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Overview

Scientific research has always been at the heart of my work, with coding and computer science as key tools to drive my projects. Participating in the 3-year long "Youth and Science" research program by Fundació Catalunya La Pedrera has been one of the most transformative experiences in my journey. **It opened doors to the world of research and allowed me to gain first-hand experience in a professional scientific environment.**

I have got in touch with a variety of fields, ranging from mathematics to biology, and I embrace learning about different topics. However, **my true passion is high-energy astrophysics and cosmology**. I've worked on measuring the Hubble Constant -the expansion rate of the Universe- first using Cepheids, and later on with Type Ia supernovae collaborating with the Supernova and Stellar Transients Group at the Institute of Space Sciences (ICE-CSIC-IEEC).

In the immediate future I would like focus on Gamma-Ray Bursts (GRB) as potential standard candles, that is cosmological distance indicators. GRBs are the most energetic events in the Universe after the Big Bang and can release as much energy as the sun in its entire life in just seconds. This makes them detectable at very high redshifts, making them a powerful tool for probing the distant cosmos.

Additionally, I love to share my science enthusiasm with others. **Volunteering in scientific dissemination outreach initiatives**, like the "Explainers" program by CosmoCaixa (Barcelona's Science Museum) or the "Festa de la Ciència" (a science fair organized annually). I am also deeply involved in my school's science club and STEM-related activities, as well as encouraging and mentoring fellow students to engage with scientific topics.

Research Experience

- **Research Stay [🌐]** *5 weeks in June-July 2025*
  Osservatorio Astrofisico di Brera, Sede di Merate (OAB-INAF) Place: Merate, Italy
  - Focus: Multi-Messenger Cosmology: combining Gamma-Ray Burst (GRB) data from $E_{\text{peak}} - E_{\text{iso}}$ relation (Amati relation) and a simulated population of binary neutron star (BNS) mergers detectable by Einstein Telescope
  - Research stay at an research institute for 5 weeks during summer 2025.
  - Skills: Gamma-Ray Bursts, relativity with photons, and relativistic plasma physics, working in logarithmic scales (leveraged), statistical methods (χ^2, reduced χ^2, partial differentiation, and more)
  - Other: Engaging in journal clubs, night sky observations at the observatory, discussing research, collaboration with visiting and resident scientists (supervisors & Ricardo Spinelli and Alberto Colombo)
  - Supervised by Dr. Giancarlo Ghirlanda and Dr. Om Sharan Salafia (High-Energy Astrophysics Group)

- **Researcher [🌐]** *July 2024 - present*
  Collaboration for the Analysis of Photonic and Ionic Bursts and Radiation from Barcelona (CAPIBARA) & PLD Space online
  - CAPIBARA is a group of high-school and university students aiming to research the high-energy cosmos. It comprehends two missions (short therm pathfinder, long-term transient observatory) focusing on both engineering and scientific research.
  - Established strategical partnerships with PLD Space & OBA Space among others.
  - Leading one of the research initiatives to use Gamma-Ray Burst data from the CAPIGX mission to constrain cosmological parameters and study the Universe at high redshift.
  - CAPIGX also should be a useful resource for electromagnetic counterpart follow-ups in the multi-messenger era (2030s)
  - Status: Year 1 Collaboration Status Report on July 2025

- **Student Internship [🌐]** *2 weeks in September 2024*
  Institute for Remote Sensing - German Aerospace Center (IMF-DLR) Oberpfaffenhofen airport complex, Weßling, Germany
  - First Week Activities: Worked with the Experimental Methods Department, learned about hyperspectral imaging, conducted outdoor field measurements, and participated in a drone-boat measuring experiments. Visited the German Space Operation Center (GSOC), where both satellite and human spaceflight are guided; the Earth Observation Center (EOC).
  - Second Week Activities: Worked the Photogrammetry and Image Processing Department, analyzed data using QGIS software and GDAL Python library, and studied temperature variations using Landsat 8 satellite thermal imaging. And visited the Galileo Competence Center (GK).

