

# Staff at ESO

## Eleonora Sani

I've always been fascinated by natural behaviour — why things work in one way rather than another. But, sincerely, I hadn't thought to become an astronomer. I started to be interested in astronomy just by chance when I was in my late teens. Walking in the city centre I saw an amateur telescope in a shop and thought, "Well it would be nice to look at stars and galaxies with such a thing!"

I became enthusiastic about going around the countryside camping and looking at the sky with my brand-new telescope, but still astronomy was not my first choice for future studies. I started studying physics at the University of Florence with some vague idea of taking a Masters in quantum physics or something related to the super-small world. But then, when I had to choose my specialisation I realised that astrophysics is the most complete discipline, because it spans the range from atomic physics, Solar studies, radiation processes, plasma physics and complex dynamics to cosmology, and entails the use of many different kinds of technologies, from ground-based facilities to satellites and many more. How can a researcher desire more than having almost all these fields rolled into one?

I had taken the first step, but still had to choose the topic for my degree thesis (and thus, once more, an important challenge for the future). I was interested in observational work on Solar spectroscopy and had already contacted one team, since the Observatory of Arcetri (where I was supposed to finish my Masters) had a great tradition in such studies. But then I had a meeting with the director, Professor Franco Pacini, and he convinced me that working in extragalactic astronomy with a recently formed team of young researchers would be really stimulating. So once more I changed my plans and started a curriculum centred on supermassive black holes and their co-evolution with galaxies. My PhD and my first postdocs were great periods, during which I started my own project based on Very Large Telescope data and had the opportunity to visit the Max Plank Institut für extraterrestrische Physik in Garching to work on both satellite and interferometric data.

My first experience with an 8-metre-class telescope came when I went to Paranal to observe with the Infrared Spectrometer and Array Camera (ISAAC) for my own project. I remember how nervous and excited I was at the same time because of the scientific challenge and I was also a bit fascinated by the skills of the



Eleonora Sani

support astronomers, who appeared to me as super-heroes!

Now I have become part of this team, supporting VLT Unit Telescope 1 and I am in training as the instrument scientist for the K-band Multi-Object Spectrograph (KMOS), a jewel of infrared technology. I am not a super-hero for sure, but will face new challenges and exciting times in the future with the new generation of facilities.

# Fellows at ESO

## Matthieu Béthermin

I was born in Paris in 1985 and grew up in Suresnes in the western suburbs. From there, the night sky was a sort of bright orange haze caused by all the sodium streetlights. The city of light was certainly not the best place to enjoy the faint and diffuse Milky Way. At a young age, I was already fascinated by the question of our origins. Everything about astronomy, dinosaurs, and prehistoric

men attracted me. But this was nurtured only through reading books and watching TV documentaries.

One of the main events that pushed me towards astronomy, paradoxically, happened on a crowded urban highway in the south of Paris. I was ten years old. After being stuck in a traffic jam for three hours trying to re-enter Paris after a weekend, my parents had decided that Paris was no longer a place to bring

up kids. A few months later, we moved to the south of France. There, I discovered why people say the night sky is black and I saw the Milky Way for the first time. This was beautiful. I started to explore this new world with binoculars and then with a small telescope. After observing the Andromeda Galaxy and reading that the light from there had travelled 2.5 billion years before hitting my retina, I was so fascinated that I decided I wanted to study the cosmos.

I thus started to study physics and maths, since this is the first requirement towards becoming an astrophysicist. I always loved physics and how it connects the world of numbers to reality and paradoxically gives sense to events through abstraction. I first studied at the Lycée du Parc in Lyon and then at the Ecole Normale Supérieure in Cachan, near Paris. During this period I had a six-week internship at the Nançay radio telescope studying pulsars under the supervision of Ismael Cognard. I discovered the large gap between amateur and professional astronomy. There was no long night-sky observing, but high-tech instruments and massive use of computers. Thus it was decided: I definitely wanted to become astrophysicist!

