Cristóbal Sifón

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Research Interests

My research focuses on galaxy cluster physics including observable–mass scaling relations for cosmological analyses and the transformation of galaxies in and around galaxy clusters. I am also interested in intrinsic galaxy alignments, both as contaminants for cosmic shear and as a physical mechanism in their own right. I use various tools and techniques to study these phenomena, including weak gravitational lensing, spectroscopy, the exploitation of optical surveys in general, and most recently also of hydrodynamical simulations.

Collaborations: 4MOST Chilean Cluster Galaxy Evolution Survey (CHANCES) — 4MOST Hemisphere Survey (4HS) — Atacama Cosmology Telescope (ACT) — Canadian Cluster Comparison Project (CCCP) — Cerro Chajnator Atacama Telescope (CCAT) — CMB-S4 — Galaxy Cluster Mass Reconstruction Project — Kilo-Degree Survey (KiDS) — Legacy Survey of Space and Time Dark Energy Science Collaboration (LSST-DESC) — Multi-Epoch Nearby Cluster Survey (MENeaCS) — Simons Observatory.

Employment

[2022 – Present] Profesor Auxiliar, Pontificia Universidad Católica de Valparaíso (PUCV), Chile
[2019 – 2022] Profesor Asociado, PUCV
[2016 – 2019] Postdoctoral Research Associate, Princeton University, USA

Education

[2012 – 2016] Ph.D. Astrophysics, Universiteit Leiden, The Netherlands
[2010 – 2012] M.Sc. Astrophysics, P. Universidad Católica de Chile (PUC), Chile
[2005 – 2010] B.Sc. Astronomy, PUC

Teaching & Mentoring

Graduate Research Mentoring

[2023 – Present] Javier Urrutia, PUCV: MSc thesis advisor.
[2020 – 2022] Camila Aros, PUCV: MSc thesis advisor.
[2017 – 2019] Naomi Robertson, Oxford University (UK): co-advised PhD thesis project (Advisor: Joanna Dunkley).
[2013 – 2014] Joshua Albert, Universiteit Leiden: co-advised MSc thesis project (Advisor: Huub Röttgering).

Undergraduate Research Mentoring

[PUCV] 3 Senior theses and 4 Summer projects.
[Princeton] Summer project and Junior project.
[Others] Four-month research project through the Central American-Caribbean Bridge in Astrophysics (URL).

Courses Taught

Graduate: Data Analysis (2023), Techniques of Observational Astrophysics (2022), Observational Cosmology (2020-2021)
Undergraduate: Astronomical Instrumentation (2023), Galactic Astronomy (2021-2022), Programming (2020-2022), Cosmology (2020)
Non-Physics Major: Basic Astronomy for Engineers (2022)

Grants

[2020] ALMA-ANID Fund to hire a postdoc (**Co-PI**, 2 years, US$77,000)
[2019] FONDECYT Iniciación research grant (**PI**, 3 years, US$125,000)

Successful Observing Proposals (as PI)

I have been the PI of 12 successful observing proposals totalling hundreds of observing hours in optical (Gemini-South/GMOS, VST/OmegaCAM), near-infrared (Magellan/Fourstar), submm (APEX/CONCERTO), and radio (GMRT, VLA) telescopes.

Observing Experience: I have spent roughly 180 hours observing with optical (Gemini South/GMOS) and near-infrared (NTT/SofI, Magellan/Fourstar) instruments performing both imaging and spectroscopy of galaxy clusters.

Community Activity

Journals: I have served as a referee for Astronomy & Astrophysics, The Astrophysical Journal, Monthly Notices of the Royal Astronomical Society, and Nature Astronomy.
Telescope Allocation Committees: Canadian Astronomical Society, *Chandra* X-ray Observatory
Grant Allocation Committees: Swiss National Science Foundation

Press Articles Authored

[July 2017] *Galaxy clusters: Falling into line* (Nature Astronomy *News & Views*)
[July 2013] *Featured Science: Dynamical masses of galaxy clusters discovered with the Sunyaev-Zel'dovich effect* (Gemini Focus)

