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Linking simple molecules to grain evolution across planet-forming disks

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Curriculum Vitae

I was born in Santiago de Chile on a very hot day (even for Chilean standards) in the summer of 1990. I lived with my grandparents, my mother and my little brother in a quiet residential area. A few years later I moved to a countryside area very close to the city known for its excellent wines. For as long as I can remember my mother encouraged me to explore her artistic and scientific interests: music and astronomy. I started playing piano when I was 5 years old and I even briefly attended the Music Conservatory of the Pontificia Universidad Católica. At first, the piano and I were not the best of friends. Today, playing the piano is a wonderful gift that I have learned to appreciate and love. Knowing how to express yourself through a musical instrument is one of the greatest joys in life. In a very similar fashion, my mother's obsession with stars and the Universe (and in particular Carl Sagan's COSMOS) started rubbing off on me at a very young age. The images of the tilted rings of Uranus and the huge rings of Saturn dazzled me. As a fully fledged nerd teenager I participated in math tournaments and attended public talks on physics and astronomy during my high school years. I enrolled in the bachelor programme of Science at Universidad de Chile and started my studies in 2008. This programme is designed to provide a strong foundation on math and physics, as well as a broad variety of subjects, ranging from economy to chemistry, during its first two years. My first real experience with astronomy came around May 2010 during my first astrophysics course, *Astronomía Experimental*, where I got to operate the GOTO telescope at the Cerro Calán Observatory in Santiago. The pixelated image of Jupiter and its Galilean moons is engraved in my memory.

After finishing my bachelor's degree I was admitted to the master programme of Astronomy, at the same University, to work under the supervision of Prof. dr. Simón Casassus. During this time I was teaching assistant of two of my favorite physics topics: relativity and quantum mechanics. I also gave talks for the general public at the Cerro Calán Observatory. My master's research project consisted in implementing and designing an algorithm using principal component analysis (PCA) to improve the classical spectral deconvolution imaging (SDI) technique. This technique is used to directly image the circumstellar material and forming exoplanets around young stellar objects in the infrared regime. I devised a selection criterion that resulted in roughly twice the amount of throughput in comparison to the classical approach. In early 2013, I was invited to the PhD application round at Leiden University where I was offered a position to work with Prof. dr. Michiel Hogerheijde on the radial and vertical distribution of the gas and dust content of planet forming disks. During my PhD I analyzed data from the *Herschel Space Telescope* and the Atacama Large (sub)Millimeter Array (ALMA) toward two well-known protoplanetary disks around HD 163296 and TW Hya. My PhD dissertation focused on the link between the morphology of key gas-phase molecular species and grain evolution processes, probed by continuum observations in the (sub)millimeter regime, towards these two sources.

During my years in Leiden I got to travel to wonderful places to present my research

and I met many young and talented scientists. I participated in the traditional dutch borrel committee where I enjoyed many lively conversations with fellow PhDs and post-docs. Next year, I will continue my career at the University of Kagoshima in Japan as a specially appointed research staff for the NAOJ Chile Observatory working with Prof. dr. Shigehisa Takakuwa. This new project aims to use ALMA to understand the processes involved in the formation of planet forming disks which are still embedded in an envelope of gas and dust.

Acknowledgments

I apologize in advance if I forget to thank someone in specific, since I met so many wonderful and interesting people throughout this journey. Although so many of you have contributed in different ways to the completion of this dissertation I would like to start with the most obvious and sometimes (surprisingly) overlooked individual: my supervisor. I was truly lucky to have Michiel guide me through my PhD. You perfectly fit my archetypal view of a mentor. Thank you for your patience, for answering three (or many more) times the same question, and for never undermining my confidence. Without your constant support and understanding this would have seemed an impossible task.

Irene, Matteo, Marco, Berenice, Thanja, Silvia and Nicola were among the first people that welcomed me to Leiden. I enjoyed our baking club meetings and our constant complaining about the weather. Tiffany, my first office mate, thank you for your guidance during my chaotic first months. I also had the pleasure of meeting Nienke during my first year in Leiden. You have proven to be a valuable friend and I thank you for your support and unconditional friendship. I hope we continue to visit each other wherever life take us. Emanuelle, thanks for keeping things light and your funny but inappropriate jokes.

