Report: Erasmus+ internship at the Instituto de Astrofísica de Canarias

My name is M. and I am currently finishing my Master's degree in Astrophysics at the University of Potsdam as part of the Faculty of Sciences. As part of my studies, I had the opportunity to carry out a year-long Erasmus+ internship at the Instituto de Astrofísica de Canarias (IAC) in La Laguna, Tenerife, Spain. The internship was conducted within the Laboratory for Innovation in Opto-Mechanics (LIOM), based at IACTEC and took place from the 8^{th} of February 2025 to the 6^{th} of February 2026.

The IAC has an exceptional position among European research institutions due to its direct association with both the Observatorio del Teide (OT) (Tenerife) and the Observatorio del Roque de los Muchachos (ORM) (La Palma), making it a leading institution in astronomical instrumentation development.

LIOM was particularly interesting due to the ongoing development of the hybrid interferometric telescope Small ExoLife Finder (SELF). My academic training in astrophysics had so far included relatively little instrumentation education. However, a deep understanding of the enabling instruments is essential for becoming a good astrophysical researcher. Being directly involved in an ambitious and innovative project appeared to be a formidable opportunity.

My goal for this internship was to develop a deep understanding of the constraints of astronomical instrumentation development through direct involvement in forefront innovation and development. This internship provided the framework for conducting research for my Master's thesis, thereby contributing directly to the completion of my degree.

The internship was carried out at the IACTEC building in La Laguna. The office is located within an urban green space, the Parque de las Mantecas, and is well connected by public transportation. The building offers modern infrastructure, including laboratory facilities for astronomical instrumentation development, air conditioning, heating, and well-equipped office spaces.

I was granted access to high-performance computing (HPC) infrastructure as well as a laptop for my work. This technical support was essential for carrying out simulation-based modeling and machine learning projects efficiently.

A typical workday often included breakfast and lunch breaks in a professional yet collegial work environment.

My primary tasks were centered around two major research projects.

The first project involved developing an exoplanet yield model for the SELF telescope. For this purpose, I adapted the Exoplanet Open-Source Imaging Mission Simulator (EXOSIMS) for a ground-based observatory.

The second project focused on constraining exoplanet surface characterization capabilities. I developed an exoplanet cartography method employing an unrolled deep convolutional neural network (DCNN) for neural-learned regularization. To generate appropriate training data for the network, I implemented a procedural world generation code in C++. The modeling and simulation work for both projects was primarily conducted in Python, while computationally demanding components were optimized in C++.

Both projects required intensive simulation work, algorithm development, and theoretical analysis of observational constraints. They were directly connected to the development goals of SELF and contributed to assessing its future scientific capabilities.

From my yield model I was able to constrain that SELF will likely be able to detect a handful of Jovian exoplanets and substellar mass companions around stars within a radius of a few tens of parsecs. The exoplanet cartography method I developed demonstrates that neural learned regularization can constrain cloudless rocky exoplanet surfaces. A satisfactory reconstruction fidelity here can be achieved assuming realistic ground-based and space-based observing schedules. Favorable observing conditions with a high data quality may even allow constraining biomes on Earth-like exoplanets.

From the beginning of the traineeship, I was integrated into the LIOM working group and introduced to the overall goals of the SELF project. I was also introduced and was given a tour of the whole IACTEC facility on my first day by the head of the department. Carrying on, I was able to participate in regular group discussions and scientific exchanges within the team, at least on a weekly basis during our group meeting.

My work required a high degree of independence, particularly in the modeling aspects, as relatively few team members were directly familiar with the specific simulation frameworks and machine learning methods I employed. While this presented a significant level of responsibility in decision-making, it ultimately strengthened my competence as an independent researcher.

At the same time, collaboration with other researchers across the institute played an important role. Especially regarding instrumental constraints and machine learning methods, discussions with colleagues were essential for refining approaches and validating results. This broad collaboration significantly enhanced the quality of my work.

My direct supervisors were the LIOM heads, but I not only received constructive feedback from them. All group members of the LIOM team provided valuable input that substantially helped me advance my research. I collaborated most closely outside of LIOM with the initial developer of the foundation of the exoplanet cartography method I continued developing.

The traineeship significantly expanded both my technical and personal competencies.

From a technical perspective, I deepened my understanding of astronomical instrumentation constraints, interferometric systems, and observational limitations. I further developed my programming skills in Python and C++, gained experience working with HPC systems, and strengthened my expertise in simulation-based modeling. The development of the exoplanet cartography method specifically enhanced my knowledge of machine learning techniques and their potential application in astrophysics.

