

## Fellows at ESO

### Agnieszka Sybilska

I've been interested in learning about the Earth and beyond for as long as I can remember – at least since I received a children's cosmos encyclopedia at the age of seven. I remember telling everyone around that a teaspoon of matter from a black hole would weigh 100 million tons – I was fortunate enough to have an encouraging family who wanted to listen!

Having said that, nothing extraordinary happened between then and my high school years, other than that I was always curious to read and learn more and was fascinated by stories of planets, distant stars and galaxies. I majored in mathematics and physics in high school and took a first-year physics laboratory course at the local university, but there was little to no astronomy in it. There have been other "loves" in my life and, after finishing high school, I first went to study English philology and linguistics and only when I was in my third year in college, did I decide to start on an astronomy major as well. Doing the two simultaneously was admittedly challenging (imagine close to 50 course hours a week at three different locations in the city), but in the end I managed to obtain two Masters degrees after a total of seven years.

What has played a crucial role in my choosing a career in science, as opposed to humanities, was definitely an opportunity I got in 2008 to work as a Summer Research Assistant at the Space Telescope Science Institute (STScI) in Baltimore. Working at the STScI with Roeland van der Marel, Alessandra Aloisi and Aaron Grocholski on Hubble Space Telescope (HST) Wide Field and Planetary Camera 2 (WFPC2) data of nearby starburst galaxies was the opportunity that allowed me, for the first time, to see world-class science being done. I was really encouraged by the very positive attitude towards budding scientists like myself, which certainly gave me the motivation to continue in the field. The work I did at STScI evolved into a Masters thesis and certainly served as an excellent springboard to a PhD in astrophysics which I started in 2009 at the Instituto de Astrofísica de Canarias in Tenerife, Spain.



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There I was a principal investigator of a project devoted to 3D spectroscopic imaging of dwarf early-type galaxies, the first of its kind for low-mass systems. I worked with Jesus Falcón-Barroso and Glenn van de Ven (Max Planck Institut für Astronomie, Germany) and we looked in particular at the kinematic and dynamical properties of our dwarfs. I got to experience first-hand all the steps of project development: from proposal writing, to preparing observing runs and then carrying out observations at the Observatorio del Roque de los Muchachos in La Palma, through to the reduction and analysis of the data and publishing of the results.

I moved to Germany a few months after finishing my PhD in June 2014, having worked on a Space Situational Awareness project for the European Space Agency (ESA) in between. Two months of an intensive language course in Munich went by and I was ready to go back to doing science full-time. My current work involves looking at both real and simulated galaxies to better understand the importance of the local environment on their evolution. As for the former, my main focus is on stellar populations and star formation histories of early-types, from dwarfs to giants. I also look at the evolution of simulated late-type galaxies in a

cluster-like environment to follow the formation of their substructures.

At ESO I really enjoy the independence and being able to pursue my own research line. Working here has also given me a unique opportunity to experience first-hand the forefront of European astronomical research. Among other things, I got a chance to help as a scientific assistant to the ESO Observing Programmes Committee, which is enormously useful for better understanding the time allocation process and, hopefully, being able to write better proposals in the future (observing or otherwise). I've joked a number of times that when you're at ESO you don't have to travel to be up to date with the latest developments in the field – it's happening right here. While an exaggeration of course, the sheer number of conferences/workshops/symposia and numerous talks can make your head spin – just be careful not to make your goal attending all of them!

I'm a keen hiker and it somehow happened that I've always picked places to live abundant with magnificent hiking trails. This also nicely combines with my other hobby – landscape photography. I have never abandoned my linguistic interests and could say that learning new languages when starting a new job was almost as exciting as the job itself! Thanks to my astronomy adventures I now speak almost fluent Spanish and very good German. I've always found new challenges exciting and so as my family and I move to Poland in a few months, I'm very much looking forward to starting a job in a new field, working on precise astrometry in the context of ESA space surveillance and tracking activities.

### Annalisa De Cia

I grew up in a small town in northern Italy, surrounded by the Dolomite mountains and stunning landscapes. As a kid, I would follow my father's adventures as a paraglider pilot, and soon became fascinated by flying machines. My dream back then was to become a fighter-jet pilot, until I realised I was not really up for the army, nor for wars. But instead I loved science! At junior-high school I had a brilliant teacher and great facilities for all

sorts of experiments — in electronics, optics, chemistry and biology. We would make field trips with experts in geology, and astronomy too. So I had no doubt that I would enroll in a science high school later. Soon I learned to have fun with mathematics and physics, and became more and more curious about how things work in the Universe.

