Follows formatting guidelines (see program solicitation for more details)

8.5”

11”

Childhood story to express longtime enthusiasm for STEM (but tread carefully)

Identifies field (but could be more specific)

Clearly articulates motivations and professional goals

Quantifies experiences (lots of numbers!)

Clearly identifies the meaning of experience and **bolds** it

Identifies relevant skill (“engaged workforce”)

States personal outcome of achievements (more than restating resume)

Long-term research experience demonstrates ability to be successful grad student

Illustrates diverse range of experience and engagement with scientists outside of own field

Personal, Relevant Background, and Future Goals Statement

[redacted]

Personal History Since I was a child, a career in science seemed natural to me. My parents were great role models—both Serbian immigrants, my mother is a molecular biologist and my father is a mechanical engineer. I have always been curious about nature and how we can apply our understanding of natural phenomena to help those in need. Once I was old enough to understand what a professor does, it quickly became clear that this was my dream job. I could not only make discoveries about the Universe at the cutting edge, but also teach and inspire new generations of scientists and engineers. With my academic interests divided between fundamentals and applications, mechanical engineering seemed like a suitable field for me because of its breadth. **Over the past six years, I have been sharply focused on my long-term goal of becoming a professor and tailored my experiences to develop into a capable researcher and teacher.** I launched my career in research as early as possible and engaged in multiple different fields ranging from mechanics to biomedicine in order to discover my passion at the intersection of science and engineering: applied physics. Most importantly, I have chosen to immerse myself in research because I simply enjoy it. I cannot imagine a more exciting job than being a professor—each day brings with it new puzzles to solve, lessons to learn and teach, and ways to make the world a better place through scientific discovery.

Research Experiences My research journey began after my first year of undergraduate study at the [redacted], working under Prof. [redacted] and Dr. [redacted]. I helped to bridge the gap between micro- and macrotribology and learned how phenomena on length scales as small as nanometers can affect the operation of machines over ten orders of magnitude larger. My project involved characterizing the adhesion between stainless steel and an MoS_2-based dry lubricant used on the James Webb Space Telescope. I developed a method of functionalizing atomic force microscopy (AFM) probes with single stainless steel microbeads as small as 10 μm. I used these functionalized probes to measure the adhesion force between stainless steel and the lubricant, collecting over 2,000 measurements over two summers. **The process of designing this experiment taught me what it takes to come up with original ideas and the time and effort I need to dedicate to my experiments to do them right—in other words, patience and diligence.** Later, Dr. [redacted] and I developed a MATLAB script to geometrically interpenetrate AFM images of the microbeads and the lubricant in 3D to simulate the experiment. This novel, broadly applicable simulation allowed us to estimate the work of adhesion using the adhesion force measurements. This was my first taste of theory and computation, and although I found it challenging, it exposed me to methods of problem solving that were completely different from what I encountered in my experiments. Years later, **I would end up coming back to theory-building research for its unique challenges, but in the meantime, I worked on becoming a good experimentalist and indulged my curiosity about other areas of research.** This project also gave me the opportunity to develop **one of my most valuable skills as a researcher: communication.** I presented my work at an undergraduate research conference in 2015 and won runner-up in my category. In addition, I was the first author on a paper about this project published in *Advanced Engineering Materials* in 2017. **Publishing a paper as an undergraduate was extremely encouraging, as it showed me that I enjoyed conducting and disseminating original, independent research.** Although I was still far from being a professor, this achievement gave me the resolve to aim high and confidence that I could achieve my goals.

My work with Prof. [redacted] and Dr. [redacted] validated my interest in research, and the skills I developed under their supervision served as the springboard for my [redacted], a co-op program at [redacted] that gave me the opportunity to work full-time as a researcher after my third year of undergraduate studies. Although I enjoyed the research I had done over the past two summers, **I wanted to branch out and expose myself to other fields, with the hope of borrowing ideas from areas of research I would not see in a conventional mechanical engineering program.** Inspired by my mother, I tried biomedicine and tackled the problem of medication compliance under the supervision of Prof. [redacted], Prof. [redacted], and Dr. [redacted] at [redacted]. I designed and prototyped two

Long-term research experience demonstrates ability to be successful grad student

"Engaged workforce"

States relevant skills that will enable them to be successful in their chosen research

"Advancing knowledge"

temperature-triggered, self-deploying gastroretentive structures for long-term therapeutic drug
These devices eliminate the burden on patients of remembering to take their medication by giving
one-time, long-lasting dose. This especially benefits patients with infectious diseases or deb
mental illnesses, where a lack of compliance can have disastrous outcomes for the patients and po
their communities. This project culminated in a paper published in *Science Translational Med*
2019, on which I was the second author. I also worked on a project aiming to mitigate the risks
and falls. Dr. [redacted] and I designed a bio-inspired shoe grip made of a kirigami metamate
increases traction without protruding from the shoe. The shoe grip could help to reduce the rate
and falls, which are a leading cause of death for older adults as well as occupational deaths. Using
plate to measure the forces exerted by human subjects when walking, we demonstrated that the
the shoe grip significantly increases the coefficient of friction when walking on a variety of s
including icy surfaces. We published our design as co-first authors in *Nature Biomedical Engine*
2020. Both of these projects were highly interdisciplinary and taught me the value of teamwor
importantly, **I learned that broadly impactful science often involves the union of different**
expertise to produce work that is more than the sum of its parts.

