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Elementary: the chemical fingerprints of massive galaxy formation over cosmic time

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PUBLICATIONS

First Author

* = Part of This Thesis

1. *Hidden mass in early galaxies revealed by bottom-heavy initial mass functions**
Cheng, C. M., Slob, M., Kriek, M., Beverage, A. G., van Dokkum, P. G., Bezanson, R., Brammer, G., Conroy, C., de Graaff, A., Eftekhari, E., Feldmann, R., Goesaert, W. M., Gu, M., Leja, J., Lorenz, B., Mancera Piña, P. E., Martín-Navarro, I., Newman, A. B., Price, S. H., Shapley, A. E., Sharda, P., Suess, K. A., van der Wel, A., Weisz, D. R. 2026, *Nature Astronomy*, under review.
2. *Clues to inside-out quenching in quiescent galaxies at $1.2 \lesssim z \lesssim 2.2$: Age, Fe-, and Mg-abundance gradients from JWST-SUSPENSE**
Cheng, C. M., Slob, M., Kriek, M., Beverage, A. G., Barro, G., Bezanson, R., de Graaff, A., Förster Schreiber, N. M., Lorenz, B., Marchesini, D., Martín-Navarro, I., Muzzin, A., Newman, A. B., Price, S. H., Suess, K. A., van der Wel, A., van de Sande, J., van Dokkum, P. G., & Weisz, D. R. 2026, *A&A*, in press. DOI: 10.1051/0004-6361/202557254.
3. *Ages and metallicities of quiescent galaxies: confronting broad-band (UVJ) colours with stellar absorption lines**
Cheng, C. M., Kriek, M., Beverage, A. G., Slob, M., Bezanson, R., Franx, M., Leja, J., Mancera Piña, P. E., Suess, K. A., van der Wel, A., van de Sande, J., & van Dokkum, P. G. 2025, *MNRAS*, 540, 1527. DOI: 10.1093/mnras/staf806.
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I., Romanowsky, A. J., & van Dokkum P. G. 2023, MNRAS, 526, 4004. DOI: 10.1093/mnras/stad2967.

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Contributing Author

1. *Fast Rotators at Cosmic Noon: Stellar Kinematics for 15 Quiescent Galaxies from JWST-SUSPENSE*

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2. *Carbon and Iron Deficiencies in Quiescent Galaxies at $z = 13$ from JWST-SUSPENSE: Implications for the Formation Histories of Massive Galaxies*

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3. *The JWST-SUSPENSE Ultradeep Spectroscopic Program: Survey Overview and Star-Formation Histories of Quiescent Galaxies at $1 < z < 3$*

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Non-Astronomy

1. *First Evidence of Axial Shape Asymmetry and Configuration Coexistence in*

⁷⁴Zn: *Suggestion for a Northern Extension of the N = 40 Island of Inversion*

Rocchini, M., Garrett, P. E., Zielińska, M., Lenzi, S. M., Dao, D. D., Nowacki, F., Bildstein, V., MacLean, A. D., Olaizola, B., Ahmed, Z. T., Andreoiu, C., Babu, A., Ball, G. C., Bhattacharjee, S. S., Bidaman, H., **Cheng, C.**, Coleman, R., Dillmann, I., Garnsworthy, A. B., Gillespie, S., Griffin, C. J., Grinyer, G. F., Hackman, G., Hanley, M., Illana, A., Jones, S., Laffoley, A. T., Leach, K. G., Lubna, R. S., McAfee, J., Natzke, C., Pannu, S., Paxman, C., Porzio, C., Radich, A. J., Rajabali, M. M., Sarazin, F., Schwarz, K., Shadrack, S., Sharma, S., Suh, J., Svensson, C. E., Yates, D., Zidar, T. 2023, Phys. Rev. Lett., 130, 122502. DOI: 10.1103/PhysRevLett.130.122502.

2. *EEG features of spontaneous recurrent seizures in a mouse model of extended hippocampal kindling*

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4. *High-precision branching ratio measurement and spin assignment implications for ⁶²Ga superallowed β decay*

MacLean, A. D., Laffoley, A. T., Svensson, C. E., Ball, G. C., Leslie, J. R., Andreoiu, C., Babu, A., Bhattacharjee, S. S., Bidaman, H., Bildstein, V., Burbadge, C., Bowry, M., **Cheng, C.**, Cross, D. S., Diaz-Varela, A., Dillmann, I., Dunlop, M. R., Dunlop, R., Evitts, L. J., Finlay, P., Gillespie, S., Garnsworthy, A. B., Garrett, P. E., Gopaul, E., Griffin, C. J., Grinyer, G. F., Hackman, G., Henderson, J., Jigmeddorj, B., Leach, K. G., Kasanda, E., McAfee, J., Moukaddam, M., Natzke, C., Nittala, S., Olaizola, B., Park, J., Paxman, C., Pore, J. L., Porzio, C., Radich, A. J., Ruot-salainen, P., Saito, Y., Sharma, S., Smallcombe, J., Smith, J. K., Sultana, R., Turko, J., Williams, J., Yates, D., Zidar, T. 2020, Phys Rev C, 102(5), DOI: 10.1103/physrevc.102.054325.

5. *Impaired Spatial Learning and Memory in Middle-Aged Mice with Kindling-Induced Spontaneous Recurrent Seizures*

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Model of Extended Hippocampal Kindling in Mice

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CURRICULUM VITAE

On February 12, 1998, I was born in Toronto, Ontario, Canada. Three months later, my parents, Joan and Sydney, moved us to Arcata, California, where we lived for three years, and where my brother, Ethan, was born. The US ultimately did not live up to my parents' expectations. So, in 2001 we moved back to Canada, settling in Markham, Ontario, where my youngest brother, Jordan, was born a few years later.

