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From a biased perspective: quasars, mergers, and planet-forming discs

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First Author

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CURRICULUM VITAE

I was born in Abano Terme (Italy) on October 31st, 1997, the first of five children. I grew up in Mira, a small town in northeastern Italy along the Riviera del Brenta, the historic waterway connecting Padova to Venezia. I was the smallest kid in sight – shy, timid, and scared of just about everything. At the same time, I was full of energy and curiosity, and I managed to do well in school while being appreciated by both classmates and teachers. In high school – finally an actual person, rather than the weird creature one becomes in middle school – I spent some genuinely happy years at Liceo Scientifico Galileo Galilei in Dolo. My feelings about school remain mixed: on one hand, it was often boring and I rarely paid attention in class; on the other, I loved the thrill of learning and discovering the world. I was especially drawn to mathematics, physics, philosophy, and literature. A few professors – those I actually listened to – left a profound mark on me. Among them was my Italian literature teacher, Lucia Tosi. Though she spent little time with us, as she was battling cancer during our final years, she taught me to love the world in both its beauty and its suffering. In essence, she was a poet, and whatever there is that is poetic in me, she helped awaken.

In high school, though, it was often outside the classroom that I lived my most enriching experiences. The Scout association taught me lessons no chalkboard ever could, and entertaining children in my parish gave me both confidence and joy. Fueled by curiosity and by a tendency not to be content with what was given, I threw myself into a range of extracurricular activities. The ones I remember most fondly are the national Physics and Astronomy Olympiads, the philosophy debate tournament organized by the University of Padova, and a few small research internships at the University of Padova, the Osservatorio Astronomico di Asiago, and the Haus der Astronomie in Heidelberg. Through these experiences, my interest in physics and astronomy steadily grew.

Finally, I chose to study physics at the university and was admitted to the Scuola Normale Superiore (SNS) in Pisa. Passing the admission test at SNS will always remain one of the hardest – and most unexpected – accomplishments of my life. In 2016 I moved to Pisa and, as required, attended courses both at SNS and at the University of Pisa, where I obtained my Bachelor's and Master's degrees. SNS gives a lot and takes a lot: it gave me a solid foundation in mathematics and physics, some of the best teachers I will ever meet, and, most importantly, a group of brilliant people with whom I shared everything – from endless hours of study and problem-solving to water balloon wars, 24-hour table-soccer marathons, and much more. What it demanded, essentially, were several years of my life. Time, interests, social connections – everything was confined within the walls of the Scuola.

I often wonder whether it was worth it. Perhaps the answer will take time to emerge, but I know I am deeply grateful for the unique experience I was able to live.

During my studies, I had the opportunity to take part in several research experiences abroad, including a wonderful summer in Leiden as part of the LEAPS program. The project I began there with Giovanni Rosotti and Benoît Tabone eventually led to the publication that now forms one of the chapters of this dissertation. For my Bachelor's thesis, I decided to reach out to Andrea Ferrara, who leads the Cosmology Group at SNS – a choice that proved extremely rewarding. While Bachelor's theses in Italy are usually limited to short in-depth reviews of lecture topics, Andrea instead presented me with some data to explain and an idea for how to tackle the problem. I was hooked. That project became my first publication and later grew into my Master's thesis, which I completed in 2021 under the supervision of Andrea Ferrara and Andrea Pallottini, earning special praise from the examining committee (the so-called *abbraccio accademico*) as well as two national-level prizes.

Thanks to the projects I undertook during my university years, I became convinced that I wanted to explore the world of research further. I decided to return to Leiden to pursue my Ph.D. under the joint supervision of Joe Hennawi and Joop Schaye. Over these four years, the projects I worked on, the guidance of my supervisors and mentors, and the inspiring environment of the Observatory and the institutes I visited have transformed me from a good student into a scientist. I now feel that academia – with all its flaws and limitations – is the place where I belong at this stage of my life. After receiving my doctorate, I will move to the Center for Astrophysics at Harvard University to continue my research on quasars and the growth of supermassive black holes as an NHFP Einstein Fellow.

