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Simulating the birth environment of circumstellar discs

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List of publications

First author

1. The viscous evolution of circumstellar discs in young star clusters
Concha-Ramírez, Francisca; Vaher, Eero; Portegies Zwart, Simon
Monthly Notices of the Royal Astronomical Society, Volume 482, Issue 1, p.732-742 (2019)
2. External photoevaporation of circumstellar discs constrains the time-scale for planet formation
Concha-Ramírez, Francisca; Wilhelm, Martijn J. C.; Portegies Zwart, Simon; Haworth, Thomas J.
Monthly Notices of the Royal Astronomical Society, Volume 490, Issue 4, p.5678-5690 (2019)
3. Effects of stellar density on the photoevaporation of circumstellar discs
Concha-Ramírez, Francisca; Wilhelm, Martijn J. C.; Portegies Zwart, Simon; van Terwisga, Sierk E.; Hacar, Alvaro
Monthly Notices of the Royal Astronomical Society, Volume 501, Issue 2, pp.1782-1790 (2021)
4. Evolution of circumstellar discs in young star-forming regions
Concha-Ramírez, Francisca; Portegies Zwart, Simon; Wilhelm, Martijn J. C.
Monthly Notices of the Royal Astronomical Society, in review

Contributor

1. A MODEST review
Varri, Anna Lisa; Cai, Maxwell Xu; **Concha-Ramírez, Francisca**; Dinnbier, František; Lützgendorf, Nora; Pavlík, Václav; Rastello, Sara; Sollima, Antonio; Wang, Long; Zocchi, Alice
Computational Astrophysics and Cosmology, Volume 5, Issue 1, article id. 2 (2018)

Proceedings

1. The size-evolution of circumstellar discs in the Trapezium cluster
Portegies Zwart, Simon; **Concha-Ramírez, Francisca**
Memorie della Societa Astronomica Italiana, Volume 88, p.648 (2017)

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Curriculum Vitae

I WAS born on the 21st of April of 1988 in Temuco, a city in the south of Chile with a weather remarkably similar to that of Leiden. From a young age I was attracted to astronomy, or rather, to astronomy outreach: during the summer holidays, I would sit my family down and give them short “lectures” about the phases of the Moon.

It was not until my high school years in Colegio Universitario El Salvador, in Santiago de Chile, that I started developing an actual interest for physics and astronomy. The event that sparked my curiosity came about in my first year: I was invited by the only physics teacher in the school, Patricio Arriagada (who used to jokingly call himself “the physics department”), to join a recreation of Eratosthenes’ experiment to measure the radius of the Earth. Simultaneously with a group of students in a city in the north of the country, we measured the length of the shadow cast by a stick on the ground. The last-year students then used trigonometry (which was very impressive to me at that time) to calculate the radius. It was teacher Patricio who awakened my interest in physics, and it was thanks to him that I learned that astronomy was an actual career that I could study. My math teachers, Inés Millán and Marta Quevedo, were also a great support in helping me follow this path.

When I was still in high school, in 2004, I joined the Astronomy Summer School at Universidad de Chile, in which for a month I had the closest to a university education that I had had so far. We learned about the orbits of the planets of the solar system, about stellar evolution, and about galaxy dynamics. It was this course that solidified my interest not only in astronomy, but also in where I would study it. In March 2007 I arrived as a starry-eyed student to the Facultad de Ciencias Físicas y Matemáticas of Universidad de Chile, of which I am a very proud alumna. After the first two years, which were joint with the engineering programmes and consisted of basic physics, mathematics, and engineering courses, I began my specialization in astrophysics.

During my years as a bachelor student, I met some of the people that would be vital in my development as a scientist, in particular Professor Patricio Rojo and Professor Maria Cecilia Rivara. Professor Rojo taught the Stellar Astrophysics course, and it was thanks to him that I discovered that astronomy was not only looking through telescopes and analysing images, but that a big part of being an astronomer was developing code. Thanks to him I also had the opportunity to dip my toes into observational astronomy, in several observing trips to Cerro Tololo and La Silla to collaborate with his exoplanet research. As fascinating and exciting as those trips were, I was already starting to realize that observational astronomy was not my path. During my bachelor studies I had to carry out a small research project, which I developed with Professor Andrés Escala. While my results of this project were not particularly remarkable, it was here where I had my first approach with actual computational astrophysics: I analysed the formation of clumps in SPH simulation snapshots of galaxy collisions. I did not run the simulations myself, but I became fascinated which how much you could learn using this tool, and with how you could model all kinds of astrophysical

phenomena in a computer.

After that, I decided that computational astronomy was what I wanted to focus on. As a way to prepare, during the last couple of years of my bachelors I enrolled in a series of courses from the Computer Science department. It was in the Computer Graphics course where I would meet Professor Maria Cecilia Rivara, who also became pivotal for my future. After being successful in the class and eventually becoming Teaching Assistant for it for a few terms, I continued to work on research on Computational Geometry with Professor Rivara. I figured that a strong computational background would be key for my development as a computational astronomer, so after receiving my Bachelor in Science degree in 2013 I enrolled in the Master's degree in Computer Science at Universidad de Chile. After taking some courses and carrying out short research projects on computational geometry and graphics processing unit (GPU) accelerated computing, I started working on my thesis project. My Master's thesis consisted in the development of a light curve extraction pipeline powered by the GPU, which I completed under the supervision of Professor Rivara and Professor Rojo.