Beyond technical skills, I developed important soft skills. The high level of responsibility for independent modeling decisions strengthened my ability to structure complex research problems autonomously. Collaborative work within an international research environment improved my communication skills and my ability to engage in interdisciplinary scientific dialogue.

Although I had initially planned to improve my Spanish language skills more substantially, this objective was only partially achieved. Due to the predominantly English-speaking research environment and limited engagement outside of work, I did not advance my Spanish as much as intended. Nevertheless, the experience increased my intercultural awareness and confidence in navigating an international environment.

Overall, I am satisfied with what I have achieved professionally and personally during my mobility period, except for my limited engagement outside of work.

Globally, I evaluate the host institution very positively. The IAC provides an excellent scientific environment with strong international visibility and access to outstanding observational facilities. The research atmosphere within LIOM was motivating and intellectually stimulating.

The tasks assigned to me were highly relevant to my academic background and future goals. They were demanding but appropriate for a Master's student working on a thesis project. I was entrusted with meaningful responsibilities, and my work contributed directly to an ongoing major instrumentation project.

The initial phase of the mobility was somewhat challenging due to administrative stress and the search for accommodation. Finding housing in Tenerife is increasingly difficult, and future students should allocate sufficient time for this process. I would recommend using platforms such as Idealista and WhatsApp communities. There are several active, town-specific WhatsApp communities, including some verified by Erasmus. Securing accommodation before arrival, even at the cost of paying rent slightly in advance, may reduce stress during the first weeks. While not having experienced it myself, I would recommend being aware of scams. I ultimately found my accommodation through Idealista.

On the administrative side I would have appreciated a timelier communication of the required paperwork. However, I want to stress that part of the blame is on me for not having explicitly asked for necessary documentation before. Further, my direct points of contact always were quick in responding and were helpful. At times, I experienced the administrative system as somewhat rigid and understaffed, which occasionally slowed down processes.

Despite these initial difficulties, once settled, I experienced a very supportive and welcoming environment both professionally and socially. The interactions with local Canarian people were consistently warm and helpful.

Life in Tenerife is generally more affordable than in urban areas of Berlin or Potsdam. The island offers an exceptional natural environment, including diverse landscapes and opportunities for outdoor activities.

Cultural experiences, such as traditional Romerías and Christmas events, provided beautiful insights into local traditions. Even with limited Spanish proficiency, I always felt welcomed and supported in daily life situations.

The experience of living and working in an international and multicultural setting significantly broadened my personal perspective.

The mobility period had a significant impact on my academic development and future plans. It allowed me to conduct research for my Master's thesis abroad, gain experience in an international research institution, and build a professional network.

The experience strengthened my intention to pursue a career in academic research and motivated me to apply for a PhD position. The combination of independent research responsibility and collaborative project integration provided an ideal preparation for this next step.

I am grateful for the support I received from my working group, the receiving institution, my sending institution, and the Erasmus+ program. The financial support provided through Erasmus+ was an essential factor in enabling my mobility and ensuring financial independence during the traineeship.

Overall, I have a very positive view of my mobility period and would strongly recommend participation in similar international programs.

Figure 1 Members of the LIOM team gathered around an amateur telescope at the OT, with the Milky Way in the background.

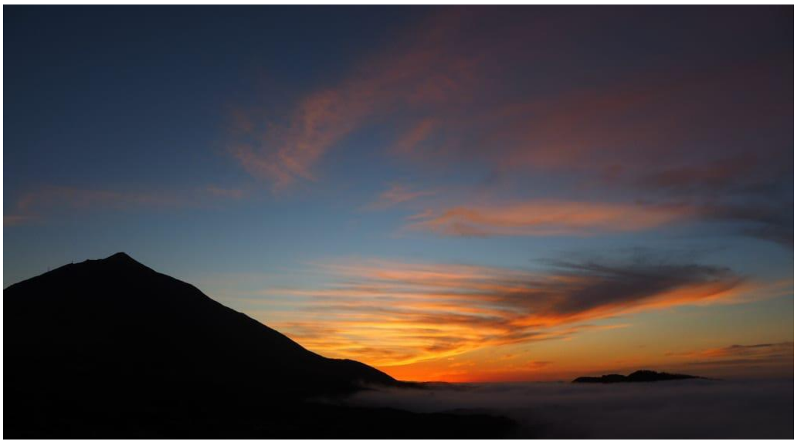

Figure 2 Sunset at the OT with a view of Teide and La Palma.