- **Research Stay [🌐]** *8 weeks in June - July 2024*
  Institute of Space Sciences (ICE-CSIC-IEEC) Universitat Autònoma de Barcelona, Bellaterra, Spain

- Focus: Utilizing Type Ia Supernovae in the infrared range as cosmological distance indicators. Analyzed data from ESO observatories (SOFI) and optical data from ATLAS and ZTF surveys to compute supernova distances, and fitted cosmological parameters such as the Hubble constant H_0 and dark energy density parameter Ω_Λ.
- Skills: Supernova Ia, Python, Object-Oriented Programming (OOP), Paper Reading, Networking Aperture photometry, Data Analysis.
- Other: Engaging in journal clubs, seminars of visiting scientists, research discussions, and collaborating with scientists in astrophysics.
- Supervised by Dr. Lluís Galbany, principal researcher of the Supernova and Stellar Transients Group.

• **Scientific Paper Writing [🌐]** *August 2023 - December 2023*
Youth and Science - Fundació Catalunya la Pedrera online
- Writing of a scientific paper: Recomputing the Hubble constant. I became interested in cosmology and Hubble tension, addressing this problem by employed the same methods as 100 years ago with modern data from the NASA-IPAC NED Database and the Konkoly Observatory.
- Supervised by Dr. Ignasi Pérez-Ràfols and Dra. Laia Casamiquela.

• **Research Stay [🌐]** *2 weeks in June 2023*
Fundació Catalunya la Pedrera MonNatura Pirineus, Spain
- Research stay in astronomy and astrophysics at MonNatura Pirineus, where 4 researchers introduced us (10-body student group) on astronomical observations, astrophysical phenomena from star evolution to black holes and relativity. Accompanied by data collection and analysis, as well as practical demonstrations.
- Night & Day observations with three 10" Schmidt-Cassegrain telescopes and one 16" Schmidt-Cassegrain telescope.

Volunteer Experience

• **Volunteer** *April 2024 - Present*
En Bici Sense Edat (Cycling Without Age) NGO [🌐]
- Offering tricycle rides for the elderly and people with functional diversity.
- Accompanying and providing support tricycle rides to combat solitude.
- Skills: active hearing and conversational skills, making users have fun and feel valued.

• **Student Tutor** *November 2023 - Present*
German School of Barcelona
- Academic tutoring for students in grades 5 to 11 focusing on mathematics, physics, chemistry, and biology among others.
- Skills: identifying the students needs and providing support and guidance throughout the learning process.

• **Explainer Volunteer** *September 2022 - Present*
CosmoCaixa Barcelona's Science Museum [🌐]
- Program to teach scientific knowledge and soft and communication skills to high school students.
- Explaining science modules to the Museum's visitors, regardless of age; developing activities for the museum's community. I also attended other science fairs and events like *La Festa de la Ciència* divulging science on behalf of the program.
- Skills: talking in public and engaging people with scientific content. Deal with unexpected situations such as broken experiments, teamworking with fellow explainers.

Leadership Experience

• **Group Leader** *July 2024 - Present*
Collaboration for the Analysis of Photonic and Ionic Bursts and Radiation from Barcelona (CAPIBARA) [🌐]
- CAPIBARA is a group of 8 high-school students and faculty advisors working together in 1 goal: exploring the high-energy Cosmos, comprehending 2 scheduled missions and related research initiatives (both in engineering and science).
- Leading project planning, monitoring progress, managing relationships with partners and collaboration members.
- Creating a collaborative environment for advanced research, facilitating effective communication and providing mentorship to support team members in achieving research objectives.

Education

• **Ludwig-Maximilians Universität München** *2025-2028*
Physics Bachelor of Science München, Germany

• **Perimeter Institute** *July 2025*
GoPhysics! Course for High-School Students Online (Ontario, Canada)
- Course with asynchronous and synchronous materials on Gravity and Black Holes

• **German School of Barcelona** *2007 - 2025*
Secondary Education (5-12 grades) Esplugues de Llobregat, Spain
- Abitur: 1.0/1.0, Bachillerato: 13.338/14.0 (equivalent to 4.0/4.0 GPA)

◦ Thesis: "Kosmologische Entfernungsberechnungen mit Distance-Ladder-Methoden unter Berücksichtigung der aktuellen Krise in der Kosmologie"

