Miguel Cárcamo, Prof.

Departamento de Ingeniería en Informática, Universidad de Santiago de Chile
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Education

2019 – 2023 **Ph.D., The University of Manchester** Astronomy and Astrophysics.
Supervisor: Prof. Anna Scaife
Thesis title: *Compressive Faraday Imaging for Next-Generation Radio Telescopes.*

2015 – 2016 **M.Sc. Computer Engineering, Universidad de Santiago de Chile**
Supervisor: Prof. Fernando Rannou
Thesis title: *Interferometric image synthesis through parallel iterative algorithms on multiple GPUs.*

2010 – 2016 **Civil Computer Engineer, Universidad de Santiago de Chile**

2010 – 2013 **B.Sc. Engineering Sciences, Universidad de Santiago de Chile**

Research Interests

My research focuses on radio interferometry, advanced imaging techniques, cosmic magnetism, high-performance computing, and large-scale data processing for astronomical applications. I design computational methods for next-generation radio telescopes, with particular emphasis on compressed sensing approaches for Faraday depth reconstruction and high-performance image synthesis. A central theme of my work is building end-to-end computational pipelines that take radio astronomy data from raw observations to calibrated, imaged, and scientifically validated products. I am currently the principal developer of *Pyralysis*, a Python object-oriented framework for big-data and high-performance computing applications tailored to SKA-era data volumes.

Employment History

2023 – · · · · **Assistant Professor** Universidad de Santiago de Chile.

2022 – · · · · **Associate Researcher** Data Observatory.

2019 – 2022 **Part-time Instructor Professor** Universidad de Santiago de Chile

Projects

2026 – · · · · **Principal Investigator (PI)** DICYT Regular 2026 — *Pyralysis: Desentrañando los Campos Magnéticos del Cosmos con Big Data y Supercómputo*. Universidad de Santiago de Chile (internal funding).

2025 – · · · · **Co-Principal Investigator (co-PI)** FONDECYT Regular 2025 — *Physical conditions and kinematics in planet-forming systems.*

Research Publications

Journal Articles

1 S. Casassus, M. Vidal, **M. Cárcamo**, L. Verstraete, N. Ysard, and E. Habart, "ALMA Band 1 observations of the ρ Oph W filament - I. Enhanced power from excess microwave emission at high spatial frequencies," *A&A*, vol. 707, A255, 2026. DOI: 10.1051/0004-6361/202557944

2 O. Domínguez-Jamett, S. Casassus, H. Baobab Liu, Y. Aoyama, **M. Cárcamo**, P. Weber, O. Chrenko, G.-D. Marleau, B. Ercolano, and J. Szulágyi, "Multi-frequency observations of PDS70c: Radio emission mechanisms in the circumplanetary environment," *A&A*, vol. 702, A18, 2025. DOI: 10.1051/0004-6361/202554485

3 C. Arce-Tord, S. Casassus, W. R. F. Dent, S. Pérez, **M. Cárcamo**, P. Weber, N. Engler, L. A. Cieza, A. Hales, A. Zurlo, and S. Marino, "Radio-continuum decrements associated to shadowing from the central warp in transition disc DoAr 44," *Monthly Notices of the Royal Astronomical Society*, vol. 526, no. 2, pp. 2077–2085, Sep. 2023, ISSN: 0035-8711. DOI: 10.1093/mnras/stad2885

4 S. Casassus, L. Cieza, **M. Cárcamo**, Á. Ribas, V. Christiaens, A. Rodríguez-Jiménez, C. Arce-Tord, T. Bhowmik, P. Chavan, C. González-Ruilova, and R. Martínez-Brunner, "Azimuthal temperature variations in ISO-Oph 2 from multifrequency ALMA observations," *Monthly Notices of the Royal Astronomical Society*, vol. 526, no. 1, pp. 1545–1558, Sep. 2023, ISSN: 0035-8711. DOI: 10.1093/mnras/stad1981

5 P. Weber, S. Pérez, A. Zurlo, J. Miley, A. Hales, L. Cieza, D. Principe, **M. Cárcamo**, A. Garufi, Á. Kóspál, M. Takami, J. Kastner, Z. Zhu, and J. Williams, "Spirals and Clumps in V960 Mon: Signs of Planet Formation via Gravitational Instability around an FU Ori Star?" *The Astrophysical Journal Letters*, vol. 952, no. 1, p. L17, Jul. 2023. DOI: 10.3847/2041-8213/ace186

