

# Miguel Cárcamo, Prof.

 Departamento de Ingeniería en Informática, Universidad de Santiago de Chile  
 Av. Víctor Jara 3659 (ex Av. Ecuador), Estación Central, Chile  
 miguel.carcamo@usach.cl  @miguel\_carcamov  miguelcarmcamov  
 (+56) 2 2718 0940  0000-0003-0564-8167  miguelcarmcamov

## Education

- 2019 – 2023  **Ph.D., The University of Manchester** Astronomy and Astrophysics.  
Advisor: Prof. Anna Scaife  
Thesis title: *Compressive Faraday Imaging for Next-Generation Radio Telescopes*.
- 2015 – 2016  **M.Sc. Computer Engineering, Universidad de Santiago de Chile**  
Advisor: 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 program encompasses radio interferometry and advanced imaging techniques, cosmic magnetism, high-performance computing, and large-scale data processing for astronomical applications. I develop novel computational methods and algorithms for next-generation radio telescopes, with particular emphasis on compressed sensing frameworks for Faraday depth reconstruction and high-performance image synthesis techniques. My work emphasizes end-to-end computational workflows for radio astronomical data, developing software systems that handle the complete processing chain from raw observations through to calibrated, imaged, and validated scientific datasets. Currently, I serve as the principal developer of *Pyralysis*, a Python object-oriented framework designed for big data processing and high-performance computing applications targeting 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

## Research Publications

### Journal Articles

- 1 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 PDS7oc: Radio emission mechanisms in the circumplanetary environment,” *A&A*, vol. 702, A18, 2025.  DOI: 10.1051/0004-6361/202554485.
- 2 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.

- 3 S. Casassus, L. Cieza, **M. Cárcamo**, Á. Ribas, V. Christiaens, A. Rodríguez-Jiménez, C. Arce-Tord, T. Bhowmik, P. Chavan, C. González-Ruiz, 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.
- 4 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.
- 5 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.
- 6 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.
- 7 **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.
- 8 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.
- 9 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.
- 10 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.
- 11 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  $\rho$  Oph," *Monthly Notices of the Royal Astronomical Society*, vol. 495, no. 3, pp. 3482–3493, May 2020.  DOI: 10.1093/mnras/staa1422.
- 12 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.
- 13 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.
- 14 **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>.
- 15 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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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.

### 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.

## Academic/teaching experience (continued)

### The University of Manchester – Laboratory Demonstrator

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| 1/2023 | ■ <b>Introduction to Programming for Physicists.</b> |
| 2/2022 | ■ <b>Object-Oriented Programming in C++.</b>         |
| 1/2022 | ■ <b>Introduction to Programming for Physicists.</b> |
| 2/2020 | ■ <b>Theory Computing Project.</b>                   |
| 1/2020 | ■ <b>Introduction to Programming for Physicists.</b> |

## Invitations, talks and posters

### Invitations

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| 2024 | ■ <b>1st FARGO3D Workshop.</b> Invited to give lectures on Radio Interferometry and Radio Interferometric Synthetic Observations.                                |
| 2023 | ■ <b>Rich and Nonlinear Tomography – a multidisciplinary approach programme.</b> Invited as participant by the Isaac Newton Institute for Mathematical Sciences. |

### Talks

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| 2022 | ■ <b>A Compressed Sensing Faraday Depth Reconstruction Framework for the MeerKAT MIGHTEE-POL Survey,</b> URSI AT-RASC Conference, Gran Canaria, Spain. |
| 2021 | ■ <b>High-throughput computing for Cosmic Magnetism studies in the SKA-era,</b> National Astronomy Meeting - University of Bath, UK.                   |

### Posters

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| 2023 | ■ <b>The importance of compressed sensing and regularization: An application to Faraday depth imaging,</b> BASP Frontiers conference, Villars-sur-Ollon, Switzerland. |
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## Professional Service

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| ■ <b>Journal Reviewer</b> for RAS Techniques & Instruments (RASTI). |
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## Skills

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| 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, L <sup>A</sup> T <sub>E</sub> X   |
| Databases                        | ■ MySQL, PostgreSQL, SQLite, TaQL   |
| Web Dev                          | ■ HTML, CSS, JavaScript, J <sub>2</sub> EE, 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

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### 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).