Outreach

[Nov. 2023] Guest in "Diálogos Cósmicos" podcast (in Spanish, available here).
[Aug. 2023] Guest in "Conversemos de Astronomía" podcast (in Spanish, available here).
[Nov. 2022] Guest in "Rockstars" podcast by Radio TXS (in Spanish, available here).
[Oct. 2022] Interview for Radio Valentín Letelier, Valparaíso, to talk about CHANCES.
[Mar. 2021] Online public talk in the conext of the Chilean *Day of Astronomy* (in Spanish, available here).
[2018 – 2019] Assisted with *Public Astronomical Observations in Spanish*, Princeton University.
[2013 – 2014] Assisted with *Public Observations at the Old Observatory*, Leiden Observatory.
[2012] Co-taught an *Astronomy Course for Seniors*, PUC.
[2011] Participated in *Starry Nights*, observation nights for elementary and middle school students in social risk organized by ESO-Santiago.
[2010] Invited talk on board the "FFG14 Almirante Latorre" Chilean Navy ship, Valparaíso, Chile.
[2010] *The Universe*, a series of talks for elementary school students in social risk organized by PUC.

Technical skills

I am an experienced `Python` programmer and I have some familiarity with `IDL` and `Julia`. I wrote `pygmos`, a Python/PyRAF pipeline to reduce Gemini-GMOS spectra which is available here. I am one of the lead developers and maintainers of the galaxy-galaxy lensing pipeline used by the KiDS collaboration (written in `Python`, but which is not public at the moment). Other codes I have written are posted at my github page.

Other Work Experience

[2020 – 2021] Data science & Machine Learning2 consultant, Minera Centinela, Chile.
[2007 – 2008] Ski instructor at Homewood Mountain Ski Resort in Lake Tahoe, CA, USA. Obtained certification as *Level I Ski Instructor* by the Professional Ski Instructors of America (PSIA).
[2006 – 2007] Ski lift operator at Sun Valley Resort, Sun Valley, ID, USA.

References

- Prof. Henk Hoekstra (*PhD advisor*)
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- Prof. L. Felipe Barrientos (*MSc advisor*)
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Publication list

I have co-authored 131 scientific articles intended for peer-reviewed publication, including 7 first-author papers. They have been cited more than 7,000 times and have an h-index of 46, with more than 350 citations on my first-author papers. The full list of publications can be accessed at the SAO/NASA Astrophysics Data System. This document is maintained live on `github`.

First-Author Papers

8. **C. Sifón**, J. Han, **"The history and mass content of cluster galaxies in the EAGLE simulation"**, 2023, Draft, to be submitted to A&A

7. **C. Sifón**, R. Herbonnet, H. Hoekstra, R. F. J. van der Burg, M. Viola, **"The Galaxy-Subhalo Connection in Low-Redshift Galaxy Clusters from Weak Gravitational Lensing"**, 2018, MNRAS, 478, 1244 [arXiv]

6. **C. Sifón**, R. F. J. van der Burg, H. Hoekstra, A. Muzzin, R. Herbonnet, **"A First Constraint on the Average Mass of Ultra Diffuse Galaxies from Weak Gravitational Lensing"**, 2018, MNRAS, 473, 3747 [arXiv]

5. **C. Sifón** et al. (25 co-authors), **"The Atacama Cosmology Telescope: Dynamical Masses for 44 SZ-Selected Galaxy Clusters over 755 Square Degrees"**, 2016, MNRAS, 461, 248 [arXiv]

4. **C. Sifón** et al. (26 co-authors), **"The Masses of Satellites in GAMA Galaxy Groups from 100 Square Degrees of KiDS Weak Lensing Data"**, 2015, MNRAS, 454, 3938 [arXiv]

3. **C. Sifón**, H. Hoekstra, M. Cacciato, M. Viola, F. Köhlinger, R. F. J. van der Burg, D. J. Sand, M. L. Graham, **"Constraints on the Alignments of Galaxies in Galaxy Clusters from ∼14,000 Spectroscopic Members"**, 2015, A&A, 575, A48 [arXiv]