6 S. Casassus and **M. Cárcamo**, "Variable structure in the PDS 70 disc and uncertainties in radio-interferometric image restoration," *Monthly Notices of the Royal Astronomical Society*, vol. 513, no. 4, pp. 5790–5798, May 2022, ISSN: 0035-8711. DOI: 10.1093/mnras/stac1285

7 S. Casassus, **M. Cárcamo**, A. Hales, P. Weber, and B. Dent, "The Doppler Flip in HD 100546 as a Disk Eruption: The Elephant in the Room of Kinematic Protoplanet Searches," *The Astrophysical Journal Letters*, vol. 933, no. 1, p. L4, Jun. 2022. DOI: 10.3847/2041-8213/ac75e8

8 **M. Cárcamo**, A. M. M. Scaife, E. L. Alexander, and J. P. Leahy, "CS-ROMER: a novel compressed sensing framework for Faraday depth reconstruction," *Monthly Notices of the Royal Astronomical Society*, vol. 518, no. 2, pp. 1955–1974, Nov. 2022, ISSN: 0035-8711. DOI: 10.1093/mnras/stac3031

9 S. Casassus, V. Christiaens, **M. Cárcamo**, S. Pérez, P. Weber, B. Ercolano, N. van der Marel, C. Pinte, R. Dong, C. Baruteau, L. Cieza, E. F. van Dishoeck, A. Jordan, D. J. Price, O. Absil, C. Arce-Tord, V. Faramaz, C. Flores, and M. Reggiani, "A dusty filament and turbulent CO spirals in HD 135344B - SAO 206462," *Monthly Notices of the Royal Astronomical Society*, vol. 507, no. 3, pp. 3789–3809, Aug. 2021. DOI: 10.1093/mnras/stab2359

10 R. Martinez Brunner, S. Casassus, S. Pérez, A. Hales, P. Weber, **M. Cárcamo**, C. Arce-Tord, L. Cieza, A. Garufi, S. Marino, and A. Zurlo, "High-resolution ALMA observations of V4046 Sgr: a circumbinary disc with a thin ring," *Monthly Notices of the Royal Astronomical Society*, vol. 510, no. 1, pp. 1248–1257, Nov. 2021. DOI: 10.1093/mnras/stab3440

11 S. Ndiritu, A. Scaife, D. Tabb, **M. Cárcamo**, and J. Hanson, "Gaussian Process Modelling for Improved Resolution in Faraday Depth Reconstruction," *Monthly Notices of the Royal Astronomical Society*, vol. 502, no. 4, pp. 5839–5853, Feb. 2021, ISSN: 0035-8711. DOI: 10.1093/mnras/stab379

12 C. Arce-Tord, M. Vidal, S. Casassus, **M. Cárcamo**, C. Dickinson, B. S. Hensley, R. Génova-Santos, J. R. Bond, M. E. Jones, A. C. S. Readhead, A. C. Taylor, and J. A. Zensus, "Resolved observations at 31 GHz of spinning dust emissivity variations in ρ Oph," *Monthly Notices of the Royal Astronomical Society*, vol. 495, no. 3, pp. 3482–3493, May 2020. DOI: 10.1093/mnras/staa1422

13 S. Casassus, H. Avenhaus, S. Pérez, V. Navarro, **M. Cárcamo**, S. Marino, L. Cieza, S. P. Quanz, F. Alarcón, A. Zurlo, A. Osses, F. R. Rannou, P. E. Román, and M. Barraza, "An inner warp in the DoAr 44 T Tauri transition disk," *Monthly Notices of the Royal Astronomical Society*, sty894, 2018. DOI: 10.1093/mnras/sty894

14. S. Casassus, S. Marino, W. Lyra, C. Baruteau, M. Vidal, A. Wootten, S. Pérez, F. Alarcon, M. Barraza, **M. Cárcamo**, R. Dong, A. Sierra, Z. Zhu, L. Ricci, V. Christiaens, and L. Cieza, "Cm-wavelength observations of MWC 758: resolved dust trapping in a vortex," *Monthly Notices of the Royal Astronomical Society*, vol. 483, no. 3, pp. 3278–3287, Nov. 2018, ISSN: 0035-8711. DOI: 10.1093/mnras/sty3269

