

Adriana Ladra's MSRP application essay questions (2021)

MSRP General Essay Responses

* indicates a required field

Describe at least one of the research experiences you have had as an undergraduate, including lab experiences, data compilation and analysis, or other research activities, in detail by answering the following questions:

Where did you conduct research? How long was this research experience? Who was your mentor or supervisor? What was the purpose of the project? What was your specific contribution to the project? Why was it an interesting project? What impact did it have on your scholarly goals? Maximum 500 words

I attended the 2019 MatSE/Physics REU hosted by Penn State University, which ran from May 28 - August 2. Dr. Long-Qing Chen was the Principal Investigator, while Dr. Bo Wang and Dr. Jianjun Wang were my project mentors. My project was to gain insight into how epitaxial strain affected the polarization domain structures in $(K(1-x), Na(x))NbO_3$ (KNN) thin films, which are lead (Pb)-free materials (compared to popular $Pb(Zr(x), Ti(1-x))O_3$, PZT) whose piezoelectric properties could be manipulated to develop environmentally-friendly piezoelectric devices.

I produced phase-field simulations of the polarization domains present in KNN thin films, in which

I varied the epitaxial strain of several simulations by helping to create input files that contained the properties of substrates and thin films. I plotted the produced outputs as polarization domain structures and calculated their domain fraction per structure, documented how epitaxial strain varied the domain fractions, and used the structures to generate and analyze the multi-domain approach to anisotropic misfit strain phase diagrams of KNN.

We discovered that some of the domain structures resembled herringbone patterns in the experimental results of a manuscript published by the Germany IKZ group, and so I continued simulation work to help investigate KNN domain wall arrangements both computationally and experimentally.

My current research project, beginning in February 2020 with Dr. Inna Ponomareva as the Principal Investigator, seeks to discern the structure-property relationship between the presence of polar nanoregions (PNRs) within ferroelectric relaxors and relaxor behavior, as well as provide insight into PNR structure and their intrinsic dynamics.

I first began by creating supervised machine learning (SML) toy models that predicted the phases of a relaxor dataset, $\text{Ba}(\text{Ti}(1-x), \text{Zr}(x))\text{O}_3$ (BZT), under varying Zr concentrations and frequencies. To obtain the phases, I determined the phase transition (Curie) temperature, T_c , for all data concentrations and frequencies, and used T_c to obtain the temperatures for each phase class of the SML model.

I then developed a k-means clustering unsupervised learning (UML) model, which is another toy model trained using images of the plotted hysteresis loops from the same BZT dataset. I converted the images into feature vectors that construct the 2D image dataset and performed principle components analysis (PCA) on the dataset. To compare models, I constructed concentration-temperature phase diagrams for actual data and each model's phase predictions. My goal is to prove the grouping functionality of the k-means method using the BZT toy dataset and therefore extend this model to approach the PNR-relaxor question.

Both of my experiences have taught me very valuable technical skills, and helped me grow as a young researcher. I co-authored papers that were published and/or submitted to scientific journals, learned to strategize reading scientific literature, how to present my research, and think analytically and creatively. Most importantly, research inspired me to pursue a Ph.D in Computational Science and Engineering so I could help develop and improve the computational tools used to study the complex systems of the natural sciences.

What are your future educational and career goals, and how does training as a researcher fit with your goals? Describe any contributions you wish to make to your academic discipline and to your community.

Maximum 500 words

Through mentorship from the Principal Investigators I worked with, I learned that interdisciplinary efforts and creativity are essential to a successful project. Varying backgrounds of expertise strengthens the approach to a research solution; my degree pursuit in computer science didn't hinder me from learning to read physics literature and apply basic understanding to my project at Penn State, and similarly, Dr. Ponomareva's Ph.D in Physics was no disadvantage to her contribution of ideas to our machine learning approach in studying ferroelectric relaxors.

Additionally, my time working in various research areas taught me how to ask questions and propose creative approaches beyond the suggestions of my research mentors. I've learned that in research, there is no wrong answer. Everyone, even the Principal Investigators, have no absolute sureness in the success of the problem they are investigating, relying on only prior knowledge built from culminations of past research outcomes and years of degreework. But everyone, even junior research scientists like me, are allowed to ask questions. Now, if I'm given suggestions of how to investigate, I know that it never hurts to also take imaginative approaches beyond the scope of what is being asked, as it may very well end up being significant to finding the solution.

Post-undergraduate school, I plan to obtain my Ph.D in Computational Science and Engineering as a tool for computer-aided discovery, and eventually pursue a career as a research scientist at a national laboratory or as a university research professor, with an emphasis on outreach to students from minority groups. My research interests include computational modeling of physical systems, algorithm design and optimization, and machine learning. More specifically, I would like to help create and improve the computational tools used to study our natural world: to develop and improve machine learning capabilities in predicting patterns in experimentally or computationally-obtained data, as well as help to optimize the efficiency and performance of the algorithms we use to investigate and model complex systems.