2. **C. Sifón**, F. Menanteau, J. P. Hughes, M. Carrasco, L. F. Barrientos, **"Strong Lensing Analysis of PLCK G004.5−19.5, a Planck-Discovered Cluster Hosting a Radio Relic at $z = 0.52$"**, 2014, A&A, 562, A43 [arXiv]

1. **C. Sifón** et al. (36 co-authors), **"The Atacama Cosmology Telescope: Dynamical Masses and Scaling Relations for a Sample of Massive Sunyaev-Zel'dovich Effect Selected Galaxy Clusters"**, 2013, ApJ, 772, 25 [arXiv]

Major Contributor Papers

16. N. C. Robertson, **C. Sifón**, et al. (23 co-authors), **"ACT-DR5 Sunyaev-Zel'dovich Clusters: Weak Lensing Mass Calibration with KiDS"**, 2023, arXiv:2304.10219, accepted for publication in A&A

15. A. Dolfi, F. A. Gómez, A. Monachesi, S. Varela-Lavín, P. B. Tissera, **C. Sifón**, G. Galaz, **"Lopsidedness As a Tracer of Early Galactic Assembly History"**, 2023, MNRAS, 526, 567 [arXiv]

14. M. Hilton, **C. Sifón**, et al. (133 co-authors), **"The Atacama Cosmology Telescope: a Catalog of >4000 Sunyaev-Zel'dovich Galaxy Clusters"**, 2021, ApJS, 253, 3 [arXiv]

13. M. S. Madhavacheril, **C. Sifón**, et al. (61 co-authors), **"The Atacama Cosmology Telescope: Weighing Distant Clusters with the Most Ancient Light"**, 2020, ApJL, 903, 13 [arXiv]

12. R. Herbonnet, **C. Sifón**, H. Hoekstra, Y. Bahé, R. F. J. van der Burg, J.-B. Melin, A. von der Linden, D. Sand, S. Kay, D. Barnes, **"CCCP and MENeaCS: (Updated) Weak-Lensing Masses for 100 Galaxy Clusters"**, 2020, MNRAS, 497, 4684 [arXiv]

11. M. Hilton, M. Hasselfield, **C. Sifón**, et al. (43 co-authors), **"The Atacama Cosmology Telescope: The Two-Season ACTPol Sunyaev-Zel'dovich Effect Selected Cluster Catalog"**, 2018, ApJS, 235, 20 [arXiv]

10. J. G. Albert, **C. Sifón**, A. Stroe, F. Mernier, H. T. Intema, H. J. A. Röttgering, G. Brunetti, **"Complex Diffuse Emission in the $z = 0.52$ Cluster PLCK G004.5−19.5"**, 2017, A&A, 607, A4 [arXiv]

9. R. F. J. van der Burg, H. Hoekstra, A. Muzzin, **C. Sifón**, et al. (17 co-authors), **"The Abundance of Ultra-Diffuse Galaxies from Groups to Clusters: UDGs Are Relatively More Common in More Massive Haloes"**, 2017, A&A, 607, A79 [arXiv]

8. E. van Uitert, M. Cacciato, H. Hoekstra, M. Brouwer, **C. Sifón**, et al. (29 co-authors), **"The Stellar-to-Halo Mass Relation of GAMA Galaxies from 100 Square Degrees of KiDS Weak Lensing Data"**, 2016, MNRAS, 459, 3251 [arXiv]

7. D. Kirk, M. L. Brown, H. Hoekstra, B. Joachimi, T. D. Kitching, R. Mandelbaum, **C. Sifón**, M. Cacciato, A. Choi, A. Kiessling, A. Leonard, A. Rassat, B. Malte Schäfer, **"Galaxy Alignments: Observations and Impact on Cosmology"**, 2015, Space Sci. Rev., 193, 139 [arXiv]

6. A. Kiessling, M. Cacciato, B. Joachimi, D. Kirk, T. D. Kitching, A. Leonard, R. Mandelbaum, B. Malte Schäfer, **C. Sifón**, M. L. Brown, A. Rassat, **"Galaxy Alignments: Theory, Modelling & Simulations"**, 2015, Space Sci. Rev., 193, 67 [arXiv]

