by newborn planets. Those were some intense years, but I absolutely enjoyed them.

I defended my PhD in 2015 and continued my research as a postdoc working with Catherine Espaillat at Boston University. There I completed the spectral energy distributions of discs in the Taurus, Ophiuchus, and Chamaeleon I regions down to (sub)millimetre wavelengths, with the idea of combining them with disc models and statistics to learn more about the conditions in which planet formation takes place. However, protoplanetary discs are complex and so are their models, and computing them takes way too long for such an analysis to be feasible. This problem led me to start what has been my most challenging research project to date: using artificial neural networks to speed up and apply disc models to large samples of discs. It was also in Boston that I started working with interferometric observations while using data from the Karl G. Jansky Very Large Array (VLA) to study a circumbinary disc that has somehow survived for several million years in a quadruple system. Being used to unresolved photometry, working with data that could resolve scales of a few astronomical units in discs completely blew my mind and led me to learn more about this technique.

As an ESO/ALMA Fellow in Chile, I have the opportunity to work on my own research as well as to perform functional duties at the observatory, which has been a very unique and enriching experience for me. During my research time, I continue trying to better understand disc evolution and planet formation by combining Atacama Large Millimeter/submillimeter Array (ALMA) observations and statistics. The scientific environment in Santiago is really vibrant, not only because of the interactions at ESO, ALMA, and the many Chilean universities, but also because of the continuous flow of visitors from all over the world. On the other hand, thanks to the duties at the observatory I get to learn a lot more about interferometry and observatory operations, and even make some small contributions to those operations. Pointing the antennas to gather some precious photons feels like getting one step closer to a fascinating answer. But then, leaving the control room at night, the incredible night sky of the Atacama Desert above leaves me in absolute awe and wonder — an immediate reminder that, no matter how much we learn, there will always be many more questions to ask.