15. **M. Cárcamo**, P. Román, S. Casassus, V. Moral, and F. Rannou, "Multi-GPU maximum entropy image synthesis for radio astronomy," *Astronomy and Computing*, vol. 22, pp. 16–27, Jan. 2018, ISSN: 2213-1337. DOI: https://doi.org/10.1016/j.ascom.2017.11.003

16. L. A. Cieza, S. Casassus, S. Pérez, A. Hales, **M. Cárcamo**, M. Ansdell, H. Avenhaus, A. Bayo, G. H.-M. Bertrang, H. Cánovas, V. Christiaens, W. Dent, G. Ferrero, R. Gamen, J. Olofsson, S. Orcajo, A. Osses, K. Peña-Ramirez, D. Principe, D. Ruíz-Rodríguez, M. R. Schreiber, G. van der Plas, J. P. Williams, and A. Zurlo, "ALMA observations of Elias 2–24: A Protoplanetary Disk with Multiple Gaps in the Ophiuchus Molecular Cloud," *The Astrophysical Journal Letters*, vol. 851, no. 2, p. L23, Dec. 2017. DOI: 10.3847/2041-8213/aa9b7b

Conference Proceedings

1. F. R. Rannou, D. Guzmán, **M. Cárcamo**, and S. Pérez, "Split bregman image synthesis in radio interferometry," in *2024 4th URSI Atlantic Radio Science Meeting (AT-RASC)*, 2024, pp. 1–3. DOI: 10.46620/URSIATRASC24/VJYI4215

2. **M. Cárcamo**, A. Scaife, R. Taylor, M. Jarvis, M. Bowles, S. Sekhar, L. Heino, and J. Stil, "A Compressed Sensing Faraday Depth Reconstruction Framework for the MeerKAT MIGHTEE-POL Survey," in *2022 3rd URSI Atlantic and Asia Pacific Radio Science Meeting (AT-AP-RASC)*, 2022, pp. 1–4. DOI: 10.23919/AT-AP-RASC54737.2022.9814329

3. **M. Cárcamo**, F. R. Rannou, P. E. Román, V. Moral, and S. Casassus, "High performance GPU Bayesian image synthesis," in *2015 IEEE International Symposium on Signal Processing and Information Technology (ISSPIT)*, Dec. 2015, pp. 264–268. DOI: 10.1109/ISSPIT.2015.7394340

Academic/teaching experience

Universidad de Santiago de Chile (USACH) – Assistant Professor

1/2024 – 2/2025 — **Operating Systems**. Taught. Contents: Processes, Threads, Concurrency, Deadlock, Scheduling and Virtual Memory.

1/2024 — **Software development**. Taught. Contents: Python, Functional programming, Object Oriented programming, `numpy`, `cupy`, `dask`, Scrum and Extreme Programming, Software versioning, `git`, Continuous integration and pipelines, Python packaging.

2/2023 – 2/2025 — **Distributed and Parallel Systems**. Designed and taught. Contents: Concurrent and parallel programming, Architectures, Communication, Coordination, Consistency and replication, Fault tolerance

Radio interferometry and image synthesis in astronomy. Designed and taught. Contents: Radio interferometry principles, Mathematical Groundwork for radio astronomy, Advanced Python for radio astronomy, Positional astronomy, Visibility space, Image Synthesis, Image synthesis deconvolution, Observing systems, Data reduction and errors.

2/2023 — **Distributed Systems**. Taught. Contents: Architectures, Communication, Coordination, Consistency and replication, Fault tolerance

1/2023 – 2/2023 — **Software Engineering Project**. Taught. Contents: Scrum Methodology, Software testing, Continuous Integration, Deployment.

1/2023 — **Operating Systems**. Taught. Contents: Processes, Threads, Concurrency, Deadlock, Scheduling and Virtual Memory.