As a child, I was extremely fortunate in many ways, but especially in that my parents encouraged me to try everything. I dabbled in a variety of sports¹ – from soccer, to snowboarding, to figure skating – in several musical instruments – including piano, flute, violin, and classical singing – and a multitude of creative hobbies – such as knitting, crocheting, and sewing. Additionally, as physicians, my parents fostered in me a love for learning, and a need to seek answers to unsolved problems.

I attended Roy H. Crosby and Unionville Meadows Public Schools, where I continued to develop my interests in athletics, the arts, and science. At this point, I decided that my primary passion was for music, so I auditioned for an arts program at Unionville High School. I was successful, and began my secondary school career as a classical voice major. These four years allowed me to hone my musicianship and performance skills. Simultaneously, however, the majority of my peers were interested in science, and this influenced me to continue to take science courses. I quickly realized that science was the optimal way to sate my need to solve problems, so at around age 15, I decided that I wanted to be a doctor, like my parents. When I was in Grade 11, I took my first physics course, which opened my eyes to an analytical, quantitative way of understanding the world that really tickled my brain (this was ironic as I had always hated math). Around this time, NASA and ESA released the sharpest ever view of the Andromeda Galaxy, taken with the Hubble Space Telescope². Until this point, I had had zero interest in space, but I found this technological feat that gave us the ability to see millions of tiny stars from such a great distance truly inspiring. While I was still keen on studying medicine, I had been bitten by the astronomy bug.

When it came time to start university, I applied for undergraduate programs widely, keeping doors open for music, medicine, and physics. I decided to study science at the University of Toronto as a member of Trinity College, where I completed an Astronomy and Physics Specialist and Mathematics Minor. For the first

¹Other prominent athletic endeavours included: skiing, swimming, horseback riding, gymnastics, taekwondo, and running.

²<https://esahubble.org/images/heic1502a/> .

few years of my Bachelor's, I was still interested in medicine. As a result, I worked in a fundamental neurobiology lab for two summers at the Toronto Western Hospital, supervised by Dr. Liang Zhang. This was a unique experience, where I had the opportunity to participate in hands-on mouse experiments to study epilepsy. In the summer of my third year of my undergrad, however, I decided it was time to commit to physics. I did a summer internship at TRIUMF, a particle accelerator in Vancouver, British Columbia, where, supervised by Dr. Adam B. Garnsworthy, I worked on nuclear physics experiments. In the fourth year of my undergrad, I finally stopped beating around the bush. I completed a research thesis project in galaxy evolution, where I worked with Professor Jo Bovy and was primarily supervised by Dr. Natalie Price-Jones, his senior grad student at the time. I had the opportunity to assess chemical homogeneity in chemically tagged birth clusters in the Milky Way. Through this experience, I learned that I had a keen interest in spectroscopy, galactic archaeology, and statistical and computational methods. With the support of my supervisors, I was able to publish my first astronomy paper. I received my Honors Bachelor of Science with Distinction from the University of Toronto in 2020. I also kept up my other interests during this time – I played quidditch for the University of Toronto Centaurs and continued to participate in classical singing competitions.

Towards the end of my Bachelor's I began to apply for direct-entry PhD programs, as my goal was to stay at the University of Toronto, where there was no Master's program. Instead, I was accepted for a Master's program at the University of Waterloo, where I was supervised by Professor Michael Balogh. With Michael's support, I worked on measuring the stellar initial mass function (IMF) in compact stellar systems, and through this research I became an expert on stellar population modeling and the IMF, resulting in my second publication. I received my Master of Science in 2022.

This period was also challenging for me, in that I completed my entire Master's degree remotely due to the COVID-19 pandemic, and that I experienced some difficult interpersonal conflicts. I seriously considered leaving the field. However, I realized that I thoroughly enjoyed the work that I was doing, but needed to be around the right people. With this in mind, I decided to apply for PhD programs, but executed a strategy of requesting Zoom meetings with potential supervisors before even applying. I was fortunate in that most people agreed. One of these people was Professor Mariska Kriek, who thankfully accepted my invitation to meet (something that she later told me she never does). I had thought that Mariska was at the University of California Berkeley, but in reality she had just moved to Leiden. I had never heard of Leiden, and did not know much about The Netherlands, but I admired Mariska's style and work, so I decided to apply for her position. In 2022, I was accepted to the PhD program at Leiden Observatory to work with Mariska. Accepting her offer was the best decision I could have made. I have transitioned from studying Milky Way stars in my Bachelor's, to nearby stellar systems in my Master's, to distant, massive, quiescent galaxies in my PhD, but have continued to apply the same principles of examining the fossil records of galaxies with detailed modeling throughout.

In addition to building up my scientific profile, I have gained a lot of other in-

credible experiences during my PhD. I had the rewarding opportunity to supervise two Master's students at Leiden. I have also had the chance to travel and present my work widely, nationally and internationally, at conferences in Malaysia, Spain, Italy, Switzerland, Ireland, and Japan. It has additionally been important to me to contribute to the Observatory, and I have participated in the EDI, Borrel, Social, and PhSki Committees. Finally, I have been involved in observing programs on major telescopes, and have even had the opportunity to act as Co-PI and PI on two JWST programs, respectively.

I am very thankful that my academic journey will not end here. While I have experienced a tough job application cycle, I am happy to say that I will be starting a postdoctoral position with Professor Allison Man at the University of British Columbia in Vancouver, Canada. I am excited to move back to my home country, and to continue to advance the expertise that I have developed during my PhD while expanding my experience in galaxy evolution research.

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