



Tips for posdoc interviews

3 minutes “elevator pitch”

During my internship at the National Laboratory of Astrophysics (LNA), I developed a method to characterize CCD cameras used in the OPD observatory. This involved experiments to determine key performance metrics like read noise, dark noise, electronic gain, and quantum efficiency (QE). One of our experiments uncovered an unexpected spatial distribution in the dark current of one camera, likely tied to its fabrication process. Building on this during my master's at UNIFEI, I developed an optimization method for the scientific cameras of SPARC4, using Bayesian Optimization. This method significantly improved camera efficiency, optimizing the signal-to-noise ratio and acquisition rate. When applied in real observations, it showed up to 97% improvement in camera performance.

Currently, in my PhD at INPE, I'm focused on developing the Artificial Image Simulator (AIS) for SPARC4. This Python-based software simulates photometric and polarimetric images, helping us model how SPARC4 interacts with observed light. We are working to calibrate this model against real observations and aim to characterize SPARC4's polarimetric response to match it to the SDSS system.

Additionally, I participated in an exchange program at Liverpool John Moores University, where I worked on data acquisition with the MOPTOP instrument. We characterized its polarimetric response and applied it to analyze the polarization of Gamma-Ray Burst 230818A.

Throughout my academic journey, I developed the SPARC4 Camera Control System (S4CCS), which integrates LabVIEW, Python, and an SDK from Oxford Instruments to control SPARC4's cameras. This system supports rapid imaging with minimal overhead, facilitating efficient data collection for scientific observations.

Why this specific fellowship/institution?

I chose your institution because of its outstanding reputation in astronomical instrumentation. The access to state-of-the-art facilities, such as the Potsdam Arrayed Waveguide Spectrograph (PAWS), or even the MARCOT segmented telescope, perfectly aligns with my professional background. I believe my experience in astronomical

instrumentation will contribute to your current projects, and I'm eager to collaborate with your team to drive innovation in this field.

Where do you see yourself in 5-10 years? What do you want to do after a postdoc?

I have a strong passion for the control and automation of instruments, particularly when it comes to the planning and development of software solutions. I find great satisfaction in the process of carefully designing and then implementing systems that enhance the functionality of scientific instruments. In the future, I aspire to contribute to the development of astronomical instrumentation, leveraging my expertise in this area.

Additionally, much of my knowledge has been self-taught. Reflecting on this, I recognize the value of having guidance and mentorship during the learning process. For this reason, I am deeply motivated to mentor and support students in their development, sharing the knowledge and experience I have gained throughout my career.

What research question in your field is of most interest to you? Where do you see your field going in the next few years?

The coming years in astronomical instrumentation will be primarily defined by the next generation of large telescopes, such as the Giant Magellan Telescope (GMT), the Thirty Meter Telescope (TMT), and the European Extremely Large Telescope (ELT). These projects represent collaborative efforts between multiple nations and institutions to construct observatories that surpass the scale and capabilities of the largest telescopes currently in operation. Alongside these groundbreaking telescopes, cutting-edge advancements in astronomical instrumentation are emerging, particularly in the development of data processing pipelines that leverage machine learning algorithms to manage the vast amounts of data these facilities will generate. Consequently, I anticipate significant growth and development within my field of expertise.

What has been your biggest challenge in your research program, and how have you dealt with it?

The greatest challenge in my research has been the absence of an advisor with a strong background in software engineering. As a result, there was a period in my professional life when I had to independently acquire all the knowledge necessary to properly develop software for large-scale projects. Despite this difficulty, I am satisfied with my current programming skills. Moreover, this experience has taught me how to effectively study and

approach new topics in which I initially had no prior expertise.

What do you consider your most innovative accomplishment to date and why?

My most significant innovative accomplishment is the development of the S4CCS, a software system designed to control the scientific cameras of SPARC4. I have been working on this project for seven years, and much of my programming expertise has been acquired through this development process. The project has been a collaborative effort, involving multiple team members, with each contributing to different components. In the end, it is essential that all of our software components integrate seamlessly, ensuring proper communication and functionality across the entire system.

