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Fellows at ESO

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Growing up in one of the most remote cities from the sea, Urumqi, deep in northwestern China, I was fascinated by astronomy since my early childhood, just like hundreds of millions of other boys on this planet. I can still remember one night more than 20 years ago, at nine-years old, I was copying a table of the temperatures and fluxes of the brightest stars in the sky from a book with my friend. I would come to consider that moment the beginning of my scientific career in astronomy. My love of astronomy just kept growing over my childhood, partially because of my stubbornness and persistence.

Four years later, in junior high school, I started to write letters to the author of that same book — the then director of Yunnan Observatory — asking astronomy questions. I was incredibly grateful that he responded to all my mails carefully. Among those letters, I asked how I could get prepared to be a professional astronomer. He replied with detailed and insightful suggestions covering two pages that have impacted my life ever since. Later, in high school, my passion for astronomy helped me join the astronomy club. The teacher responsible for the club was Gao Xing — one of the most famous amateur astronomers in China. With him, we learned a lot about basic concepts in astronomy and had many unforgettable experiences of observations such as eclipses, meteor showers, the transit of Venus and Messier marathons (during which amateur astronomers try to find as many Messier objects as possible in one night).

Naturally, after high school, I chose one of the few universities in China that has an astronomy department to pursue my passion for a career in astronomy. I was very serious about becoming an astronomer. During the last year of my undergraduate life, I started to study the cold dust emission in galaxies with data from the Submillimetre Common-User Bolometer Array (SCUBA) on the James Clerk Maxwell Telescope, under the mentorship of Gao Yu from Purple Mountain Observatory in Nanjing. It was also then that I learned about the Atacama Large Millimeter/submillimeter Array (ALMA) and that it would become the most powerful telescope in the near future. I dreamed of using it one day. After I graduated, I entered the masters programme at the same university.

By coincidence Gao Yu happened to meet Alain Omont from Paris during that time. Alain was working on a new project that could lead to a masters student project. So I was fortunately introduced to Alain and started a research programme co-supervised by Yu and Alain. Around that time, submillimetre water vapour lines were coming back to people's attention because of the launch of the Herschel Space Observatory. Its instruments the Spectral and Photometric Imaging Receiver (SPIRE) and the Heterodyne Instrument for the Far Infrared (HIFI) enable us to detect a massive number of submillimetre H_2O lines in our Galaxy and in nearby galaxies. These H_2O lines are a unique and essential diagnostic tool that helps us understand better the conditions in the interstellar medium. So I started to investigate those H_2O lines using Herschel Science Archive data, by collecting data from all of the galaxies that had been observed. At the same time, with Alain, we also started to target those bright H_2O lines in the high-redshift Universe, by picking up strongly lensed starbursts from large-area Herschel SPIRE maps. We quickly built the largest sample of the H_2O-line-detected sources across cosmic time.

After obtaining my masters degree, I entered Purple Mountain Observatory for a PhD programme with Yu. And to continue our study of the sample of strongly lensed high-redshift starbursts, I started a co-tutelle (joint) PhD programme between Université Paris-Sud and University of Chinese Academy of Sciences from 2014. I moved to Paris from Nanjing that year and started my research projects under the supervision of Alain Omont and Alexandre Beelen. Université Paris-Sud is in Orsay, the beautiful southern urban area of Paris. I started a systematic investigation of the physical conditions of the cool interstellar medium in the high-redshift strongly lensed starburst galaxies using different telescopes. With the 30-metre telescope of the Institut de Radioastronomie Millimétrique (IRAM), one of my favorite telescopes, I had several observing runs lasting weeks to study the CO ladder of those galaxies. We also obtained a massive amount of data from the Plateau de Bure Interferometer, from which I gained most of my knowledge of interferometry. Unfortunately, I never had a chance to see the

antennas on the plateau. However, on my 28th birthday I observed with the James Clerk Maxwell Telescope and finally saw world-famous telescopes like Keck with my own eyes. It was an unforgettable experience. With the Karl G. Jansky Very Large Array (VLA), we studied the properties of dense gas in those lensed starbursts and, little by little, I realised that my passion is for astronomy observations, including the joy when the proposal is accepted, and the excitement of checking freshly acquired data.