- **Harbour Space** *October 2022 - May 2023*
  League of Codes online
  ◦ C++ coding course combining lectures by Informatics Olympiad winners and practical exercises.
  ◦ Successful completion of practical exercises required to continue each week.
- **Universitat Politècnica de Catalunya** *July 2022*
  University Courses for High-School Students Mathematics and Statistics Department, Barcelona, Spain
  ◦ ALGOPROG Course (C++ coding).
- **Universitat Autònoma de Barcelona** *June 2022*
  University Courses for High-School Students Science Department, Bellaterra, Spain
  ◦ Mathematics, Statistics, and Data Science.
  ◦ Adapt: Our evolutionary history read in the genome.
- **Escola Canigó** *2012 - 2017*
  Primary Education (1-4 grades) Sant Just Desvern, Spain

Minor Coding Projects

- **ZTF-API: An API to facilitate access to the ZTF Photometry Service** *June 2024 - November 2024*
  Tools: Python: requests, subprocess, os, pandas, astropy, Licensing, NumPy, Zenodo [GitHub]
  ◦ Focus: Providing easier access to the Zwicky Transient Facility (ZTF) photometry database for retrieving large datasets.
  ◦ API Advantages: Faster and avoids typing errors.
  ◦ Skills: Python programming, automation, Python package, online requests, data fetching.
- **GEN-API / Genetics10: Education tools to learn about genomics** *March 2023 - Present*
  Tools: Python, Python Notebooks, API building [Web]
  ◦ Focus: Educational software for teaching biology and genetics to high-school students, enabling first-hand experience with data.
  ◦ Genetics10: Python notebook (web-based) with pre-established functions for easy code exploration, allowing for both simple and scalable coding.
  ◦ GEN-API: Open-source python module for genetic data analysis, enabling system-wide use of genetics10 functions, and integration with other tools.
  ◦ Skills: Python programming, package, continuous integration (CI) and automated testing, genetics.
- **TdM: A game to practice mental calculations** *May 2023 Year - December 2024*
  Tools: JavaScript, HTML, CSS, Python, GitHub Pages [Web]
  ◦ Focus: helping everyone, young and adult, to improve their mental calculation skills.
  ◦ In the latest version of the program (4th), I migrated from Python to JavaScript, allowing for integration into my website and therefore an enhanced user interface, accessibility, and experience.
  ◦ Features: Different modes to tailor your practicing needs, and availability in 10 languages.
  ◦ Origin: Started as a local program for my younger brother to practice math.
  ◦ Skills: Python, JavaScript, HTML and CSS website design, GitHub Pages for deployment.
- **Integral Calculus for Summation of Arithmetic Series** *December 2023 - February 2024*
  Tools: calculus: integration and derivation [Web]
  ◦ Developed a written paper explaining how to implement simple integral calculus to compute the summation of arithmetic series
  ◦ Expanded my knowledge from calculus class (which I was taking at the moment)
- **28M: A program for the Spanish local elections of 2022** *April 2022 - May 2022*
  Tools: Python, HTML, CSS, Cloud Storage, xlwings, matplotlib [GitHub]
  ◦ Focus: Develop a system to count votes for the 10 electoral schools in Sant Just Desvern (Spain), which I implemented for the local elections on May 28, 2022.
  ◦ Skills: Python programming, xlwings and MS Excel, cloud data storage, path management, chart generation, live results display in website.

Computer Skills

◦ **Programming Languages:** Python, HTML, CSS, Javascript, C++
◦ **Frequent Python Libraries:** matplotlib, numpy, pandas, scipy, astropy, requests, subprocess, xlwings
◦ **Web Technologies:** Developed various websites using GitHub Pages: personal website, website for CAPIBARA project (which I coded entirely).
◦ **DevOps & Version Control:** Git, GitHub, YAML
◦ **Specialized Area:** Due to the nature of my projects specialized in big datasets, data retrieval, mathematical computation, curve fitting, physical modeling, and diagram creation.
◦ **Other Tools & Technologies:** LaTeX, Markdown, MS Word, MS PowerPoint, KeyNote

Talks

- **De l'aula a l'espai: joves, ions i fotons per entendre l'univers d'altes energies** *March 2025*
  CosmoCaixa Science Museum, Barcelona [🌐]
  ◦ CosmoXarxa is an initiative create by and for Explainesr of the science museum. I presented the CAPIBARA project, its objectives and status, both technical, scientific and educative; inviting public to join the efforts.