Always prepare some questions to ask the interviewers! For example, you may want to ask about

- How does the institution support postdocs in developing their academic careers (e.g., grant writing, teaching opportunities, mentorship)?
- Are there opportunities for professional development, such as attending conferences, workshops, or networking with other leading experts?
- Can you tell me more about the team dynamics and the overall work culture in the department or lab?
- How does the institution support postdocs in transitioning to permanent academic or research positions?

Perguntas gerais

Por que você se interessou por astronomia?

From a young age, I have been deeply interested in fields related to electronics, programming, and physics. As I grew older, I decided to pursue a Bachelor's degree in Physics Engineering, driven by the desire to apply physics concepts in creating innovative technologies. During my internship, I had the opportunity to work on the characterization of the SPARC4 cameras, which later led to my involvement in the development of the S4CCS. Over time, this experience fostered a strong interest in astronomical instrumentation, which has become a central focus of my career aspirations.

Qual área da astronomia mais te fascina e por quê?

The area of astronomy that fascinates me the most is astronomical instrumentation. Studying the universe demands the most advanced technological innovations. For instance, the next generation of telescopes currently under construction and satellites such as the James Webb Space Telescope are remarkable examples of what humanity can achieve when combining the intellectual and material resources of multiple nations. These developments represent the pinnacle of human collaboration and technological progress in our quest to understand the cosmos.

Conte-me sobre sua experiência em pesquisa em astronomia

My career has largely been focused on working with the scientific cameras of the SPARC4 instrument. Initially, during my internship, I was involved in the characterization of these cameras. Following that, during both my Master's and PhD projects, I have been responsible for the development of the software used to control these cameras. Throughout this period, I have participated in several commissioning runs of the instrument on the telescope, during which various celestial objects were observed. These included standard stars and rich fields for characterizing the instrument's performance, as well as scientific objects related to the research themes of the astronomers within the development team.

Quais são seus objetivos de carreira em astronomia?

I aspire to contribute to the development of astronomical instrumentation at an international level, collaborating with global teams to advance cutting-edge technologies in this field.

Como você se mantém atualizado sobre as últimas descobertas e avanços em astronomia?

To stay current with the latest technologies, I regularly read articles on instruments being developed around the world and the methods employed in their construction. Additionally, I actively follow professional profiles on LinkedIn, as well as YouTube channels that discuss the most recent advancements in astronomical instrumentation. These resources help me remain informed about emerging trends and innovations in the field.

Quais são seus pontos fortes como astrônomo?

One of my key strengths is my inclination to invest significant time in thoroughly planning

a project before beginning its execution. This is a skill that I apply across various aspects of my life. By developing a clear, comprehensive understanding of how all components should function together, the development process becomes far more efficient and manageable.

Como você lidaria com um desafio em um projeto de pesquisa em astronomia?

My approach to problem-solving begins with organizing all relevant information. First, I clearly define the problem, identifying its causes and consequences. Next, I conduct a thorough review of the literature and consult with more experienced colleagues to explore potential solutions. Once I have a comprehensive understanding of the available options, I select the most appropriate course of action and proceed with implementing the solution.

Por que você deseja trabalhar em nossa instituição?

This questions has already been answered.

Perguntas profissionais sobre astronomia

Descreva seu caminho para se tornar um astrônomo. Quais foram as etapas mais importantes e desafiadoras?

This question has been already answered (pitch).

Quais habilidades você considera essenciais para um astrônomo de sucesso, além do conhecimento técnico?

In addition to technical knowledge, I believe that the development of soft skills is equally important. Most astronomical projects currently under development rely on collaboration among institutes and individuals with diverse areas of expertise. To foster collaboration, it is essential to create an environment conducive to contribution and positive relationships. This is a practice that must be developed and nurtured on a daily basis within the work environment.