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To my supervisors, Joe and Joop: I have learned more from you than I could ever put into words. You showed me not only what it takes to be an astronomer, but how to approach research with enthusiasm and curiosity. Working with you was demanding, yet always rewarding—and, above all, fun. It was exactly what I needed. Matthieu, you often stepped in as a third supervisor; I'm grateful for your help, your insights, and your kindness.

To all the other mentors who have shaped my path over these years. Christina, collaborating with you was one of the highlights of my Ph.D. Thank you for the care you showed during my visit to MIT, and for always offering encouragement and perspective. Andrea, I am deeply grateful for your support and advice throughout these years. Having you to look up to gave me the confidence to face each step in my career with more courage and trust. Giovanni, if working on protoplanetary discs in the middle of a Ph.D. on quasars ever felt manageable, it was thanks to your patience and guidance. And on the other side: Boyi, you were a fantastic Master's student—we both grew a lot through the journey we shared.

Being part of two groups was a gift—it broadened my perspective and made each day richer. Riccardo, JT, and Caitlin—thank you for the many ways you supported me; you all were deeply missed in the group. Timo, Daming, Ben, and Lars—it was a pleasure to share this journey with you. And Timo, getting to know you better over time—through climbing, skiing, and more—was something I greatly enjoyed. To the gang at UCSB: meeting you in person after so many online (and inevitably awkward) interactions was wonderful. Joey and Roi, I often felt you were like older brothers I could look up to academically. Victor and Rob, thank you for your patience with all my HBT-related questions. Evgenii, Filip, Jeger, Orestis, Will, Yunhao, and Zorry—I learned a great deal from each of you.

Who would have thought that leaving Italy I'd end up finding some of my favorite Italians? Ale, the way you connect with people is rare. You've changed me in many ways; I'd call it bullying, you'd call it painting on a blank canvas—but I know we'll both miss it dearly. Nicco, I admire the passion and enthusiasm you bring to everything you do—it's contagious. Nicole, your humor never fails to make me laugh—it's always more fun when you're there. Karin, your energy was a breath of fresh air this past year—thank you for bringing it into my life. Bianca and Paola, I'll thank you together so I don't mix up the names, but each of you made my time here warmer and brighter. Riccardo, Arianna, Luca, Elisa, Joan: thank you for the furniture hunts, the moves, the dinners, and everything in between.

These past four years have been the most intense of my life, filled with experiences that will stay with me forever: (mud)runs, ski trips, wipeouts,

canal swims, camping nights, football tournaments, and more. To everyone who helped turn those moments into memories, thank you. Andrew, whether trying a new sport or doing something ordinary, it was always better with you around. Josh, thank you for dragging me into so many things, and for being the one I both dreaded and loved to find in my office. A special thanks to the climbers—Amadeo, Thijs, Erik, Billy, Dario, Manuel, Yuze—and to the members of the amazing Cosmos United team. To all the PhSki organizers: you created a truly wonderful tradition and made me fall in love with skiing again. And beyond Leiden, thank you Dominika, Teo, and Kai-Feng for including me in your adventures. I look forward to many more!

But life isn't just about big experiences—it's also built on the small, everyday moments. To my office mates, past and present—Piyush, Beth, Filip, Yannick. Piyush, a special thanks for your constant support, and for all the gossip. And finally, to everyone who made the observatory feel more than just a workplace: Alberto, Alfred, Amy, Andres, Anna, Anniek, Ani, Ben, Brigitte, Casper, Celine, Chloe, Christiaan, Christian, Ciaran, Dennis, Dilovan, Elena, Esther, Fran, Fraser, Gijs, Ivana, Jelle, Jessica, Julia, Jurjen, Kevin, Kirsty, Kostantinos, Leoni, Logan, Louis, Lucie, Luna, Mantas, Marta, Martje, Naadiyah, Osmar, Pavel, Pranjali, Richelle, Roland, Sam, Sid, Sill, Thomas, Veronica, Victorine, Willeke, Zeynab—thank you for all the little things we shared.

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