I then studied for my Masters in astrophysics in Paris. I discovered far-infrared surveys during a hands-on session on data analysis. I really liked the challenge of extracting galaxies in data with a very limited resolution. These surveys were also essential to understanding the star formation history of the Universe. The subject was scientifically interesting and challenging and I decided to do my PhD thesis on this topic supervised by Hervé Dole, and in close collaboration with Guilaine Lagache.

The goal of my thesis was to identify the galaxies at the origin of the cosmic infrared background. This background is the relic of all the dust emission across cosmic time and is very important for the understanding of the formation of stars in the Universe. The newborn stellar populations emit a lot of ultraviolet light, which cannot escape the clouds of dust in the vicinity where the stars were born. But the dust re-emits the energy of this light in the far-infrared, allowing us to study this hidden star formation.

Unfortunately, these distant galaxies cannot be detected directly in the data of the Spitzer and Herschel far-infrared space observatories. I thus developed statistical tools to detect the signature of these distant galaxy populations in the faint fluctuations they cause in the cosmic infrared background. After a three-year PhD thesis and a further two-year post-doc at the Commissariat à l'énergie atomique (CEA) Saclay (France) with



Matthieu Béthermin

Emanuele Daddi, my collaborator and I finally managed to identify the galaxies at the origin of the infrared background and the dark-matter halos which host them. We found that in the early Universe, about 10 billion years ago, a large fraction of the stars were formed at a very rapid pace in few very massive galaxies hosted by massive overdensities. The nature of these gigantic star factories, forming 100 times more stars than the Milky Way, was very hard to explain.

After these few years of hard but exciting work, I had the amazing opportunity to come to ESO as a Fellow to pursue my own research programmes, aimed at unveiling the nature of these galaxies. Being independent so early in a research career is extremely stimulating. I continue to use Herschel data and have found gigantic gas reservoirs in these giant galaxies in the young Universe. But, a revolution in my research field is starting with the Atacama Large Millimeter/submillimeter Array (ALMA).

ALMA is especially designed to observe the dust in distant galaxies. It is equivalent to a virtual telescope of up to 10 kilo-

metres diameter with a resolution and sensitivity in the submillimetre matching the performance that the Hubble Space Telescope can reach in the visible. For the first time, the dust in distant galaxies is not seen as a faint blob, but we can study the detail and find surprising morphologies.

As an ESO Fellow, I had the honour to go to observe at ALMA as astronomer on duty. The basecamp of ALMA from which the telescope is controlled offers a breathtaking view of the Atacama Desert and the Andean volcanoes. But the high site at 5000 metres above sea level, on a gigantic plateau, where the array is installed, is even more incredible. Operating such ultra-high technology facilities in such a tough environment is challenging. My experience at ALMA was probably one of the highlights of my career as an astronomer, and this was thanks to the ESO Fellowship!

### Ke Wang

I grew up in the suburb of Chongqing, in southwest China, a place famous for its delicious Sichuan cuisine. There, in summer, temperatures can reach 40°C, so families would gather in the front yard after supper to enjoy the cool evening breeze. My brother and I would play with our dog and cat before falling asleep in the starry light. It was at that time I became fascinated by the charming beauty of the night skies. Then I started a long journey to find out "what these shining little dots are". I conducted my first observations using a homemade toy telescope, targeting the Moon and Jupiter, without knowing that Galileo Galilei did the same thing almost 400 years before. "How great it would be, if I could own a real telescope," I thought. Astronomer soon topped the list of my dream careers. Also included in that list were astronaut, athlete, archaeologist and history teacher. After running several marathons, my injured meniscus warned me that being an athlete was not a good option.

In high school I did well in natural sciences, was interested in many fields, but physics was always my favourite. So I was really excited to find out that there is a field combining the fun parts of both

fields, called astrophysics. I started to read any book about astronomy that I could find, even though some of them turned out to be science fiction (which I actually enjoyed). Book hunting continued throughout my university study at Beijing Institute of Technology (BIT), where I was usually the only visitor to the astronomy section in the library. However BIT did not have an astronomy group. In the final year of my study at BIT, I became a frequent visitor to the neighbouring Peking University (PKU) for seminars in the Department of Astronomy, and naturally conducted my bachelor thesis there, on the habitable zones around Solar-like stars. After a valedictory presentation at BIT I was awarded a place in the PhD programme at PKU, exempt from the entry exam.

