Academic integrity reminder: This is the work of a real person; do not plagiarize.

NSF GRFP, 2017 successful application

Personal, Relevant Background, and Future Goals Statement

Although I am American, I grew up overseas in both [redacted] and [redacted]. In addition to the wonderful opportunities that this experience afforded me, it was also very challenging. In 2010, while living in [redacted], the political situation in the country suddenly changed, and my family had to make plans to leave the country quickly. I wanted to remain abroad to complete my [redacted] Baccalaureate because of the stimulating education it offered. It seemed impossible, but after selling all our belongings, we traveled to the US, applied for [redacted] visas, received them, and left for [redacted] in a whirlwind three-week period. Through these events, I learned how to navigate unexpected situations and do so in a multi-cultural environment. My overseas experience built in me a determined and perseverant attitude toward my technical work and has fostered a love for outreach and diversity which are foundational principles for my professional life.

Intellectual Merit/Technical Work: In high school, through a careful technical analysis of energy resources, I came to the conclusion that nuclear power could meet our world's steep energy demands in a consistent and environmentally sound way. Since then, I have become a passionate advocate for nuclear science and technology. In college, I committed to learning about a variety of nuclear engineering topics to narrow down a specific interest. I therefore pursed internships in thermal hydraulics, structural plant design, nuclear materials, and reactor physics. These experiences led to my strong interest in computational reactor physics. My goal is to become an independent researcher in this field and to lead a research team at a laboratory or university. Such a position will provide me with a large sphere of influence in the technical world but also in my ability to mentor others and effect change. Obtaining my PhD in Nuclear Engineering is critical to this goal.

Pre-computational experience: I began doing research after my freshman year in 2013 when I joined Professor [redacted]'s solar cell research group at the [redacted]. During this year-long experience, I developed fabrication recipes for amorphous silicon, a cheaper material to drive down the cost of solar panels. This was a great introduction to research because I learned how to design experiments and collaborate with graduate students. However, I wanted to get more involved in nuclear-related topics, so I interned at [redacted] and [redacted], consecutively. At [redacted], I built my programming skills in thermal hydraulics. By leveraging my knowledge of MATLAB and Unix, I restructured the loss of coolant accident analysis scripts to be more efficient. At [redacted], I used finite element analysis to create seismic models of nuclear plant components. Industry experience showed me the difference between bachelor and doctorate level projects in the workplace, and I knew I wanted to solve the more cutting-edge problems. When I returned to [redacted] in spring 2015, I joined Professor [redacted]'s lab where I identified mechanical properties of steels treated to become more radiation-resistant, and I presented this work at an [redacted] Conference poster session. Each of these projects taught me about the research world and solidified my choice to pursue a PhD as a starting point for a career dedicated to novel, impactful science.

Computational experience: I formed my interest and expertise in computational methods over the course of three major research projects. The first related internship was in the [redacted] Computational Reactor Physics Group under Professors [redacted] and [redacted]. My contributions enhanced an international benchmark for pressurized water reactors with real plant measurements. I developed and carried out ideas for quantifying uncertainties in utility data so that groups around the world could validate their simulation tools.

In addition, I volunteered my time in a separate project to create a solid geometry model of a reactor at [redacted], having no prior experience with the method. I presented this work and won best poster, undergraduate runner up, at the [redacted]. In this internship, I gathered a deeper picture of computational reactor physics by seeing aspects of neutronics, geometry, data, and processing tools.

This year, I have begun an independent research project with [redacted] who works at [redacted] and is an adjunct professor at [redacted]. Our project has been to write a diffusion theory code and a depletion solver to test code coupling strategies in depletion problems. Reducing error while maintaining efficiency in coupled sets of non-linear equations constitutes a major contemporary challenge in computational methods, and our research strives to eliminate a common source of error in conventional depletion models. I have written our solvers from scratch, using graduate-level course notes and published research articles for reference. Because I am independent in this project, I am developing an intuition for best programming practices through trial and error and learning to seek answers through experiment and literature. I have finished writing our diffusion and depletion solvers, and I am currently setting up computational experiments to test and contrast coupling methods. The results will quantify the accuracy gains from each code coupling strategy and inform the computational community of these best methods. We are planning to submit this work as an ANS transaction.

Finally, in summer 2016, I learned how to run MCNP, a Monte Carlo software, at [redacted] under Dr. [redacted] in the Center for [redacted]. In an effort to benchmark the performance of our computer clusters, I ran MCNP phantom calculations in parallel, measured the calculation runtimes, and drew conclusions about influential parameters. This project led me to a better understanding of high performance computing, a crucial tool in my line of work. I took further advantage of my time at ORNL by visiting many of the other research groups, particularly in radiation transport. I learned from the groups developing GPU-compatible Monte Carlo codes (as opposed to CPUs) and groups improving cutting-edge depletion solvers. These discussions helped me understand the scope of research avenues that are available to me in the field of nuclear computation.