Como você visualiza o futuro da astronomia e qual o seu papel nesse cenário?

The future of astronomy will be driven by next-generation telescopes like the ELT, GMT, and TMT, which will significantly expand our observational capabilities. These

advancements, coupled with cutting-edge instrumentation and machine learning algorithms for managing vast datasets, will lead to groundbreaking discoveries in areas such as exoplanet research, dark matter, and the early universe. Collaborative efforts and innovations will shape a transformative era for the field.

Given that my desire is to work with astronomical instrumentation, I believe that there may be a change for me to work with the large scale instruments with international collaboration.

Compartilhe um momento "Eureka!" em sua trajetória na astronomia, quando uma descoberta ou aprendizado te impactou profundamente.

An experience that left a profound impression on me was when I gained a deeper understanding of how the Point Spread Function (PSF) of stars is formed on a detector during observation. These images result from two fundamental phenomena. The first is the diffraction of light, determined by the size of the telescope's primary mirror. The second is the dispersion of this diffraction pattern around a central point, caused by atmospheric turbulence.

Como você lida com a pressão e os desafios inerentes à pesquisa em astronomia, como lidar com dados complexos, prazos apertados e a busca por resultados?

Sometimes we encounter situations so challenging that they can deeply affect our emotions. In these moments, it is important to stay focused on our goals by breaking tasks into stages and seeking support from the team. Organization and planning are my allies in managing deadlines and complex data. Celebrating small achievements and maintaining enthusiasm for the pursuit of knowledge help me overcome the pressure and keep moving forward.

Perguntas concentradas no tema da astronomia instrumental.

Quais avanços tecnológicos você considera mais promissores para o futuro da astronomia instrumental?

This question has been already answered.

Como você se mantém atualizado sobre as últimas descobertas e avanços em

astronomia instrumental?

This question has been already answered.

Na sua visão, quais os maiores desafios e oportunidades na área de astronomia instrumental para as próximas décadas?

The future of instrumental astronomy is promising but also filled with challenges. The construction of increasingly larger and more complex telescopes requires significant investments and international collaboration. The growing amount of collected data demands the development of new processing and analysis techniques. However, these challenges also bring opportunities: the discovery of new planets, the study of dark matter and dark energy, and the search for extraterrestrial life. I believe that instrumental astronomy holds great surprises and advancements for us in the coming decades.

Como você imagina que a inteligência artificial e o machine learning impactarão a astronomia instrumental no futuro?

Artificial intelligence and machine learning are already revolutionizing instrumental astronomy by automating data analysis, identifying complex patterns, and aiding in the discovery of new celestial objects. In the future, these technologies will become even more critical for handling the increasing volume of data generated by telescopes. Advanced algorithms will be able to detect astronomical events in real-time, such as supernovae and gamma-ray bursts, enabling swift and detailed observations. Artificial intelligence will also assist in optimizing the design and operation of telescopes, maximizing their efficiency and discovery potential.

Que áreas de pesquisa em astronomia instrumental você considera mais promissoras para sua carreira?

This question has been already answered.

Perguntas do ESO fellowship

What do you think are the biggest achievements in Astronomy/AIP in the last 5/10 years?

The biggest achievement of AIP was the development of a Arrayed Waveguide Grating

(AWG), a photonic integrated circuit (PIC) dispersive element manufactured by innoFSPEC, optimized for splitting the light into several overlapping spectral orders in the astronomical H-band. Laboratory tests showed that, using AWG, a resolving power of $R \sim 30.000$ can be achieved.

Where do you think new instrumentation/telescopes will take your research field? Or: which future instrument will impact your research the most? How?

This question has been already answered.

What do you think will be the biggest impact of new instrumentation/telescopes onto Astronomy in general?

This question has been already answered.