Right after my bachelor study I had no idea which topic I would do for a PhD, but I knew I would like to observe using telescopes. Luckily, at PKU we had one year to experience the different subjects being studied at the Department before making the decision. During that year I made my first observing trip to the Purple Mountain Observatory (PMO) 14-metre radio telescope and observed molecular lines in a sample of infrared dark clouds (IRDCs). I was amazed by the (already) gigantic dish and its spherical dome. Although images made by radio telescopes are not (yet) as stunning as optical telescopes, I appreciated the physics one can derive even from a spectrum. Also the fact of “seeing the invisible” (even in the day time!) at radio wavelengths is attractive. So that’s it, radio astronomer!

Soon after I returned from the PMO 14-metre, I was awarded a position in the pre-doctoral programme at the Harvard-Smithsonian Center for Astrophysics (CfA), in the Submillimeter Array (SMA) group. For the first time I flew outside China and moved to Cambridge, Massachusetts, USA. The CfA is one of the hot spots on the world map of astronomy, and the SMA was the first interferometer working at submillimetre wavelengths. With the Atacama Large Millimeter/submillimeter Array (ALMA) coming online in a few years, I knew I was at a good place at a good time. I dived into the sea of knowledge, eagerly learning the fundamentals and the practical aspects of radio interferometry, not only from text-



Ke Wang

books but also from textbook authors and a Nobel Prize Laureate. It was such a privilege to work with people who had actually built and maintained a cutting-edge interferometer: there is no better way to gain a solid understanding of radio interferometry. So I felt that it was like an award to join the SMA remote operations team, controlling the telescope array from a comfortable room at the CfA every week. Early mornings in Boston’s wild winters, clearing the heavy snow in front of the rear door in order to enter the building on time for my SMA observations, is a special memory.

More enjoyable was of course to fly to Hawaii and drive up to the Martian-like landscape of Mauna Kea, home to the SMA and a family of world-class telescopes. Literally above the clouds, watching the array of telescopes moving under my command felt so good! I was also a frequent user of other interferometers and single-dish telescopes including the Jansky Very Large Array (JVLA), the Combined Array for Research in Millimeter-wave Astronomy (CARMA), the Caltech Submillimeter Observatory (CSO) and the Green Bank Telescope (GBT). I used these telescopes to obtain deep, high-resolution images of IRDCs in order to study the initial fragmentation leading to the formation of massive stars and clusters. These observations were later published by Springer as my PhD thesis.

Having spent three years in the USA, I convinced my girlfriend to venture to Europe, a slightly more exotic continent where we did not understand the local

languages. Soon I found myself in the Netherlands, but outside Holland, for a ten-month European Erasmus post-doctoral fellowship at the Kapteyn Astronomical Institute, University of Groningen. That was before my PhD thesis defense. In Groningen, I extended my research horizon to another wavelength range, using data from the Herschel space telescope. In addition to the iconic tulip fields and windmills, I appreciated the Dutch enthusiasm for cycling. I was totally shocked at how efficient the sky is over this land in converting clouds into rain. By the end of my fellowship I could handle sudden rains as elegantly as the locals.

I joined ESO Garching on the occasion of ESO’s 50th anniversary in October 2012. ESO is a unique place in many aspects, from its international, intergovernmental nature to its internal organisation, from the high quality of science it delivers to its frequent exposure in social media. That gives us the opportunities to witness the, usually hidden, political and engineering aspects of a modern observatory, and how decisions are made to shape the next decades of European and world astronomy. Science wise, I was a little surprised to hear “there is no group at ESO”, but few months later I fell in love with the way it is organised: everyone belongs to the ESO family. As an ESO Fellow, I enjoy the freedom of being an independent researcher and at the same time, the rare opportunity to work for the largest ever ground-based astronomy project — ALMA. I have continued to expand my expertise in radio interferometry, gained from the SMA and