The University of Bologna was my next step, where I got both Bachelor and Masters Degrees in Astronomy and Astrophysics. As part of my Masters, I spent almost a year at the University of Calgary, Canada. Back in Italy for my Masters thesis, I worked at the Astrophysics Institute (INAF/IASF) on the X-ray properties of a low-luminosity active galactic nucleus. While writing my thesis, I remember receiving an email regarding a PhD project on even more energetic and mysterious phenomena, gamma-ray bursts (GRBs), and their environments. And in Iceland. Poyekhali!\*

Without hesitation, I took up the challenge, and set off on a new adventure. This was in 2008. The Centre for Astrophysics and Cosmology, University of Iceland, was a small but warm and stimulating astronomy group, which nurtured my scientific growth and also encouraged my independence by supporting visits and extended projects abroad with my external collaborators, such as at the Dark Cosmology Centre (Denmark), ESO in Chile and the University of Leicester (UK). My PhD years went by excitingly between science, aeroplanes and volcanic eruptions. I am still dreaming about the tremendous and exotic beauty of Icelandic nature.

During a conference in Nikko, Japan, I had learned to appreciate the scientific excellence of the Experimental Astrophysics Group of the Weizmann Institute of Science, Israel. So the science call, and (literally) favourable winds, took me south, to the opposite side of Europe. At Weizmann, I was introduced to the world of supernovae (SNe), and became part of a very active and cutting-edge supernova survey, the Palomar Transient



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Factory. In particular, I started to work on superluminous supernovae (SLSNe), the most luminous SNe in the Universe, whose origin is a hot and still debated field. In the meantime, I became more and more fascinated by small distant galaxies, so faint as to elude normal observations. But we can use bright and distant background sources, such as quasars, GRBs, or SLSNe, to probe their gas properties in incomparable detail. In particular, I started to study the metals and dust within these distant systems, also known as Damped Lyman- $\alpha$  Absorbers (DLAs). The Middle East revealed itself as a very intriguing land, with an impressive historical heritage. But unfortunately with a complex and painful military and political struggle continuing.

In time, I developed a strong European feeling, and so I decided to move to a major astronomical organisation in Europe. I started at ESO as a fellow in September 2015, and immediately found myself loving the place, and being involved in observational and scientific activities, such as the "Gas Matters" club, which my colleagues and I founded to bring the Garching community together and discuss the multi-phase gas inside and outside galaxies. Scientifically, I have just published an extensive work (De Cia et

al. 2016, A&A 596, A97) in which, for the first time, the chemical properties of the gas in the Galaxy and in distant galaxies were characterised in a unified picture. In particular, we derived the properties of the dust and the dust-corrected metallicity in the interstellar medium.

While I have used Very Large Telescope (VLT) observations for my science, I now have the opportunity to be a night astronomer on Paranal. As an ESO fellow, I am observing with Kueyen (Unit Telescope 2), driving the UV-Visual Echelle Spectrograph (UVES), the Fibre Large Array Multi Element Spectrograph (FLAMES) and the X-shooter spectrograph through their diverse science objectives, and learning more deeply the science operations at the Observatory, appreciating the excellence of these world-leading facilities, and participating in ensuring that the observations run smoothly and efficiently, thereby enabling the best science from the collected data. Enjoying a red sunset at the platform, watching the Sun melting into the clouds over the Andes (always hoping for a green flash) and the VLT showing its majesty, I feel lucky. None of this would have been possible without the many brilliant people who guided or inspired me through my journey. I have not named any of them here, but I am grateful to every single one of them. The journey is not over, and I am looking forward to what will be next! And I hope that science will continue to drive my dreams.

#### Jorge Lillo Box

Astronomy, with its link to philosophy, is probably one of the oldest sciences in the history of human beings. Our current job is nothing but a technological improvement and knowledge accumulation over the centuries, building on what the Mayas did in Central America, what the philosophers did in ancient Greece, what Hypatia and her disciples did in Alexandria, what the Rapa Nui did in Easter Island, etc. Nothing more, nothing less.