During the last year of my PhD, when I received an offer from ESO for a fellowship in Chile in January 2017, I was thrilled that I would be working with ALMA, the most powerful (sub)millimetre telescope that I dreamt about back in 2010. My dream came true and I moved to Chile in November 2017.

At ESO, I spend 50% of my time at ALMA performing functional duties. I still remember my first trip to the 5000-metre-high array operations site of ALMA. The landscape is simply Martian. I have enjoyed participating in the science operations at ALMA a lot, where I keep learning every day and work to contribute to ALMA. During the other half of my time, I continue my research into molecular gas and dust in galaxies. Using ALMA, I acquired images of dust and gas emission at scales of 100 pc for dusty galaxies when the Universe was about two billion years old. I am also using the NOrthern Extended Millimeter Array (NOEMA) of IRAM and ALMA conducting spectral line surveys of high-redshift galaxies, pushing the limit of astrochemistry studies to the early Universe. Besides, the submillimetre H_2O emission from galaxies has been one of my areas of interest. With the Atacama Pathfinder Experiment telescope (APEX), we achieved the first detection of the 752-GHz H_2O line in extragalactic systems from the ground.

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External Fellows at ESO

In addition to the ESO fellowships, a number of external fellows are hosted at ESO. Profiles of two of these fellows are presented here.

Prashin Jethwa

It could so easily not have happened at all! My two-year stint at ESO has been a fortunate coincidence. Sidestepping the usual route taken by fellows, my voyage through the seas of ESO has been at the command of a brave captain: Glenn van de Ven. I joined Glenn's group, funded through a European Research Council grant, for a position which was originally intended to be hosted at the Max Planck Institute for Astronomy in Heidelberg. However, along with Glenn, my position moved to ESO Garching, where I have been based since October 2017. No sooner have I learnt to navigate through the ESO headquarter buildings, however, than my time here has come to an end. I will soon move to re-join the newly appointed Professor van de Ven, this time at the Institute for Astrophysics in Vienna. Despite, then, my time at ESO having been largely unplanned, it has been an immense pleasure, and I leave as a more enriched and fulfilled person than when I arrived.

I was born and raised in London, where I spent my childhood enjoying football (Liverpool), Pokémon (Charizard), and ice cream (all varieties). Notably absent from this list is astronomy. Perhaps I can blame urban light pollution, but I cannot claim to have been especially awestruck by the Universe in my formative years. Rather than looking up through a telescope, I kept my head down, often in a mathematics textbook. This is what really absorbed the academic side of my youthful brain: maths problems, puzzles and... polynomials? This led me to the University of Cambridge, where I completed an undergraduate degree in mathematics. It was a broad curriculum, spanning aspects of pure and applied maths as well as theoretical physics. The latter topic dominated my choice of courses in the final year, reflecting my evolving interest in mathematics: not just as an abstract puzzle, but a tool for modelling real phenomena and solving real problems.

My transition then began in earnest. I chose to continue at Cambridge with a master's degree in astronomy, learning the fundamentals of the subject from a mostly theoretical perspective. I then spent a year as a European Space Agency (ESA) Young Graduate Trainee in Madrid, where I got to experience a more "hands-on" side to astronomy. My project at ESA consisted of modelling overexposures on the cameras of XMM-Newton, a space-based X-ray telescope. During this time, I also enjoyed my first look through a telescope. After an impromptu 100-kilometre drive south of Madrid with a friend's 20-inch Dobsonian telescope, I saw Saturn's rings, Jupiter's moons and made amends for my youthful oversight. Having ticked this box, gained some substantial research experience, and seen part of the wider astronomy community, I felt ready to move on to the next step.

For my doctoral studies, I returned to the Institute of Astronomy in Cambridge. Under the supervision of Vasily Belokurov and Denis Erkal, I completed a thesis about the Milky Way halo. The halo refers to the region out to distances of a few