Fernanda Muñoz

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Spanish: Native
English: Proficient

Profile

MSc student in Astrophysics with research experience in galaxy evolution and the circumgalactic medium (CGM). Skilled in spectroscopic and photometric analysis, and gravitational lensing with ESO facilities. **Interested in pursuing a PhD focused on extragalactic topics.**

Education

Pontificia Universidad Católica de Chile
2024 – Present
MSc in Astronomy — *Santiago, Chile*

- Current GPA: 6.8/7.0 (as of 2025, Transcript)
- Thesis: *Revealing the CGM with an Einstein Cross: A Tomographic Study of KIDS J2329*

Pontificia Universidad Católica de Chile
2019 – 2023
BSc in Astronomy — *Santiago, Chile*

- GPA 6.39/7.0 (Transcript)
- Thesis: *Characteristics of a Galaxy Group at Intermediate Redshift in the SGASJ0033 field* (Grade: 6.9/7.0)

Projects and Publications

Revealing the CGM with an Einstein Cross: A Tomographic Study of KIDS J2329 (Muñoz-Olivares et al., in prep.)
2024-2025

- As my MSc thesis project, I investigate the CGM of a galaxy using the bright Einstein Cross system, KIDS J2329. By leveraging the geometry provided by gravitational lensing, I analyze multiple lines of sight through the galaxy's halo. I extracted and analyzed spectra from the lensed background source to detect MgII absorption, characterized the intervening galaxy's structure and kinematics, and built a kinematic model of the galaxy. Through this work, I aim to gain insights into the relationship between a galaxy's interstellar medium and its circumgalactic medium. I anticipate that this project will contribute to a publication in a scientific journal by the ARCTOMO team.

Unveiling large-scale rotation in the intragroup medium at $z \sim 1$ through gravitational-arc tomography (Ledoux & Muñoz-Olivares, submitted.)
2023-2024

- In the SGASJ003 field, I studied the kinematics of a group of galaxies using [OII] velocity maps. I constructed kinematic models of the main galaxies in the group using GalPaK3D. I characterized these galaxies through their kinematic parameters and compared the models with the MgII absorption observed in the field. This comparison allowed me to investigate the relationship between the galaxies kinematics and the CGM. We found that the individual galaxies cannot account for the observed absorption due to the complexity of the group environment. Instead, the results reveal a multiphase intragroup medium (IGrM), in which cool ($\sim 10^4$ K) clouds are embedded within a dynamically coherent, group-scale halo.

Characteristics of a Galaxy Group at Intermediate Redshift in the SGASJ0033 field
2023

- As part of an ESO summer internship, I worked with a MUSE data cube and HST images to study the SGASJ0033 field which has a lensed system at z=2.39. I characterized a group of intermediate redshift galaxies showing [OII] emission using photometry and spectroscopy, making use of the BAGPIPES software. In addition, I studied the observed MgII absorption in the arc. The arctomography technique was used.

PypeIt Data Reduction
2022

- I have worked reducing Multi-Slit spectra with PypeIt for the LAGER proyect. The data used are obtained from LCO using the Magellan/LDSS3 spectrograph.

MUSE spectroscopic analysis of an Einstein cross (KIDS J2329) 2021

- As part of an IA summer internship, I worked with a MUSE data cube to study an Einstein cross. The light profile of the lensing galaxy was modeled using astronomical libraries and the python programming language. As a final goal, the flux contribution from the lensing galaxy was subtracted to minimize the noise added to the distant source spectra.

Research & Teaching Experience

ESO, Summer Research Programme 2024, 2023
Research Intern *Santiago, Chile*

- Analyzed MUSE data cubes and HST images of SGASJ0033 field (z=2.39).
- Studied galaxy group kinematics and MgII absorption; continued as BSc thesis.
- 2024: Investigated CGM kinematics under supervision of Dr. Cédric Ledoux.

Pontificia Universidad Católica de Chile 2021 – 2023
Research Assistant *Santiago, Chile*

- Modelled galaxy in an Einstein Cross system with MUSE data cubes.
- Reduced multi-slit spectra with PypeIt for the LAGER project (Magellan/LDSS3).

