

## Fellows at ESO

### Edmund Christian Herenz

A large number of professional astronomers felt somehow drawn to the nightly heavens since their early childhood days. I did not fall under this spell. My first encounter with astronomy was late in high school as part of the advanced physics curriculum. I enjoyed this course and it prompted me to attend a summer camp on astronomy. There, for the first time in my life, I peered through a telescope, but I did not feel much excitement — even with this aid to the eyes, the heavenly bodies looked nowhere near as interesting as in textbooks or magazines.

When I later enrolled at Humboldt University in Berlin to study physics, my dream was to become a solid-state physicist. This idea was largely nourished by my uncle, who followed this profession and with whom I spent many days in the lab as a kid. However, during my studies I realised that my level of manual skill was not fully compatible with sensitive laboratory equipment. In fact, it was so desperate that tutors already judged my practical exercises as successful when I managed not to break the experiment.

In search of something more suitable, I attended an astronomy lecture provided by Lutz Wisotzki from the Leibniz Institute for Astrophysics in Potsdam (AIP). This is when the spark of inspiration hit me: astrophysics is a subject where knowledge of physics can be used to understand processes on unimaginable scales and at distances far beyond the realm of ordinary human experience. Realising this made the whole physics curriculum even more exciting. Mechanics, thermodynamics, electrodynamics, quantum physics, special and general relativity — all these subjects provided tools that can be used to understand astrophysical phenomena.

Fuelled by a new passion for physics in general and astrophysics in particular I did an internship at the AIP. My tutor there was Bernd Husemann, who was just starting his PhD (Bernd would become an ESO fellow in Garching after his PhD). He showed me his newly acquired data from a recent observing run at the Calar Alto 3.5-m telescope and tasked me with helping him to reduce the data. These data consisted of Potsdam Multi-Aperture



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Spectrophotometer (PMAS) 3D spectroscopic observations of Seyfert galaxies. At the end of my internship we produced maps that displayed the motions of the ionised gas in those galaxies. Seeing galaxies like this for the first time, I understood immediately that 3D spectroscopic data will provide us with unprecedented knowledge about the processes that govern the physics of galaxy formation and evolution.

I wanted to be part of the research endeavour with 3D spectroscopy, so I did my bachelor's and master's projects at the AIP. At this stage, I was introduced to the Multi Unit Spectroscopic Explorer (MUSE) science team lead by Roland Bacon. There, I started to develop expertise in high-redshift emission line galaxies. In particular, I was tasked with thinking about ways of processing MUSE data to detect the highest-redshift galaxies within reach of this instrument (so-called Lyman- $\alpha$  emitters). Provided with the opportunity of doing a PhD at the AIP, these ideas then culminated in a 3D emission line source detection software: LSDCat (Line Source Detection and Cataloguing Tool). When MUSE was finally commissioned on the ESO Unit Telescope 4 (Yepun), it gave me a great sense of accomplishment that my software started to find numerous previously unknown high-redshift Lyman- $\alpha$  emitters. Most interestingly, the stellar continuum in these galaxies can sometimes be so faint that they are absent from even the deepest Hubble Space Telescope images.

Owing to their distance and faintness, understanding the physics at play in high-redshift galaxies is notoriously challenging. Fortunately, galaxies that are similar to high-redshift systems do exist in the nearby universe. In my PhD I studied a sample of such nearby high-redshift analogues using PMAS. Then, as a postdoc with Matthew Hayes I could deepen my understanding of the fascinating processes in the interstellar- and circumgalactic medium of star-forming galaxies.

During my PhD and post-doctoral position, I was fortunate to participate in all the steps necessary for the creation of new empirical astrophysical insights: (1) pondering about astrophysical questions and the possible observational lines of attack towards answering them; (2) persuading a telescope time allocation committee to grant the needed observations; (3) performing the actual observations at the telescope; (4) reducing and analysing the observational data; and (5) publishing the results and their interpretation with respect to the original question. Moreover, by being a part of the MUSE Science Team I experienced first-hand how scientists and engineers from a multi-national background work together to realise a visionary technological idea. Experiencing astronomy and astrophysics from these various viewpoints sharpened my scientific mind.

My continuing fascination for astrophysics is sustained by future developments in ground-breaking technologies and I look forward to their application in uncovering new regions in discovery space. I have always valued that ESO is devoted to such visionary technological advances. I also value ESO as an organisation that continuously promotes and exercises the European Idea. For me, this idea not only encompasses freedom of travel and trade, but also has a transnational identity at its very heart. I strongly believe that such an identity is needed for a responsible and sustainable social commitment in a globalised world. Thus, I feel very honoured to be a fellow in an organisation embodying this idea.

As an ESO Chile Fellow, I spend 80 nights a year at the ESO Paranal Observatory site. I am assigned to UT4 — Yepun, the telescope at which MUSE is located. Being part of the operations at the world's

best telescope with its advanced four-laser adaptive optics system is a unique experience. During long exposures, I regularly go out on the platform and admire the night sky. While the heavenly bodies did not manage to cast their spell on me as a child, now as an adult they make me feel like a child again, knowing that the Universe is full of wonders just waiting to be discovered.

### Chiara Mazzucchelli

My passion for astronomy started as a very young kid, looking up at the dark night sky from the garden of my parents' house in the countryside in the north of Italy. By mere chance, I found an astronomy book in the small local library that caught my attention. I was in awe of the beautiful images from the recently launched Hubble Space Telescope, and I found it extraordinary that we could, with the power of mathematics and physics, (try to) understand and describe phenomena and objects so remote from us, literally "alien".

