Carlos Molina

Curriculum Vitae

✉ *carlos.molina@upc.edu*
cmolinaord.github.io

Education

June-July 2023 **IoT Industrial: Dispositivos inteligentes**, *CIFO Vallés*, Terrassa, Barcelona, System, Networking, and LAN/WAN management.
This course was divided in two main parts: Networking technologies and IoT devices, and IoT industrial applications. A general review of networking, IP networks, router configuration, LAN/WAN environments, VPN, Wi-Fi technologies was done. Then the application of IoT devices to industrial applications was developed, focusing on the integration of geolocation instruments on vehicles using the Traccar open source platform.

2019–2024 **PhD in Signal Theory and Communications**, *Universitat Politècnica de Catalunya (UPC)*, Barcelona, *Signal Theory and Communications.*
My PhD focused on the study of the ionosphere and the perturbations observed in the propagation of GNSS signals through it, in particular, on some origins of these perturbations. The main topic investigated was the interaction between the lithosphere and the ionosphere, observed in the impact of earthquakes and volcanoes on the ionospheric scintillation, both as a precursor and as a consequence of them. Seismic data from several months were correlated with ionospheric scintillation from satellite sources. Also, the volcanic eruption in La Palma (2021) was correlated with the ionospheric scintillation estimated from GNSS-R, GNSS-RO and ground stations. The PhD also included, in the context of an ESA project, the development of a ray tracing software for radio wave signals in the ionosphere, using the most up-to-date models of electron density, magnetic field, and gas temperature/density. Finally, a neural network to estimate the ionospheric disturbances using data from the previous ESA projects was developed to compare the results with the WBMOD model for ionospheric scintillation.

2018–2019 **Master's Degree**, *Universitat Politècnica de Catalunya (UPC)*, Terrassa, Barcelona, *Master's Degree in Space and Aeronautical Engineering.*

2008–2018 **Bachelor's Degree**, *Universidad de Sevilla*, Sevilla, *Degree in Physics.*

Experience

Vocational

Jan 2024–present **Postdoc Researcher**, *Institut d'Estudis Espacials de Catalunya (IEEC)*, Castelldefels (Barcelona).

INTREPID project: Research and development of models to estimate the ionospheric scintillation impact on future LEO-PNT (Position Navigation and Timing) receivers. From May 2025 I was working for the project AURORA for the European Space Agency along with the UPC and Research and Development in Aerospace GmbH (RDA), which is intended to study the impact of the ionosphere on future distributed radar sounder missions, where the low frequencies used (around 45 MHz) sets a challenge for the ionospheric scintillation observed.

Sep 2019–Jun 2024 **Camera engineer for Earth Observation Payload**, *NanoSat Lab UPC*, Barcelona.

As part of the IEEE 2º Student Grand Challenge, the NanoSat Lab participated in the design of an earth observation payload for a 3U cubesat. RITA is a 1U multi-sensor payload for Earth Observation including a microwave radiometer and a multi-spectral camera, and I was in charge of different aspects of the mission:

- Mission design and concept-of-operations development, including data/power budget calculations and the definition of several areas-of-interest aided by orbital simulations from AGI STK.
- Design, integration and testing of the multi-spectral sensor and optics. This includes the selection of the optical lenses and sensor (ranging from Red to NIR), the integration of lenses with an in-house made C-mount, and camera testing in different illumination conditions, focusing distance and temperatures, using the equipment in the NanoSat Lab (clean room and the thermal and vacuum chamber).

Jan 2019–Oct 2019 **CubeSat electronics engineer**, *NanoSat Lab UPC*, Barcelona.

I was in charge of designing, implementing and testing the hardware of a generic, unified on-board computer for a CubeSat. This work was done as part of my Final Master Thesis at UPC. As part of this work I did:

- Design of the OBC architecture and schematic using Altium.
- Design of the layout of the PCB using the CubeSat standard.
- Integration of the electronic components and devices on the board.
- Test of electrical functionality of the circuit and interfaces.

2013–2017 **Analog design and layout of integrated circuits**, *Teledyne Anafocus*, Seville.

I was in charge of design of electronic analog blocks for CMOS image sensors manufactured in the company. I worked for 5 or 6 different projects working along with teams of 8-10 people including analog and digital designers. My responsibilities during the projects were:

- Design and simulation of simple analog blocks as OTA's, band-gap references, current conveyor.
- Design of physical layout of simple analog blocks or macro-blocks (read-out channel, analog control row block).
- Layout physical verifications: LVS (Layout vs Schematic), DRC (Direct Rules Check), Antenna.
- Documentation and exposition of results of simulations and tests.

Other jobs

2017–present **Home Teacher**, *(Maths, physics...)*, Seville and Barcelona.
350 hours

2012–2013 **Assistant Rowing Coach**, *Club Náutico Sevilla*, Seville.
I was in charge of a children rowing team aged from 10 to 14 years old, during one year finishing with the National Championships.

2009–2014 **Home Teacher**, *(Maths, physics...)*, Seville.
140 hours

Languages

Spanish **Native**

English **Cambridge Certificate B2 (172)** *Feb 2018*

Catalan **B1 equivalent level**

Publications

For the full list you can check my Google Scholar and ORCID profile.