Observing Experience 2021 – 2023

- **LCO:** 4 nights with Magellan/LDSS3 (remote).
- **VLT/UT4:** 1 night (Antofagasta, Chile).

Pontificia Universidad Católica de Chile 2021 – 2025
Teaching & Outreach *Santiago, Chile*

- Teaching Assistant in undergraduate Physics & Astronomy courses, including:
  Dynamics, Laboratory of Dynamics, Thermodynamics, Laboratory of Thermodynamics, Electricity & Magnetism, Introduction to Data Analysis, Astronomy Laboratory, and A Journey Through the Universe.
- Tutor in mentoring programme for first-year students (2021).
- Assistant at the Santa Martina Observatory (2022), leading outreach activities for non-science students.
- Instructor of the Python Graphing Workshop (2023) for undergraduate physics and astronomy students.
- Instructor of the LaTeX Workshop (2024/2025) for undergraduate physics and astronomy students.
- Panelist at the University Welcome Session for New Students (2025).
- Panelist at the Research Areas Fair (2025), addressing astronomy undergraduate students.
- Invited speaker at Chilean schools for science outreach presentations (2025).
- Invited panelist at the CECFA Discussion (2025), aimed at university students in STEM fields across Chile.
- Volunteer for solar telescope outreach activities (2025).
- Outreach volunteer through SOCHIAS at a rural school in Calbuco, Chile (2025).

Conferences & Workshops

- **Baryon Cycle Conference (2025, Participant and Conference Assistant)**
  Talk: *Revealing the CGM with an Einstein Cross* (Audience: senior researchers and professors).
- **SOCHIAS Meeting (2025, Participant)**
  Poster: *Kinematics of the CGM: Investigating a Galaxy Group at intermediate redshift through Gravitational-Arc Tomography* (Audience: undergraduate and graduate astronomy students).
- **Python Meeting (2025, Participant)**
  Talk: *GalPaK3D: A bayesian parametric tool for extracting galaxy parameters and kinematics from 3D Data* (Audience: graduate astronomy students).
- **CGM-Chile Conference (2024, Participant and Conference Assistant)**
  Talk: *CGM Kinematics of a Group of Galaxies from Gravitational Arc Tomography* (Audience: senior researchers and professors).
- **ARCTOMO Workshop (2024, Participant)**
  Talk: *CGM Kinematics of a Group of Galaxies from Gravitational Arc Tomography* (Audience: senior researchers and professors).
- **La Serena School of Data Science (2024, Participant)**
  Talk: *The needle in a haystack: Hunting for Exo-Comets* (Audience: interdisciplinary data science students).
- **Python Coffee (2024, Participant)**
  Talk: *GalPaK3D: A bayesian parametric tool for extracting galaxy parameters and kinematics from 3D Data* (Audience: graduate students and ESO Staff).
- **Participation:** PUC Seminars and Colloquiums (2024–25), TAO Workshop (2024), FCLA Workshop (2023), PypeIt Workshop (2022), CATA Workshop (2022), Golden Webinar in Astrophysics (2021), Latinas@NASA (2021, panelist).

Achievements

- **ANID National Scholarship** – Government of Chile (2024–Present)
- **Women in STEM Talent** – Proyecto Fondecyt (2024)
- **Ranked N°1 Best GPA** – PUC Chile (2023)
- **Matrícula de Honor** – PUC Chile (2022-2020)
- **Best Academic Average** – Colegio Divina Pastora (2018)

Software Experience

Programming & Data Analysis:
Python | SQL | Mathematica | LaTeX

Astronomy Tools: GalPaK3D | BAGPIPES | PypeIt | SExtractor | MPDAF | Galfit | DS9 | TOPCAT | MARZ | QFitsView

References

- L. Felipe Barrientos – Director, Instituto de Astrofísica UC – barrientos@astro.puc.cl
- Cédric Ledoux – Staff Astronomer, ESO Chile – cledoux@eso.org
- Ezequiel Treister – Associate Prof., Instituto de Astrofísica UTA – etreiste@astro.puc.cl
- Jorge González-López – Associate Prof., Instituto de Astrofísica UC – jgl@uc.cl

For more information, visit: Fernanda Muñoz Website