**Clarissa Do O – Personal And Goals Statement**

As a Brazilian-American who grew up in Brazil, my background posed enough challenges way before I decided I wanted to pursue a career in astronomy. Deciding to come to America (where I was born) by applying to universities in the United States would allow me to learn more about physics and the universe. Keeping in mind that I wanted to do research in astrophysics, I decided to apply to schools in the United States. I was later accepted to the physics program at UCSB. During my first quarter, I went through a lot of background and cultural difficulties. It was not easy to follow classes in this new environment that was so different from where I grew up, especially because I soon noticed the lack of basic educational knowledge I needed to have for my physics classes. However, I knew these were challenges I needed to overcome in order to become the student I dreamed of being. As the years passed, I was able to shape my study habits and research interests to begin a career in astrophysics. **I will pursue a PhD in astrophysics followed by research and possibly a faculty or research scientist position in a university or a national laboratory.** I also advocate for women scientists and diverse backgrounds in science. Since I come from both of these groups, I want to support equity for all diversity within the scientific community.

**Intellectual Merit**

My interest in astronomy started at a young age thanks to my grandfather. He would take me to the planetarium where I grew up in Sao Paulo, Brazil, and I would ask him questions about the planets and the Solar System and planets. My interest in planets led me to apply to UC Santa Barbara as a physics major and pursue astrophysics research. To that end, I joined the honors laboratory class during my sophomore year and met Prof. Ben Mazin through the professor who taught the laboratory class. **As a result of my hard work in the laboratory class, I was one of the 15 UCSB students selected for the** [**Edison Summer Research Scholarship**](https://mcnair.ucsb.edu/edison) **in 2018, in which STEM students receive funding to conduct research on campus.**

The project I worked on consisted on building a database website for the Mazin Lab. The Mazin Lab is an astrophysics lab that works with MKID (Microwave Kinetic Inductance Detectors) [[1](https://arxiv.org/pdf/1908.02775.pdf)], which can detect photon arrival time and energy with minimal readout noise. The lab’s main goal is to directly image exoplanets. In order to quickly access their data, the lab staff required an accessible database with file names, stars observed, filters used and dates of observation.

As I looked through the lab’s data, observation logs and files, I soon started to struggle: where would I start? I knew I had to come up with a strategic plan. Although I did not know much about programming or database structures, I knew that first I needed to compress their data into something easily accessible and readable. After doing some research on the internet, I found out that JSON files could provide me those tools. So, I organized all of their data, every star they have observed over the last two years, along with their file references, dates and calibrations into JSON files. Then came the hard part: organizing the files to place them in a quickly accessible and safe website. I had no experience with HTML and website designing and limited experience with Python. I struggled for four weeks until I came up with something feasible using Python Flask. It took me two weeks alone to get a function to work. At that point, I remember I considered giving up for a moment. However, my persistence in trying to both help the lab and understand how their data worked led me to continue my task. And it paid off. I recall to this day the moment I got that function to work. I was so amazed that something useful could have come out of my hands, and that a challenge had been overcome. **My first experience in astrophysics not only taught me the importance of databases in astronomy, but it also taught the value of perseverance and in learning how to solve problems, as well as the value of small victories.**

My second research project was also in the Mazin Lab. As a third year, I started working on their pipeline for MEC (MKID Exoplanet Camera), the laboratory’s new device. My job was to create a function that would locate cosmic ray incidents on the device. After reading more about MKIDs, I found out that cosmic rays caused a spread in energy on the MKID array, which generated several high counts for a short amount of time. Since photons arrive in a detector in a Poisson distribution, when looking at photon arrivals per time packet, we would expect to see an unusually high count at the tail of the distribution for a cosmic ray event. After a few challenges regarding writing code that could work with an enormous amount of data in a short amount of time, I was able to reduce the amount of time that my function took to run from five days to just under a minute. **This research project taught me about detector technology in astrophysics, as well as how to use efficient programming tools to perform tasks in a pipeline.** This project will also result in a publication along with the other Mazin Lab team members on the MEC Pipeline.

During my junior year, I applied to summer research opportunities in other institutions. **For the summer, I was accepted by four programs: Cornell Astronomy REU (11 selected students in the US), Texas A&M Astronomy REU, SULI at Stanford’s SLAC and Caltech SURF at NASA’s Jet Propulsion Laboratory.** I chose to attend the latter, and under the guidance of Dr. Gautam Vasisht I worked on PARVI (Palomar Radial Velocity Instrument).