- **Clase Universo PU** *June 2024*
  Deutsche Schule Barcelona, Esplugues de Llobregat [🌐]
  ◦ For my Physics University Preparation class, I gave two talks (1.5h each) about the foundations of astrophysics, covering the topics of: big bang model and cosmology, CMB, stellar evolution, galaxies and our place in the universe, neutron stars black holes. The opportunity was great to channel and reflect on what I'd been learning for the past years, as well as to share my curiosity and excitement with fellow classmates.

- **L'Exploració Espacial** *October 2023*
  Escola Canigó, Sant Just Desvern [🌐]
  ◦ I conducted a 1.5h activity with 4th grade students at a local school in which I explained space exploration from the beginning (apollo and space shuttle) to today (day in the life onboard the ISS and solar system exploration). With model rockets and modules I brought I managed to engage the children and create an inspiring ambience.

Language Skills

◦ **English:** proficiency level (TOEFL: 103)
◦ **Spanish:** native
◦ **German:** proficiency level (C1)
◦ **Catalan:** native

Music

◦ Playing the piano since I was 5 years old, engaging in school concerts and community events such as a volunteer Christmas concert at Barcelona's Sant Joan de Dèu Children's Hospital.
◦ Participated in 3 different bands across my education at the German School of Barcelona, playing chamber, concert, and modern music.
◦ Participated in the "Jugend Musiziert" competition:
  ∗ 2021: Achieved 1. Prize in Barcelona's Regional round and 3. Prize in National round.
  ∗ 2020: Achieved 2. Prize in Barcelona's Regional round.

Other Honors and Awards

- **First prize and Special Award in Jugend Forscht Landeswettbewerb Nordrhein-Westfalen** *April 2025*
  Jugend Forscht Stiftung - STERN - DGPH [🌐]
  ◦ First Place and Special Award of "Scientific Photography" in the "Jugend Forscht" science fair competition at the state level of Nordrhein-Westfalen (NWR) in the category of *Geo- und Raumwissenschaften* (Geo- and Space Sciences). With the project "Kosmologische Entfernungsberechnung mit Supernovae" I earned the forwarding to the final round (Bundeswettbewerb).

- **First Prize in Jugend Forscht Iberia 2025** *February 2025*
  Jugend Forscht Stiftung - STERN [🌐]
  ◦ First place in the "Jugend Forscht" science fair competition at a regional level (Spain+Portugal) in the area of astronomy. The project I presented was title "Kosmologische Entfernungsberechnung mit Supernovae".

- **Silver Honour in Final Round of IAAC 2024** *July 2024*
  International Astronomy and Astrophysics Competition [🌐]
  ◦ Silver honour presented for participating in the final round of the International Astronomy and Astrophysics Competition of 2024. The final round was a supervised exam of twenty questions which required comprehensive astronomy and astrophysics knowledge. The participant scored 18 point and was placed among the top 7% of all participants.

- **Awarding of internships in the DLR at the NWR Youth Research State Competition** *March 2024*
  Jugend Forscht Stiftung [🌐]
  ◦ Prize at Nordrhein-Westfalen "Jugend Forscht" Landeswettbewerb (Düsseldorf) for the presented project "(Neu-) Berechnung der Hubble Konstante (Recomputing the Hubble constant).

- **First Prize in Jugend Forscht Iberia** *February 2024*
  Jugend Forscht Stiftung - STERN [🌐]
  ◦ First place in the "Jugend Forscht" science fair competition at a regional level (Spain+Portugal) in the area of astronomy. The project I presented was titled "(Neu-) Berechnung der Hubble Konstante" (Recomputing the Hubble constant).

- **Bronze Honour in Final Round of IAAC 2023** *June 2023*
  International Astronomy and Astrophysics Competition [🌐]
  - Bronze honour presented for participating in the final round of the International Astronomy and Astrophysics Competition of 2023. The final round was a supervised exam of twenty questions which required comprehensive astronomy and astrophysics knowledge. The participant scored 12 points and was place among the top 20% of all participants.
- **National Award of Spain in IAAC 2023** *June 2023*
  International Astronomy and Astrophysics Competition [🌐]
  - National Award Spain presented for achieving the nationwide highest score in the final round of the International Astronomy and Astrophysics Competition 2023. The final round was a supervised exam of twenty questions which required comprehensive astronomy and astrophysics knowledge.