Measuring gold molecular gas across cosmic time

Frias Castillo, M.

Publications

Refereed publications

1. *Kiloparsec-scale imaging of the CO(1-0)-traced cold molecular gas reservoir in a z∼3.4 submillimeter galaxy*
   M. Frias Castillo, M. Rybak, J. A. Hodge, P. van der Werf, D. A. Riechers, D. Vieira, G. Calistro Rivera, L. N. Martínez-Ramírez, F. Walter, E. de Blok, D. Narayanan, J. Wagg,
   The Astrophysical Journal, 930, 35, 2022

2. *VLA Legacy Survey of Molecular Gas in Massive Star-forming Galaxies at High Redshift*
   M. Frias Castillo, J.A. Hodge, M. Rybak, P. van der Werf, I. Smail, J. E. Birkin, C.-C. Chen, S. C. Chapman, R. Hill, C. del P. Lagos, C.-L. Liao, E. da Cunha, G. Calistro Rivera, J. Chen, E. F. Jiménez-Andrade, E. J. Murphy, D. Scott, A. M. Swinbank, F. Walter, R. J. Ivison, H. Dannerbauer,
   The Astrophysical Journal, 945, 128, 2023

3. *An ALMA Spectroscopic Survey of the Brightest Submillimeter Galaxies in the SCUBA–2–COSMOS Field (AS2COSPEC): Physical Properties of z = 2–5 Ultra– and Hyperluminous Infrared Galaxies*
   C.-L. Liao, C.-C. Chen, S. C. Chapman, U. Dudzevičiūtė, **M. Frias Castillo**, W.-H. Wang, M. M. Lee, I. Smail, S. Serjeant , Y. Ao, ,A. M. Swinbank, D. J. Taylor, H. Umehata, Y. Zhao,
   The Astrophysical Journal, 961, 226, 2024

4. *At the end of cosmic noon: Short gas depletion times in unobscured quasars at z ∼ 1*
   M. Frias Castillo, M. Rybak, J. A. Hodge, P. van der Werf, L. J. Abbo, F. J. Ballieux, C. Harrison, S. Ward, G. Calistro Rivera, J. P. McKean, H. R. Stacey,
   Astronomy & Astrophysics, 683, A211, 2024

Submitted publications

1. *A Comparative Study of the Ground State Transitions of CO and [C I] as Molecular Gas Tracers at High–Redshift*

M. Frias Castillo, M. Rybak, J. A. Hodge, P. van der Werf, I. Smail, J. Butterworth, J. Jasper, T. Topkaras, C.-C.Chen, S. C. Chapman, A. Weiss, H.S.B. Algera, J. E. Birkin, E. da Cunha, J. Chen, H. Dannerbauer, E. F. Jiménez-Andrade, S. Ikarashi, C.-L. Liao, E. J. Murphy, A. M. Swinbank, F. Walter, G. Calistro Rivera, R. J. Ivison, C. del P. Lagos,
submitted to ApJ (arXiv e-prints, arXiv:2404.05596)

Curriculum Vitae

I was born the 20th December 1997 in Granada, Spain, and grew up in the nearby town of Alcalá la Real. After primary school, I went to high school at the I.E.S. Alonso de Alcalá. Although during my early years I would always reply with 'lawyer' when asked what I wanted to be when I grew up, my interest in science soon took over. This shift was largely influenced by the passion in science of my mathematics professors, Juanma and Jose Luis, who consistently supported and encouraged me throughout my high school years. In 2016, I participated in a six-month exchange program in a small town near Lille, France. This first experience studying abroad foreshadowed what would come in the following years. The Sociedad Einstein de Astronomía, a society of amateur astronomers in my hometown, first introduced me to astronomy. I quickly volunteered to form part of the main board, and helped organised night observations, conferences and other activities aimed at promoting the public awareness and interest in astronomy.