5. B. Joachimi, M. Cacciato, T. D. Kitching, A. Leonard, R. Mandelbaum, B. Malte Schäfer, **C. Sifón**, H. Hoekstra, A. Kiessling, D. Kirk, A. Rassat, **"Galaxy Alignments: an Overview"**, 2015, Space Sci. Rev., 193, 1 [arXiv]

4. R. F. J. van der Burg, H. Hoekstra, A. Muzzin, **C. Sifón**, M. L. Balogh, S. McGee, **"Evidence for the Inside-Out Growth of the Stellar Mass Distribution in Galaxy Clusters since $z \sim 1$"**, 2015, A&A, 577, 19 [arXiv]

3. M. Hilton, M. Hasselfield, **C. Sifón**, et al. (26 co-authors), **"The Atacama Cosmology Telescope: The Stellar Content of Galaxy Clusters Selected Using the Sunyaev-Zel'dovich Effect"**, 2013, MNRAS, 435, 3469 [arXiv]

2. F. Menanteau, **C. Sifón**, et al. (26 co-authors), **"The Atacama Cosmology Telescope: Physical Properties of Sunyaev-Zel'dovich Effect Clusters on the Celestial Equator"**, 2013, ApJ, 765, 67 [arXiv]

1. F. Menanteau, J. P. Hughes, **C. Sifón**, et al. (27 co-authors), **"The Atacama Cosmology Telescope: ACT-CL J0102–4915 "El Gordo," a Massive Merging Cluster at Redshift 0.87"**, 2012, ApJ, 748, 7 [arXiv]

Selected Recent Contributing Author Papers (All including C. Sifón)

10. J. van Marrewijk et al. (20 co-authors), **"XLSSC 122 Caught in the Act of Growing Up: Spatially Resolved SZ Observations of a $z = 1.98$ Galaxy Cluster"**, 2023, arXiv:2310.17535, submitted to A&A

9. Dark Energy Survey and Kilo-Degree Survey Collaborations et al. (162 co-authors), **"DES Y3 + KiDS-1000: Consistent Cosmology Combining Cosmic Shear Surveys"**, 2023, The Open Journal of Astrophysics, 6, 36

8. W. Coulton et al. (154 co-authors), **"The Atacama Cosmology Telescope: High-Resolution Component-Separated Maps Across One-Third of the Sky"**, 2023, arXiv:2307.01258, submitted to Phys. Rev. D

7. B. L. Frye et al. (44 co-authors), **"The JWST PEARLS View of the El Gordo Galaxy Cluster and of the Structure It Magnifies"**, 2023, ApJ, 952, 81 [arXiv]

6. G. A. Marques et al. (97 co-authors), **"Cosmological Constraints from the Tomography of DES-Y3 Galaxies with CMB Lensing from ACT DR4"**, 2023, arXiv:2306.17268, accepted for publication in JCAP

5. M. S. Madhavacheril et al. (159 co-authors), **"The Atacama Cosmology Telescope: DR6 Gravitational Lensing Map and Cosmological Parameters"**, 2023, arXiv:2304.05203, accepted for publication in ApJ

4. F. J. Qu et al. (158 co-authors), **"The Atacama Cosmology Telescope: a Measurement of the DR6 CMB Lensing Power Spectrum and Its Implications for Structure Growth"**, 2023, arXiv:2304.05202, accepted for publication in ApJ

3. C. Haines et al. (20 co-authors), **"CHANCES: A CHileAN Cluster galaxy Evolution Survey"**, 2023, The Messenger, 190, 31

2. J. E. Greene, J. P. Greco, A. D. Goulding, S. Huang, E. Kado-Fong, S. Danieli, J. Li, J. H. Kim, Y. Komiyama, A. Leauthaud, L. A. Macarthur, **C. Sifón**, **"The Nature of Low-Surface-Brightness Galaxies in the Hyper Suprime-Cam Survey"**, 2022, ApJ, 933, 150 [arXiv]

1. M. Aguena et al. (24 co-authors), **"CLMM: a LSST-DESC Cluster Weak Lensing Mass Modeling Library for Cosmology"**, 2021, MNRAS, 508, 6092 [arXiv]