Finally, as a bisexual Filipina woman, I would also like to strongly promote diversity in STEM for my communities by creating a safe space for women, people of color, nonbinary people and other LGBTQ+ identities, and other underrepresented groups. I believe that this begins with outreach, and so I would like to help stimulate a passion in science for young students of groups that tend to appear less frequently in STEM fields through voluntary "STEM teaching days" at primary schools, as well as inviting high school students to work or shadow me and my colleagues for a short period of time according to the students' field of interest.

Please explain how you have demonstrated a commitment to diversity in the academic, professional, or civic realm through their work experience, volunteer engagement, or leadership of student or community organizations. Additionally, describe how you will advance diversity in the future. By diversity, we mean efforts to reduce social, educational, or economic disparities based on race, ethnicity, or gender, or to improve race relations in the United States.

Maximum 500 words

I am a volunteer for DoSomething.org, in which I participate in campaigns based on my social, political, and environmental issues of interest. The causes that I have been or am currently involved in are racial justice, LGBTQ+ and gender rights, environment, and homelessness. I am also part of the USF Global Citizens Project, which seeks to encourage its members to become aware of the world, environment, and people around us by encouraging us to learn about other cultures, social issues outside of the US, and understand our place in the world.

I have also just recently been asked to be the Vice President of External Affairs for Women in Computer Science and Engineering (WICSE) at USF. I'm hoping that I can use this newfound position of leadership to cultivate opportunities to support women, especially women of color, and women from LGBTQ+ and other underrepresented groups in STEM, and contribute to the effort to reduce and eventually eliminate the gender-inequality barrier that unfortunately persists in the STEM field.

I'm hoping that I can one day be in a position where I can establish a safe space for people of all underrepresented groups and from disadvantaged backgrounds. Certainly, that starts in small steps, so I'd first like to begin by starting where the representation gap begins: youth. Ideally, I would like to establish a multidisciplinary nonprofit organization that, with parental consent, seeks to make children aware of the implicit biases that develop when they are young, as well as provide free tutoring and financial support for students in need.

I'd like to hold outreach through visiting K-12 schools and hosting "STEM days" where the next generation of scientists can be inspired to pursue a career in STEM. At the end of each visit, I'd also like to spend time explaining to students the STEM representation gap, and teach young children of groups that are historically underrepresented that they can perform just as well as their peers of majority groups with a proper environment that nurtures everyone's abilities. I would then conclude by saying that children from both marginalized and non-marginalized groups, if they decide to pursue a STEM career, should work together to help reduce the representation gap that pervades the STEM field today. I would also like to invite interested high school and undergraduate students of underrepresented groups to work with my colleagues and I so they can grasp the STEM environment.

I would also like to join or help co-found an organization that seeks to reduce the representation inequalities in STEM. Scientists from marginalized groups sometimes face workplace discrimination, lack of respect for their identity, and a plethora of other challenges, especially when personal identities are pushed aside in the pursuit of scientific solutions. Research creativity tends to be lower when the scientist feels isolated, and so I would like to help create a community in which people of minority groups in STEM can connect with people of their own and others' identities and share their ideas with each other.

What are your top 3 personal, professional, and/or academic accomplishments?

Please be specific in your responses. Maximum 250 words

My first accomplishment is a set of tangible academic ones: I managed to become a co-author of my first research papers on computational studies of ferroelectric and ferroelectric relaxor materials that were either published or submitted to the Journal of Applied Physics, Physical Review B, and APL Materials. I also was nominated by Dr. Sayandeb Basu, the USF Goldwater representative, to apply for the 2021 Goldwater Scholarship with emphasis on my research with Dr. Ponomareva and Dr. Chen's group.

I've also seen myself grow into a research scientist over the years. I've learned to grasp physics literature far beyond what I'm taught in the classroom, which I never thought I'd be able to fully understand when I picked up my first paper on transition metal dichalcogenides as a freshman. I learned to analyze results and pursue innovative research directions knowing that there is no objectively correct answer in research; anything and everything is possible until the most promising solution presents itself.

My most significant personal achievement is learning to fully love and accept myself for who I am. Being raised under strict Filipino Christian ideals, I was taught to believe in the sin of homosexuality. But after many years of lying to myself about my sapphic identity, I realize that nothing is more important than living life true to oneself. It may be a while before my parents accept my bisexuality once I come out, but what is most important is that I've finally learned to accept myself.

Cultural Background and Gender Identity: At MIT, we know that people are more than just a set of grades and scores on a screen. So we use a holistic admissions process which entails understanding as much about you as we can, and the context from which you have been shaped, both as a person and a student. The information from the application provides the pieces that help us to create a picture of you.

Please tell us more about your cultural background and identity in the space below (100 word limit).

I am Filipina by blood and was born in Wellington, New Zealand. I never got well-acquainted with the area, however, as my family moved to the United States when I was three, and I was raised into the marriage of cultures that was the Filipino household and the American education. I grew up learning Ilocano and English simultaneously, followed by French at age eleven. My parents divorced that same year I was baguettified, and with little relationship models and internalized homophobia, I battled with my sexuality for a while, but I now proudly identify as a cisgender, bisexual woman.