I enrolled in an integrated master's degree in physics and astronomy at the University of Bristol, United Kingdom, in September 2015. My first real experience with astronomy research was during the 3rd year of my degree, which I spent at the University of British Columbia in Vancouver, Canada with Prof. Douglas Scott. There, I worked on the identification of young proto–clusters and gravitational lenses at high redshift using the *Planck* satellite full–sky maps. Subsequently, I was selected for a 10–week summer research internship at Cambridge University in 2018, where I worked under Dr. Martin Bourne on simulations of AGN feedback on parsec scales. Although this further confirmed my wish to pursue research in astronomy, it also taught me that theoretical simulations was not the path for me. For my Master's thesis, I continued working on proto–clusters under the supervision of Prof. Malcolm Bremer. In this case, I used simulated lightcones to test the reliability of certain color–cuts to identify groups of galaxies belonging to proto–clusters at different redshifts. I graduated from the University of Bristol in June 2019 with First Class Honours.

In September 2019, I started my PhD at Leiden University, in the Netherlands. Under the supervision of Dr. Jacqueline Hodge and Prof. Paul van der Werf, I had the opportunity to use some of the best facilities in the world to study the molecular gas content of distant galaxies and quasars. Unfortunately, the COVID pandemic hit only a few months after I started my PhD, which severely limited my capacity to travel to present my work and visit other collaborators. Nevertheless, I was fortunate to be part of a supportive international collaboration that facilitated the progress of my projects. Over my four and a half years at Leiden University, I had the privilege of mentoring two bachelor students, Femke and Lars, as well

as two master's students, Teo and Jasper, whose contributions are featured in my publications.

Now, after nearly a decade in academia, with seven years devoted to astronomy research, this thesis marks the culmination of my journey as an astronomer. I am grateful for the opportunity to delve into the mysteries of the cosmos and eagerly look forward to the next chapter in my life.

Acknowledgements

They say it's about the journey, not the destination. And the journey towards getting this PhD could not have been possible without the support from all the amazing people that have surrounded me these past few years.

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I have met some truly wonderful people during my time at Leiden Observatory. Anniek, you have been the friend I never thought I could have. Your support and your unwavering smile helped me push through every moment I felt like giving up during my PhD. Thank you for all the amazing moments together (and for many more to come!). Nicole and Ale, in you I have found two sisters. Words cannot express how much I love you. Thank you for always having my back and being the best gym partners. Josh, thanks for being the best office mate and Disney-partner-in-crime I could have asked for. Nicco, the passion you put into anything you do is truly inspiring. Thank you for always having the best advice. Roi, your efforts to keep me updated about One Piece are priceless. I couldn't have made it without you guys.

To Amy, Chloe, Ivana, Lucie, Veronica, Martje (and also Anniek), thank you for the most memorable Big Fat Summer Trips, and for your great effort on every 'dress up' night. Anna, Fraser, Hiddo and Kirsty, our movie nights kept me sane though covid. Sarah, thank you for showing me the artistic side of science. And to Christian, thank you for always looking after Nala whenever I'm away, I'm sure by now she prefers being with you.

To everyone at Leiden observatory (current and past) that I have met along the way: Alfred, Andrew, Aniruddh, Bas, Beth, Bianca, Brigitte, Christiaan, Ciaran, Dario, Dilovan, Elia, Elina, Erik, Evgenii, Fedde, Frits, Gijs, Jeger, Jelle, Jeroen, Joey, Jurjen, Lammim, Leindert, Louis, Lukasz, Luna, Maite, Mantas, Margot, Martijn, Orestis, Osmar, Paola, Pavel, Piyush, Pooneh, Pranjal, Rico, Rob, Roland, Shun-Sheng, Sill, Silvia, Thijs, Thomas, Timo, Victorine, Willeke, Will, Yapeng, Yuze, Zephyr, Zhenlin, thank you for all the puzzles, borrels, coffee breaks, ski trips, movie nights and all other amazing memories and good times

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Por último, gracias a mis padres, porque vuestro constante esfuerzo y perseverancia siempre han sido un ejemplo para mí. A mi hermano, Jose Antonio, gracias por estar siempre disponible cuando necesito hablar y por apuntarte a todos los planes que se me ocurren. A mis abuelos, Virtu, Rafa y Paqui, gracias por recordarme que siempre me quedaban los olivos si me aburría de la astronomía, aunque en realidad solo querríais que estuviera más cerca de vosotros. No habría podido conseguir este doctorado sin vuestro apoyo. Os quiero.