PARVI is a highly stable single mode fiber-fed infrared spectrograph that will search for planets around young M stars. My job was to calculate the photon throughput (which is the fraction of original starlight that we get on our detector) for the instrument. That consisted of learning more about the instrument’s set-up, including the fiber injection unit components and the Hale Telescope’s mirror reflectivities so I could write a theoretical throughput program. After participating in three of PARVI’s observation nights in Palomar, I also performed photometry on PARVI’s guide camera and spectrophotometry on the spectrograph. I compared the throughput to my theoretical program and found that the instrument was underperforming. **In order to improve PARVI’s throughput, I performed simulations to analyze how the single-mode fiber coupling efficiency changed as optical aberrations were introduced in the system.** By introducing random wavefront errors, I was able to find an average fiber coupling efficiency that would improve my throughput calculations and provide the adaptive optics team with an average of possible wavefront errors that could be corrected.

These experiences showed me that I want to study astrophysics in graduate school, specifically exoplanet instrumentation and data analysis. Under the guidance of leaders and mentors in the field, I have learned a lot about instrument testing and building and data analysis, which makes me well prepared to pursue graduate school in this field. I have also presented my work at [CUWiP](https://cuwip.physics.ucsb.edu/speakers/#speaker-posters), JPL and [UCSB](https://lists.cs.ucsb.edu/pipermail/ns-igert-trainees/attachments/20180815/d1f2dbae/attachment-0001.pdf). These experiences have improved my communication skills.

**Broader Impacts**

When I first started at the University, I had little to no knowledge about what I should do next. I had ideas I knew I wanted to accomplish, however I did not know how to approach them at first. With the help of many qualified mentors and professors, I was able to have close guidance on how to succeed in the university. However, this is not the case for most students, especially women in physics and people of Hispanic/Latinx background. **In 2015, only 7% of Physics PhDs were awarded to underrepresented minorities, including Hispanic/Latinx Americans [2]. In 2016, only 18% of Physics PhDs were awarded to women [3].** These low numbers are not unique to the United States, however, it is also part of a student’s duty to increase these percentages within the scientific community. For that reason, **I am committed to supporting organizations that allow women and underrepresented minorities to succeed in their academic lives in university.**

During my freshman year, I volunteered on SACNAS’ (Society for Advancement of Chicanos/Latinx and Native Americans in Science) events at UC Santa Barbara. SACNAS promotes an event called [Science and Technology MESA day](http://www.ucsbsacnas.org/events.html), in which students of Latinx origin are invited to visit the University and participate in scientific experiments, workshops, and a robotics competition. This enables middle school students to actively participate and learn more about science. My job was to guide the students through campus, showing them where the competitions were happening as well as telling them about life as a physics major. **Opportunities like MESA day promote science to young students who come from underrepresented backgrounds.** This outreach program showed me that I wanted to continue to participate in events and organizations that would allow students of underrepresented minorities to engage in science.

During my third year, I attended [CUWiP](https://cuwip.physics.ucsb.edu/) (Conferences for Undergraduate Women in Physics). There, I had the opportunity to network with women who also studied physics, **and presented my research poster at the Conference for Undergraduate Women in Physics**. After my presentation, I had several undergraduate students ask me about how I came to pursue research, what steps they should take and what advice I could give them. Having the opportunity to share my experiences with women scientists and share advice with them was truly rewarding, which led me to apply to the Conference once again this year, where I hope to present the work I did at JPL over the summer.

**During my second and third years, I founded a** [**BRASA**](https://www.gobrasa.org/) **(Brazilian Student Association) branch at UCSB.** This is part of my commitment to create a community for students of Brazilian origin. Through this association, I coordinate events to unite students and make sure they can feel at home while they study in college. BRASA also promotes events that allow students to learn more about a variety of fields, such as science, art, and business. I hope to continue these social actions in graduate school, in the hopes that I can impact these students’ lives and careers, and also that I can learn from them.

**Future Goals**

As I develop my career in Physics, I want to continue working in astrophysics research, more specifically in instrumentation and analysis of exoplanet data. I also want to improve my academic and communication skills. **I hope to join Prof. Dimitri Mawet at the California Institute of Technology to work on HISPEC, a fiber fed spectrograph used for the detection of extrasolar planets.** This instrument, when used for the radial velocity measurements and for exoplanet spectroscopy, can advance our understanding of planetary systems and exoplanet atmospheres. I also understand that as a scientist, research is not my only responsibility. I must continue advocating for the diversity of backgrounds in science. For that reason, I intend to start a Latinx STEM Society during graduate school. Succeeding both on my research and on activism within science are my primary goals, and the NSF GRFP would allow me to achieve this goal within and outside of academia.

**References**

[1] Mazin, B. et al 2019, arXiv e-prints, arXiv: 1908.02775

[2]<https://www.aps.org/programs/education/statistics/urm.cfm>

[3] <https://www.aip.org/statistics/reports/women-physics-and-astronomy-2019/>