the JVLA, to a variety of duties at the European ALMA Regional Centre, such as astronomer on duty (on-site observing), contact scientist, data quality assurance, software testing, tutoring new users, etc. ALMA is revolutionising our understanding of the Universe, and I am proud to be part of the team. Undoubtedly knowing more details of ALMA benefits my own research. On the personal side, although I'm allergic to alcohol and so cannot enjoy the Oktoberfest, we are super happy to find the Alps only one hour away! How can one not fall in love with skiing in the Alps!

My ESO Fellowship has just come to an end, but thanks to the Deutsche Forschungsgemeinschaft (DFG), I can continue my research at ESO as an Associate. It turns out that I am the first to successfully bring a DFG grant to ESO! Currently I am leading an ESO Public Survey towards an all-sky sample of cold molecular clumps discovered by the Planck satellite. After all these rewarding years, the time has come when I can contribute to the community.

Looking up at the crystal-clear sky over Chajnantor on the way to a night shift

at the ALMA Operations Support Facility, my thoughts went back to the yard in my childhood. From my toy telescope to the real telescopes I've operated (or climbed) so far: the PMO 14-metre, SMA, CSO 10-metre, JVLA, GBT 100-metre, CARMA, the Institut de Radioastronomie Millimétrique (IRAM) 30-metre, Effelsberg 100-metre, the Heinrich Hertz Submillimeter Telescope (SMT) 10-metre and ALMA, and I am thankful for the boundless love, help, luck and fortune which, combined, have made my childhood dream come true. I look forward to the even more exciting years to come.

## Personnel Movements

### Arrivals (1 October–31 December 2015)

#### Europe

Agnello, Adriano (IT)	Fellow
Arrigoni Battaiola, Fabrizio (IT)	Fellow
Bonnefond, Sylvain (FR)	Student
Bordelon, Dominic (US)	Library Technology Specialist
Johnston, Tania (UK)	ESO Supernova Coordinator
Kurowski, Przemyslaw (PL)	Software Engineer
Lu, Hau-Yu (TW)	Fellow
Nilsson, Maria Theresa (SE)	Student
Stroe, Andra (RO)	Fellow

#### Chile

Bellhouse, Callum (UK)	Student
Diaz, Mariano (CL)	APEX Site Administrator
Dupeyron, Jorge (CL)	Network & Windows Specialist
Gallenne, Alexandre (FR)	Fellow
Haeussler, Boris (DE)	Operations Staff Astronomer
Hibon, Pascale (FR)	Operations Staff Astronomer
Jaffe Ribbi, Yara Lorena (VE)	Fellow
Klement, Robert (CZ)	Student
Lillo Box, Jorge (ES)	Fellow
Muñoz, César (CL)	Student
Muñoz-Mateos, Juan Carlos (ES)	Operations Staff Astronomer
Plunkett, Adele (US)	Fellow
Vogt, Frédéric (CH)	Fellow

### Departures (1 October–31 December 2015)

#### Europe

Balestra, Andrea (IT)	Software Engineer
Cabrera Ziri Castro, Ivan (VE)	Student
Chira, Roxana-Adela (DE)	Student
Erm, Toomas (SE)	Electronics Engineer
Geier, Stephan (DE)	Fellow
Haase, Jonas (DK)	Astronomical Data Archive & Pipeline Software Specialist
Jamialahmadi, Narges (IR)	Student
klein Gebbinck, Maurice (NL)	Software Engineer
Oezener, Betuel (DE)	HR Advisor
Rahoui, Farid (FR)	Fellow
Zafar, Tayyaba (PK)	Fellow
Zahorecz, Sarolta (HU)	Student

#### Chile

Duran, Carlos (CL)	Electronic Engineer
Parra, Ricardo Nelson (CL)	Electronics Engineer
Smeback, Russell (US)	JAO Head of Administration
Vigan, Arthur (FR)	Operations Astronomer