How would you describe your research to somebody that does know anything about Astronomy (your grandmother)

I would describe my work as supporting astronomers in their study of the sky by developing astronomical instrumentation. The primary tool of an astronomer is the telescope, which allows for much greater sensitivity than the human eye. However, a wide range of studies can be conducted by attaching additional instruments to the telescope. For instance, we can transform the light from a star into a spectrum, akin to a rainbow. I am responsible for developing the control systems for these types of instruments, enabling their precise operation and enhancing the scope of astronomical research.

Have you ever encountered a conflict situation during your work? If so, how did you resolve it?

There was an instance where my supervisor assigned me a task that I was certain was incorrect. In that situation, I took a moment to compose myself and proceeded with the task as requested. Ultimately, my supervisor recognized the error and was convinced of the issue.

Suppose a visiting astronomer comes to Paranal and weather conditions don't allow to open the telescope. They blame you. How do you react?

I would explain that, unfortunately, opening the telescope under the current conditions poses a risk to the observatory's equipment. Therefore, I am not permitted to allow the

observation to proceed at this time. However, I would also mention that if the individual remains patient, there is a possibility that the weather conditions may improve later in the night, potentially allowing us to open the telescope.

What do you expect to be the biggest challenge of a fellowship in AIP?

The biggest challenge will be, in a first sight, to understand how to use the equipment related to my work. Getting used to the workstations, as well as how to properly deal with the cameras to get the result that I need is a task that requires a learning curve. I believe that, after this first impression, I will be able to accomplish the objectives of my fellowship without worries.

Not so much a question: but be prepared for some instrument related questions if there is an obvious instrument for your research topic

I should read about the PAWS instrument for this one.

Assume you are offered a fellowship and after a year of work you realise you are not on track with your scientific work. How would you try and solve that problem?

If I found myself in a situation where, after a year, I realized I was not on track with my scientific work during a fellowship, I would approach the issue in a structured manner: First, I would assess the situation by identifying the specific reasons for the delay—whether they are related to unforeseen challenges in the research, time management, or other external factors. Next, I would consult with my supervisor or mentor, seeking their advice and feedback on how to adjust my approach to meet the expected goals. I believe open communication is essential in such situations to realign expectations and seek guidance on prioritizing tasks. Additionally, I would revise my work plan, breaking it down into smaller, more manageable milestones to create a clear path forward. This would allow me to focus on the most critical tasks and monitor progress more closely. If necessary, I would explore resources or collaborations that could accelerate my work, whether through technical support, additional training, or partnerships.

Why should we hire you?

You should consider hiring me because I possess a skill set that is well-suited to addressing the challenges associated with this fellowship. As you may be aware, our

objective is the characterization of the PAWS camera. I have been working with CCD cameras for eight years, and my first published article focused on the characterization of the SPARC4 cameras. With this experience, combined with my expertise in software development, I am confident in my ability to establish a robust methodology for the systematic characterization of camera performance. Additionally, I will ensure that a comprehensive record of the results obtained throughout the duration of the fellowship is maintained.

If you were offered the job, would you accept it? How long would it take for you to decide?

I am very enthusiastic about the opportunity to join your team, and I would certainly be inclined to accept the job if offered. However, I would take a moment to carefully review the details of the offer to ensure that I fully understand the terms and responsibilities. I believe that a period of two to three days would be sufficient for me to make an informed decision. Ultimately, I want to ensure that I am fully committed to the role and aligned with the organization's goals.

They also asked some specific questions about some things that I wrote on my science proposal

I should read my research proposal for this one.

Como encerrar

Thank you very much for taking the time to speak with me today. I genuinely appreciate the opportunity to learn more about the position and the team. I am very excited about the possibility of contributing to AIP and being part of such an innovative environment. Could you please share what the next steps in the hiring process will be? I look forward to hearing from you soon.

Related links

- [A guide to applying to astro postdocs. Part 2: The application process](#)
- [45 Astronomer Interview Questions \(With Sample Answers\)](#)