Nov 2023 **The 2021 La Palma volcanic eruption and its impact on ionospheric scintillation as measured from GNSS reference stations, GNSS-R and GNSS-RO**, *C. Molina, B.E. Boudriki Semlali, G. González-Casado, H. Park, A. Camps*, Natural Hazards and Earth System Sciences, European Geosciences Union.
DOI:10.5194/nhess-23-3671-2023

Feb 2023 **Ionospheric Scintillation Models: An Inter-Comparison Study Using GNSS Data**, *A. Camps, C. Molina, G. González-Casado, J. M. Juan, J. Lemorton, V. Fabbro, A. Mainvis, J. Barbosa and R. Orús-Pérez*, Ionosphere - New Perspectives, IntechOpen.
DOI:10.5772/intechopen.1001077

Jul 2022 **Ionospheric Scintillation Anomalies Associated with the 2021 La Palma Volcanic Eruption Detected with GNSS-R and GNSS-RO Observations**, *C. Molina, BE Boudriki Semlali, G González-Casado, H Park, A Camps*, IGARSS 2022-2022 IEEE International Geoscience and Remote Sensing Symposium.
DOI:10.1109/IGARSS46834.2022.9883701

Jul 2022 **Ionospheric Signal Propagation Simulator for Earth Observation Missions**, *E. Fernández-Niño, C. Molina, A. Camps*, IGARSS 2022-2022 IEEE International Geoscience and Remote Sensing Symposium.
DOI:10.1109/IGARSS46834.2022.9883781

May 2022 **A Preliminary Study on Ionospheric Scintillation Anomalies Detected Using GNSS-R Data from NASA CYGNSS Mission as Possible Earthquake Precursors**, *C. Molina, B.E. Boudriki-Semlali, H. Park, A. Camps*, MDPI - Remote Sensing.
DOI:10.3390/rs14112555

July 2021 **Possible Evidence of Earthquake Precursors Observed in Ionospheric Scintillation Events Observed from Spaceborne GNSS-R Data**, *C. Molina, B.E. Boudriki-Semlali, H. Park, A. Camps*, 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS.
DOI: 10.1109/IGARSS47720.2021.9555020

August 2020 **First Evidences of Ionospheric Plasma Depletions Observations using GNSS-R data from CYGNSS**, *C. Molina, A. Camps.*, MDPI - Remote Sensing.
DOI:10.3390/rs12223782

August 2020 **The Moon: the next international space station**, *I. Casanova, M. Sureda, O. Almirall, A. Boix, J Greaves, C. Molina, M. Murnaghan, A. Navarro, N. Partal, S. Puljic, S.A. Hadi*, Iniciativa Digital Politècnica. UPC, ISBN: 9788498808261.
URI UPCommons

Certifications and courses

April 2019 **Rosetta Science Operations Scheduling Legacy Workshop**, *ESA Academy*, ESEC, Transinne (Belgium).
During the course, experts from Rosetta science operations team from ESTEC and ESAC, teach us about the mission Rosetta to Comet 67P/Churyumov–Gerasimenko, and how science operations where designed, scheduled and commanded to the spacecraft, during the different phases of the mission: initial approach and exploration, Philae lander deploy, search of Philae and final descent and end of mission, using MAPPS, the software they actually used. We reviewed the operation of the different instruments on board the probe and how the data storage and communication with Earth was done. For me, it was an unforgettable experience and very valuable knowledge

Apr-Mar 2017 **Modern C programming course**, *Universidad de Sevilla*, Sevilla (Spain).
Introductory course on C language given by the University. During the course, the topics studied were structs, modular C, dynamic memory allocation, objects, main arguments, chained lists, input/output, depuration and graphical interface with GTK. Also, during all the course, Git and Github was used as the platform for version control and pull request the changes to the teacher's repository while developing a version of the *Game of Life*.

February 2016 **DAT208x: Introduction to Python for Data Science**, *Online course by edX given by Microsoft.*

Computer skills

Operative systems	Linux, Windows
Office	Microsoft Office (Word, Excel, Power Point) and LibreOffice (Writer, Calc)
Text editors	LaTeX, Visual Studio Code, vim
Programming languages	Matlab, Python, C, bash, markdown, OpenCV, LaTeX

Scientific software	Mathematica, Geogebra
Version control	Git and GitHub
Electronics	Networking, Arduino, Raspberry Pi, PCB design (Altium), Microelectronics design (Cadence Virtuoso Layout and Schematic)
Graphic design	GIMP, Inkscape, Blender, OpenSCAD, 3D printing

Personal interests

I have been practicing rowing since I was 8 years old at Club Náutico Sevilla, competing in almost every Spanish Rowing Championship and some international races, which taught me discipline, teamwork, and time management while balancing intense training (2h/day) with my studies. I have a passion for space exploration and astronomy, which naturally complements my professional work in space-related research. Photography has been a lifelong hobby, particularly covering rowing events and competitions, and I enjoy scientific communication through writing and giving talks about physics, space, and open source technologies.

Projects contributions

Wikipedia I contribute to Wikipedia by:

- Creating and expanding articles about rowing, space exploration, physics...
- Creating SVG graphics for Wikimedia Commons
- Adding data to Wikidata project.

Remarkable experiences

July 2019 **SG[Spain]** event at UPM (Madrid, Spain).
The Space Generation Advisory Council (SGAC) organized for the first time an event in Spain. The event consisted in a series of talks by the main space agencies, companies and start-ups based in Spain, and also some round tables to discuss topics as Clean Space, Space Exploration and AI in space.

October 2017 **#OpenESTEC** event at ESTEC (Noordwijk, Netherlands).
I travelled to the Netherlands to visit the ESTEC open-door day, where I was visiting all the facilities and labs, and I could ask questions to many engineers and scientists working in a variety of fields at ESA.

March 2017 **#Sentinel2Go** event in ESOC (Darmstadt, Germany).
I was invited to assist to the launch of Sentinel-2B satellite as a social media agent. We could visit the ESOC facilities guided by ESA scientists and engineers, and we could ask questions about rocket launches and space exploration missions which are managed by ESA. I met a lot of people from many countries in Europe, and it showed me an open door to lots of things I want to do in the near future.