Working on projects that could save lives was deeply rewarding. In one short year, I de
many technical skills and learned a lot about research and myself. Although I was exposed to
ideas and attitudes toward research—which made me a more open-minded problem solver—I
that I enjoyed physical science much more than life science and design and that **my passion is**
physics. This led me to join Prof. [redacted]'s group at [redacted], where I am working toward my
degree and PhD. Since starting graduate school, I have been a thriving and dynamic researcher in
intellectual environment despite the ongoing COVID-19 pandemic. My current research concent
near-field radiative heat transfer as part of a MURI program in collaboration with the [redacted]
[redacted], [redacted], [redacted], and [redacted]. I am investigating the near-field radiative heat transfer
Weyl semimetals (WSMs), a newly discovered class of materials that host a variety of
electromagnetic phenomena. We predicted that certain WSMs can intrinsically violate Kirchhoff'
radiation (the equality of spectral directional emissivity and absorptivity), which can enable dev
emit more radiation than they absorb and vice versa. I am the first author on a paper about this
recently accepted by *Physical Review B* as well as the third author on another paper published in
journal earlier this year. So far, **my work has been immersed in theory and computation, allow**
to cultivate my interest in this area that I first developed as a summer student at [redacted]. Ho
plan to introduce an experimental component into my work to continue building on the skills I
develop during my undergraduate studies.

Intellectual Merit Over the past six years, I have consistently demonstrated my ability to
research at a high level across multiple, interdisciplinary fields. **I have been the first author**
papers, a coauthor on four papers, and a co-inventor on four provisional patent applicatio
diversity of my research background is one of my strengths: I have learned to borrow ideas and
solving methods from areas of science and engineering outside my current research.
complemented by **my strong and diverse range of technical skills, which includes rapid prot**
mechanical testing, AFM, coding and numerical methods, and theory of transport phen
With the help of my supervisor and peers, I am quickly mastering electrodynamics, quantum me
and solid state physics, all of which have a still-growing body of work and remain highly rel
pioneering technologies, including my current research. **I have also demonstrated the ab**
effectively communicate my work through my papers and an award-winning poster. I
believe that my foundational knowledge and skills, my commitment to self-improvement,
resources and great mentorship available to me through [redacted] will enable me to become a global le

Broader Impacts My current research is in energy and materials physics. It has the potential t
the ways in which we manipulate light and heat, which could lead to novel devices that efficiently
and direct energy. **With rapidly increasing world energy consumption and the growing th**

climate change, novel materials such as WSMs and the devices they enable could play a sig
role in how we manage energy. However, this only speaks to my broader impacts as a researche
role as a teacher, I believe that I can make an even bigger impact on my community by sha
enthusiasm for science and engineering with others.

At [redacted], I will have the opportunity to teach and share my research with students
stage of education. In fact, I already started this past summer by teaching a thermal science co
students in grades 8–12 with my officemates through the [redacted]
goal was to introduce our students to thermal science and show them how it can be applied
problems such as climate change and water scarcity. More importantly, we wanted to show them
have the power to address these challenges using science and engineering as tools and encouraged
pursue a career in STEM. Despite the barriers put up by COVID-19, it was deeply rewarding to
with the students and the gratitude and resolve expressed by a few has made teaching this
highlight of my career so far. We plan to continue offering this course and update it every yea
look forward to becoming a teaching assistant for undergraduate and graduate level classes at [redacted]
excited for the opportunity to teach technical subjects with rich detail and history. In doing so, I
develop my teaching philosophy. On one hand, my goal is to **equip students with the skills t**
need to be successful scientists and engineers. On the other hand, I want to **motivate them a**
them the beauty of science and nuances we take for granted that drive my desire t
Ultimately, my teaching philosophy is simple: I want to get my students as excited about science a

Lastly, **I plan to become a mentor, which will allow me to work closely with in**
students and make a positive impact on their lives and careers. I have already made progres
this broader impact by mentoring a first-year graduate student in my department. I meet with
weekly basis to casually discuss courses, research, work-life balance, and her goals. During my
plan to engage undergraduate students, especially from groups historically underrepresented in
through the [redacted]. As someone who
significant portion of their undergraduate studies conducting research, I will use my research exp
to inform my supervision style and guide my students toward their goals. For example, wri
publishing a paper as an undergraduate was valuable experience for me, so I want to extend t
opportunity to my students. Mentorship will also give me the opportunity to **build a dive**
inclusive culture in my field by teaching my students respect, teamwork, and the value of d
in research. In this regard, I not only hope to set an example for my students, but also create a
lab culture during my PhD studies that I will carry with me throughout my career.

Future Goals My overarching goal in graduate school is to **become a better scientist and**
myself to become a versatile, flexible, and empowering supervisor that can advise studer
diverse interests and help them to achieve their personal and professional goals. As a pro
believe that a balanced skill set (in addition to expertise in my field) would allow me to reach
audience, be a great mentor for my students, and have the biggest impact on my community by be
to relate to multiple different perspectives on science. The first step toward achieving this g
follow through with my research plan, which I have designed to include a mix of theoret
experimental work and opportunities to develop new skills. I also plan to regularly publish and
my work at conferences, where I can exercise my communication skills and connect with the s
community. In parallel, I plan to teach at [redacted] and continue to participate in outreach programs
ESP to help to cultivate the next generation of budding scientists. By the time I am ready to gra
hope to have left a broad impact on my community through these experiences and be well posit
become a professor and global leader who can continue to advance our society.

"Improved STEM education and educator development at any level"

"development of a diverse, globally competitive STEM workforce"

Could have been strengthened by stating what the NSF award will allow them to do

Echoing program solicitation language