During my second year I found a very special group of people. We quickly bonded and we have shared numerous adventures together. Most memorably, the unforgettable trip to Barcelona and the NOVA school. Mike and Charlotte, I will miss our chats about cats and what is truly British. Thank you so much for decorating and lending us your tandem. Mieke, keep being your weird self, I will send goats from Japan. Aayush, we should keep playing tennis. Eleonora, whenever I drink a cappuccino around 6 pm I will think of you. Andrew, we will surely plan a trip to kiwi-land and we hope you are there to guide us. Chris and Zoe, we have managed to be away for all your pumpkin carving sessions, I hope we can be there for the next one. I also got to know Gabi with whom I share the passion of running. Gracias por todo pollita, estoy seguro que nos veremos en un futuro no muy distante.

My stay in Leiden would not have been complete without sharing an apartment in Kruitschip with two very special Danes. Ann-Sofie, thank you for your kindness. I love to hang out with you and freely be as geeky as possible, either discussing the Potter world or watching Love Actually. Special thanks to Jeroen and his knowledge about beer and dutch grammar. Christian, your enthusiasm, at times extreme, has impregnated our community. Thanks for all the lectures about bow ties and what is proper. I wish you and Iris the best in this new adventure and I hope we never lose touch.

As the saying goes "los chilenos están en todos lados". Seba and Javi, muchas gracias por su incondicional amistad. Javi extrañare tus noches de locura, nuestras selfies y cuchicheos. Seba, gracias por los incontables debates y conversaciones que pretendían arreglar el mundo. Pablo, gracias por los puchos y las noches de tertulia. Francisco, mi fuente inagotable de tabaco muchas gracias por la buena onda, te deseo éxito en todo lo

que tu y Nora se propongan. Pedro y Santi, mis queridos secuases borreleros, gracias por las parrilladas y por las lecciones de mexicano. Fran, aunque llegaste tarde fue como si siempre hubieras estado aquí, dejamos el borrelito en buenas manos. Yanett, Max, Cristi, Claudio, Cristóbal, Dani y toda la comunidad latina me han hecho sentir en casa.

A special thanks to our small (but growing) research group, Mason, Eva, Leon and Jeroen, for keeping up our morning meetings fun and interesting. A special thanks to Leon who proofread my samenvatting. Mason and Allie, sharing a traumatic experience is among one of the few things that create an unbreakable bond. I think the agony of taking that train back to Munich qualifies as such. We will be waiting for your visit (and this time having a selfie stick will be a prerequisite). Allison and Alex, thanks for your support, for never having a boring conversation and for the series & movies recommendations. Now you enter a new chapter in your lives and I could not be happier for both of you.

My dear Eva, I was trying to pick just one moment with you to immortalize in these pages, but there are so many of them. Instead, I just want to thank you for all the support and love you have given me. I have seen your PhD journey from the beginning and I have had the pleasure of sharing it with you. I hope we continue making memories for a life time. A special thanks to Niels for sharing my passion for horror movies when no one else did. Mi amorosa Heather, las palabras de gratitud sobran. Personas como tu hay pocas, con una sonrisa bordada en la cara frente toda adversidad. Gracias por ser mi amiga y confidente, espero que los años nos traigan mejores momentos, mas risas y muchos gokus en el cielo. Without my family I would have never been where I am today. Gracias a mis abuelos, que desde muy pequeño, han reafirmado mi confianza he impulsado a soñar en grande. Mama, eres sin lugar a duda la coautora invisible de estas páginas, gracias por creer en mi, cultivar mi curiosidad y ser el sustento que siempre has sido.

Finally, I want to thank my husband Wijnand who designed the cover of this thesis and translated my summary. You have endured my ups and downs. You have watched me closely and have supported every decision I have made. Coming home to you (and Shaffy) is an instant stress-cure. You and your family, now also my own, have received me with open arms and I am very grateful to have found you. This is only the start of our adventure, and knowing I can rely on you makes me stronger. Thank you for your love mi varkentje, ik houd van jou.