However, astronomy was not my only passion during my high-school years, I was very interested in literature, arts, history and related outreach activities, bringing tourists to visit beautiful castles and churches in Italy.



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I decided to pursue my interest in mathematics and physics in the end, enrolling in the physics programme at the University of Milano-Bicocca. I continued being involved in outreach activities, this time combining my passion for both history and astronomy by volunteering at the Observatory Messier 13 in Tradate (Varese), where I could show the sky to the public using small telescopes, a solar laboratory and a collection of historic solar clocks, joining science and the history of astronomy. The personnel at the observatory also observed and characterised asteroids with a 65-cm telescope. This was my first experience of working at a small observatory and in a team, and I thoroughly enjoyed the possibility of learning so much about telescopes and communication from experienced members of my local community.

After I got my bachelor's degree, I started a master's degree in astrophysics in Milan. Thanks to an exchange programme, I had the opportunity to work on my thesis at the Max Planck Institute for Astronomy (MPIA) in Heidelberg (Germany). Under the supervision of Roberto Decarli, I studied the environment of supermassive black hole candidates in quasars at low redshift,  $z \sim 0.1-0.7$ . I used multi-band observations from the Bonn University Simultaneous Camera (BUSCA) at the 2.2-m telescope in Calar Alto. I greatly enjoyed being able to develop my first fully executed project, thanks as well to the patience and enthusiasm of my supervisor. I particularly liked the lively exchange of ideas, discovering how new results could lead to new questions, and finding ways to try to answer them.

Therefore, I decided to pursue astronomical research to the next level, and I was glad to be able to start a PhD at the MPIA in Heidelberg, this time in the group led by Fabian Walter. During my PhD, I focused on quasars at very high redshifts,  $z > 6$ , in the first billion years of the history of the Universe. I find these sources extremely fascinating; they host incredibly massive black holes, and we observe galaxies that are already very evolved forming a large number of stars. How these sources could be formed in such a short time is still one of the more challenging and exciting questions in astrophysics. I was particularly interested

in the characterisation of the large-scale environment of these sources, which can tell us about the dark matter distribution at very early times and unveil the first protoclusters. I was also involved in finding new high- $z$  quasars, by mining multi-wavelength large-area sky surveys, especially the Panoramic Survey Telescope and Rapid Response System (Pan-STARRS). Given the manifold nature of my project, I could work with different datasets, such as optical/near-infrared imaging and spectroscopy, from a variety of ground-based instruments and from space (for example, the Hubble and Spitzer Space Telescopes).

I considered myself particularly lucky to be able to work as part of "Team Quasar", collaborating and learning from many experts in the field, such as Eduardo Banados, Roberto Decarli, Emanuele Farina and Bram Venemans. Even as a new student, I felt my opinions were valued, and that no question was too stupid to be asked. My PhD was not a smooth ride, but the environment I worked in was fundamental to developing my trust and excitement as part of a research team.

Another important aspect of my PhD was that I could follow up many high-redshift quasars, observing directly at the telescope. I had the opportunity to spend many (> 30) nights at the MPG/ESO 2.2-m telescope at La Silla Observatory, operating all the instruments, especially the Gamma-ray Burst Optical/Near-infrared Detector (GROND) camera. There, I fell in love with the Chilean sky and the desert, and I realised that, despite the weariness of the long nights, an observatory on top a mountain in the desert was my "home away from home".

This encouraged me to apply for the ESO Fellowship in Chile, which I started in October 2018. At Paranal Observatory, I support operations on UT1 and UT2, and I am part of the Instrument Team of the infrared  $K$ -band Multi Object Spectrograph (KMOS). I am excited to learn more about this instrument and to make my contribution as, until now, I had no experience with IR integral-field spectroscopy. Now, I especially value the extremely rich and international environment at ESO, both in Vitacura and at Paranal. Working side-by-side with operators and engineers, I am

in touch with instruments and operations in a way that would not be possible in many other institutes. I am extremely grateful also for all the personal support from the ESO staff in the last 1.5 years,

which have not always been easy. On the other hand, the scientific environment in Santiago is rich and exciting, and allows me to touch ground and start new collaborations with teams at several universi-

ties. In my free time, I enjoy learning more about Chilean culture, visiting museums and theatres in Santiago, and Chile itself, exploring deserts and mountains and, of course, the beach.

## Personnel Movements

### Arrivals (1 April–30 June 2020)

#### Europe

Cortes Carvallo, Angela (CL)	Instrumentation Engineer
Dussuet, Thierry (CH)	Software Engineer
Guglielmetti, Fabrizia (IT)	ALMA Regional Centre Scientist
Seemann, Ulf (DE)	Instrumentation Engineer
Wilson, Christopher (UK)	IT Specialist – Security

#### Chile

Berrios, Lilian (CL)	Human Resources Assistant
Buie III, John Gilbert (US)	Web Application Developer

### Departures (1 April–30 June 2020)

#### Europe

Dichirico, Canio (IT)	Electrical Engineer
Kalaitzoglou, Dimitrios (GR)	Electrical Engineer
Kurian, Kshama Sara (IN)	Student
Poci, Adriano (AU)	Student
Quattri, Marco (IT)	Mechanical Engineer
Riffald Souza Breuer, Jean-Paul (DE)	Student

#### Chile

André, Mylène (FR)	Communication Officer
Chacoff, Mercedes (CL)	Administrative Assistant
Gonzalez, Sergio (CL)	Electronics Engineer
Muñoz-Mateos, Juan Carlos (ES)	Operations Staff Astronomer
Nyman, Lars-Åke (SE)	Station Manager of Apex
Pérez Sánchez, Andrés Felipe (CO)	Fellow



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