Future plans: Throughout my internships, I have widened my understanding of the research opportunities in computational transport and reactor physics and have developed a plan for my future work. I will draw from current publications to identify significant problems in the nuclear industry, specifically in the area of computational physics. I am familiar with both diffusion theory and Monte Carlo, and I am interested in a number of possible projects such as hybrid diffusion/Monte Carlo, high-order/low-order algorithms, or non-linear multiphysics calculations.

Then, through code development, testing, and validation, I will produce methods to answer these problems. The extensive professional network I have built thanks to internships and ANS will allow me to collaborate with subject matter experts as I carry out my work. I expect to pursue several additional internships at Department of Energy research facilities during graduate school to draw even further input from other scientists.

Broader Impacts/Outreach: My technical experience has prepared me to begin conducting my own research. It has also given me a glimpse of the present state of the nuclear industry. While I am excited about current advances, I have observed stagnation in the nuclear innovation process. This field needs novel and unconventional methods to spur real innovation. I plan to bring my multi-disciplinary and multi-cultural experience to the foreground of my research to facilitate such change.

The first thing we need is a more diverse workforce to encourage original and progressive ideas to be created. I have been active in science outreach in many different capacities throughout my undergraduate career: conducting lectures 8h/week for a summer science program for minority high school students after my freshman year, and volunteering through the Society of Women Engineers for Middle School Engineering Day multiple times. My involvement with the American Nuclear Society has provided the most opportunities for such outreach. I initially became involved with [redacted]'s section of ANS through a STEM (Science, Technology, Engineering, and Math) program at an inner-city elementary school, in which I developed and implemented a hands-on engineering activity. My presentation was met with a lot of excitement about engineering. I later served as our chapter's Programs Chair, creating and coordinating all of our STEM outreach initiatives and professional development activities. Among other programs, I coordinated and developed curriculum for a lunch & learn lecture at a local high school and planned a joint Girl Scout Nuclear Merit Badge workshop with [redacted]'s chapter of Women in Nuclear.

On a national level, I put in place a podcast recorded at [redacted]'s radio station covering topics from medical radiation to nuclear space technology. Each week, I appointed someone to pick a topic and compile a list of helpful websites. We would then draw from those resources to casually explore the topic on the air. These podcasts are open to the public and shared with ANS headquarters to further the scope of our outreach. To shape the nuclear industry as a cutting edge scientific field, I will continue to play this role in the public sphere. It is very important to attract new life to this aging industry so that we can start an era of innovation and active progress.

I am also committed to fostering quality professional spaces for creative ideas to be shared. My largest and most recent efforts in this direction have been to bring the national ANS Student Conference to [redacted]. I wanted to do this to directly influence the quality of the Student Conference and play a major role in improving students' opportunity to present research. During the 2014-2015 academic year, I spearheaded the effort to write a conference proposal for the 2016 meeting. I led a team of seven students (both undergraduate and graduate) to author a 90-page proposal detailing a logistical plan and technical program for a conference potentially to be held at [redacted]. Although we did not win, the following year, in 2016, I recruited a new committee of thirteen students, and, through my project management skills, led this larger team to write a new, winning proposal.

I am now a Chair of the 2017 ANS Student Conference which has allowed me to grow in new ways. I have noticed that my leadership style is highly personal. Each of my team members has different strengths and interests, and I have been leveraging them to the team's advantage. In general, through this experience, I have learned how to bring people together, cast a vision, and see it to completion with a team. These are valuable lessons that will serve me well in graduate school and in my professional career.

I attribute much of my success to my unique upbringing. The [redacted] school system made me a rigorous worker, and my cultural exposure and relational skills allow me to bring people of different backgrounds together, understand them, and value their contributions. Graduate school will broaden my impact in this regard by increasing my sphere of influence. I will continue participating in STEM outreach on a local level, and I will increase my national involvement though serving in a technical division, contributing to policy statements, and mentoring undergraduates.

The author uses headers to not only show the structure of the narrative but also explicitly identify the *Intellectual Merits* section that the fellowship requires.

The author uses underlining to highlight conclusions and **match**. We note, however, that this practice (underlining or otherwise visually emphasizing points) is not required.

This successful statement includes all the important content without it being grouped into unique sections. Instead, that content flows through a natural narrative with headers that serve as sign posts.

Personal narrative

Your motivations and goals?

Show your passion and individuality.
Describe your research history and identity.

Experiences: meaning and match

What have you learned/accomplished and why does it matter?

Give relevant examples and demonstrate how these help qualify you for the fellowship

Specific research interest

Research areas and projects you're interested in working on and why? Professors would you like to work with?

Career goals

Briefly, what are your long-term career goals?