Academic/teaching experience (continued)

Universidad de Santiago de Chile (USACH) – Lecturer

1/2018 – 2/2018 **Programming Methods Laboratory**. Taught. Contents: Algorithmic Problem Solving, Imperative Programming, Problem Solving in C, Imperative Programming Paradigm in C.

2/2015 – 2/2018 **Operating Systems**. Taught. Contents: Processes, Threads, Concurrency, Deadlock, Scheduling, Virtual Memory and I/O.

2/2016 **Modeling and Simulation**. Designed and taught. Contents: Continuous Systems, Queue Theory, Pseudo-Random Numbers, Markov Chain Monte Carlo and Discrete Events.

The University of Manchester – Laboratory Demonstrator

1/2023 **Introduction to Programming for Physicists**.

2/2022 **Object-Oriented Programming in C++**.

1/2022 **Introduction to Programming for Physicists**.

2/2020 **Theory Computing Project**.

1/2020 **Introduction to Programming for Physicists**.

Thesis Supervision

Universidad de Santiago de Chile

2024 **Vergara Sepúlveda, Leo Iñaki**. *Reconstrucción de imágenes interferométricas con datos polarizados mediante algoritmos de Regularized Maximum Likelihood*. Supervisor.

2023 **Colil Colil, Matías Andrés**. *Simulación de un interferómetro a través de una aplicación móvil para divulgación científica*. Supervisor.

2022 **Guzmán Pérez, Damian Alejandro**. *Diseño y modelamiento orientado a objetos del algoritmo Split Bregman para interferometría*. Co-supervisor (with Prof. Fernando Rannou, supervisor).

2021 **López Berríos, Sebastián Israel**. *Simulación de generación de datos radioastronómicos*. Co-supervisor (with Prof. Fernando Rannou, supervisor).

2020 **Rivera Castro, Marcela Alejandra**. *Aprendizaje de diccionarios en síntesis de imágenes interferométricas*. Co-supervisor (with Prof. Fernando Rannou, supervisor).

Universidad de Concepción

2024 **Valenzuela Concha, Luis Andrés**. *Comparación automática de calidad entre imágenes astronómicas reconstruidas utilizando técnicas de deep learning*. External co-supervisor (with Prof. Cecilia Hernández and Prof. Ricardo Flores, supervisors).

Invitations, talks and posters

Invitations

2024 **1st FARGO3D Workshop**. Invited to give lectures on Radio Interferometry and Radio Interferometric Synthetic Observations.

2023 **Rich and Nonlinear Tomography – a multidisciplinary approach programme**. Invited as participant by the Isaac Newton Institute for Mathematical Sciences.

Talks

2022 **A Compressed Sensing Faraday Depth Reconstruction Framework for the MeerKAT MIGHTEE-POL Survey**, URSI AT-RASC Conference, Gran Canaria, Spain.

Invitations, talks and posters (continued)

2021 **High-throughput computing for Cosmic Magnetism studies in the SKA-era**, National Astronomy Meeting - University of Bath, UK.

Posters

2023 **The importance of compressed sensing and regularization: An application to Faraday depth imaging**, BASP Frontiers conference, Villars-sur-Ollon, Switzerland.

Academic Service

- **Journal Reviewer** for RAS Techniques & Instruments (RASTI).

Skills

Programming Languages	Python, C/C++, MATLAB, R, Bash, Java, SQL, XML/XSL, PHP
Software Development	Git, Continuous Integration/Deployment pipelines, Object-oriented design, Agile development methodologies
Containerization & Deployment	Docker, Apptainer
Parallel & Distributed Computing	CUDA, OpenMP, MPI, Pthreads, Dask, Zarr
Radio Astronomy Software	CASA, DIFMAP, AIPS, Radio interferometry data processing pipelines
Applications	Vi/Vim, LaTeX
Databases	MySQL, PostgreSQL, SQLite, TaQL.
Web Dev	HTML, CSS, JavaScript, J2EE, Ruby on Rails, Bootstrap, Node.js.
Languages	Mother tongue: Spanish, strong reading, writing and speaking competencies for English.
Misc.	Academic research, teaching, publishing.

Awards and honors

Awards

2022 **Young Scientist Award**, URSI Atlantic Radio Science Conference.

2019 – 2023 **Chilean National Scholarship for Graduate Studies**, Chilean National Research and Development Agency (ANID).