Becoming an astronomer is a long journey, and many different paths can lead to this final goal. I am pretty sure each of us has a different story in answer to the question "How did I become an

\* Russian for "Let's go!", Yuri Gagarin, 1961



Jorge Lillo Box

astronomer". My story is not really a fancy one, it is just my story. Apparently, when I was a child, with very poor drawing and painting skills, I liked to draw stars in all the school paintings. This passion, however, was hidden in my brain for years, just waiting for the appropriate moment to come out. For a long time I thought about becoming a mathematician and teaching maths, because I really liked the feeling of solving problems and logic games. Discovering the mathematics behind the tick-tack-toe grid game, for instance, was one of those moments when your brain wakes up after years of being in passive mode and starts asking for more and more challenges. This was just one year before I started my pure physics course at the high school. And that was really the critical turning point.

I had the luck to have an extremely experienced, motivated, encouraging, and great physics and chemistry teacher. By just using chalk and the blackboard, he was able to open our minds, our brains, and, last but not least, our interest in answering the question "Why?". Why do things happen as they do in nature? What are the forces governing our world? Then in the same year I skipped my first class at high school to see the 2004 transit of Venus using binoculars with solar filters attached. So, during the last two years of high school, this hidden passion for astronomy that had been there since I was a child, suddenly came out, and I finally said these words to my parents: "Mom, Dad, I want to become an astronomer".

After my degree, I specialised in a hot topic for my PhD: exoplanets in the context of the Kepler mission. My advisor, David Barrado, provided me with the unique and special opportunity to do my doctorate at the Center for Astrobiology in Madrid, and he guided me through this completely new world of astronomical research. From my point of view, this is exactly what I needed, just guiding. During life we are taught many concepts and assumed facts that are, apparently, irrefutable. Freedom of thought is usually avoided (or forgotten) during the learning process at school and university. However, during my PhD I had the necessary freedom to start thinking by myself, to have my own ideas, to start questioning what I was taught. So, this was another of those moments, mentioned before, when my brain woke up again and started exploring new ways of thinking, looking for new challenges.

And this is how I accomplished one of my dreams. Even though thousands of planets have already been discovered, one of them will always be very special to me. This is Kepler-91b, my first discovered planet. This hot Jupiter was the first planet confirmed to transit a giant star and the closest planet to an evolved host ascending the red giant branch, orbiting at just 2.3 stellar radii around the star and the only planet known around a giant star closer than 0.5 au at that time. A handful of planets of this kind were discovered afterwards and they proved to be key to our understanding of the evolution of planetary systems once the star leaves the main sequence.

In the last stages of my PhD, I had another of those "brain please wake up" moments. Suddenly, I found myself applying for postdoc positions and fellowships around the world, all of them requiring a "Research Plan". So, this was an excellent opportunity to be creative, to try breaking the established rules of what we think can and cannot exist in the Universe and to face impossible challenges. From my point of view, this is how we push science to the next level, and so I proposed the TROY project.

ESO gave me a great and unique opportunity not only to develop this project but also to learn, contribute and be part of one of the greatest astronomical facilities in the world, as part of the Scientific Operations team of the Very Large Telescope at Paranal. I was assigned as support astronomer of the Moon (Kueyen in Mapuche language or simply Unit Telescope 2), instrument fellow of X-shooter and the instrument fellow for the forthcoming Echelle SPectrograph for Rocky Exoplanet and Stable Spectroscopic Observations (ESPRESSO). The new capabilities and opportunities that ESPRESSO will bring for the exoplanet community in particular (but also for cosmology and extragalactic studies) make it a complete challenge from both the scientific and the technological point of view. It is still difficult for me to understand that we will be able to measure the radial component of the velocity of a star located hundreds of parsecs away with a precision better than the speed of a walking turtle. Just amazing!

I am looking forward to seeing ESPRESSO in operation and the new space- and ground-based facilities coming in the near future (CHaracterising ExOPlanet Satellite [CHEOPS], PLANetary Transits and Oscillations of stars [PLATO], the James Webb Space Telescope [JWST], etc.), as well as to develop my own ambitious scientific projects. All this is contributing to our understanding of the place in which we live, the Universe we inhabit. Just continuing what our ancestors did years, centuries and millennia ago. Nothing more, nothing less!