It was also during my final undergraduate years that my interest in astronomy outreach materialised into actual work. In 2012 I joined the team at Observatorio Astronómico Andino (OAA), a beautiful touristic observatory close to Santiago. There, I had the opportunity to provide astronomical tours and talks to a widely varied audience, ranging from students from the nearby primary school, to local celebrities, to the former president of Chile, Michelle Bachelet, and several ministers. It was at the OAA that I learned how to find my way around the southern sky, how to find constellations and the celestial south pole, how the sky changes during the year, at which moments of the year the solar system planets are visible, and how cold it can get at the foot of the Andes. In 2015 I began my own personal endeavour in astronomy outreach by launching "Primer Fotón"⁸, a blog where I write about astronomy and computer science. With a strong social media presence, I share naked-eyed observable astronomical events with the public, and every month I summarise a news article about astronomy in my podcast⁹. While this project took a back seat in the last year to focus on finishing my PhD, I look forward to continuing sharing astronomy with the public of all backgrounds and ages.

In September 2016 I arrived at the Leiden Observatory in the Netherlands to start my PhD project in the Computational Astrophysics group, supervised by Professor Simon Portegies Zwart. It was here when I finally got to implement my own astrophysical simulations and to bring together my love for both coding and astronomy. In early 2017 I joined the Astronomy on Tap Leiden team, which allowed me to continue sharing astronomy with the public and would become one of the most enriching experiences of my time as a PhD student.

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⁸<http://primerfoton.cl>

⁹<http://podcast.primerfoton.cl>

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I would like to thank the team of people at Leiden Observatory that made my arrival in The Netherlands and the completion of this PhD possible: Evelijn, muchísimas gracias por todo tu apoyo tanto en lo académico como en lo personal. Alexandra, thank you for all your work and your help, in particular in arranging the final stages of this PhD. Marjan, Susan, Monica, Liesbeth, thank you for your never-ending work, support, and help. It was thanks to you that my settlement in Leiden and in the observatory went so smoothly. I would also like to thank the ICT team, Eric, Erik, David, Leonardo, for their patience and assistance. Major, major thanks to Valeriu Codreanu, Maxwell Cai, and the whole support team at SURFsara for being of invaluable help in using the Cartesius supercomputer. It is not an exaggeration to say this thesis would not be finished without their friendly and patient support.

To my co-sovereigns of the CAsTLe: Santiago, Maxwell, Thomas, Jeroen, Martijn. Thank you for all the lunches, conversations, office therapy sessions, Zoom borrel-breakfasts, for your insistence in taking the stairs instead of the elevator, and for your friendship. I feel incredibly fortunate to have shared these four years with all of you. Martijn, I wish you all the best as the (currently) sole ruler of the CAsTLe! Thank you for all your help and all your work, it was great to collaborate with you. Steven, Arjan, and Inti, thank you for being the core that keeps AMUSE together, and for your infinite patience in helping us newcomers (and not so newcomers) use the framework.

One of the most important, formative, and enriching experiences during my PhD was joining Astronomy on Tap Leiden. I was lucky enough to be part of the team when it started and to see it grow into the amazing project that it is today. Liz, Yanett, Vincent, thank you for taking the steps to start AoT Leiden. To all the team that joined with me at the beginning: Eleonora, Sofia, Alex Mechev, Merel, Maaïke, Themiya, Carmen, MJ, Arun, and the ones that joined later: Alex Cridland, Wendy, Lammim, Michał, Marina, Helgi, Turgay. It was a

pleasure to work with all of you. I was also lucky enough to be the one to hand over the reins to a fantastic new team that has already shown they have what it takes to keep AoT going strong: Wendy, Anniek, Marta, Morgan, Marina, and I'm sure there's more of you that I don't know about. You have been doing amazing in this particularly difficult year and I wish you nothing but success in the future events!

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During my PhD years I deliberately skipped many meetings, conferences, borrels, and even parties, but there is one event that I almost never willingly missed: Tuesday's pub quiz at De Burcht. My dear *Ginteam* (formerly known as *The Drunk Astronomers*): Vincent, Yanett, Max, Pablo, Anne, Caroline, Tim, Eimear, Daniel, and many more that came and went. We might have never made it to first place, but we were always the winners in my heart. Tuesday nights with you were the best mid-week break, even if it made Wednesday mornings a bit harder (thank you, Debbie, for your friendliness and heavy-handed G&Ts; they were both always very appreciated). Thank you also to *The Counts of Monte Quizzto* for adopting me during the last few pub quizzes of the Before Times; I always envied your fantastic team name!

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Yanett millones de años y vidas atrás nunca me imaginé que en el futuro llegaríamos a tener una amistad. Gracias por siempre recibirme en su casa, por dejarme echarle Coca Cola a su pisco fancy, y por todas las risas, fiestas, y copas que compartimos, espero que sean muchas más. Kelsey, my girl. I feel so lucky and fortunate to have crossed paths with you when we did. Thank you for all the conversations, glasses of wine, nail art videos, and unexpected food euphemisms. Our conversations and your support kept me sane through this rollercoaster. Liz, desde que te conocí que fuiste una inspiración con toda tu fuerza y tu motivación, me siento privilegiada de haber cruzado caminos contigo. To so many more people that made my Leiden years memorable... Pablo, Pedro, Kim, Maria Cristina, Eleonora, Jeroen, Thomas, Edwin, Max, Penny, Ylva, Sofia, Anne, Nikita, Jorge, Lina, Marta, Diana, Tomás, Nico, Wijnand, Igone, Carmen, Luis, Javier, Alvaro, Sylvia, Daniel, Lammim, Andrés, and so many more that I'm probably forgetting (sorry!). Thank you for all the good times and for making this town feel like home.

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