

Science Undergraduate Laboratory Internships (SULI)

Summer 2022 - Application for: Serenity May Engel

APPLICANT PROFILE

General Applicant Information

First Name: Serenity

Middle Name: May

Last Name: Engel

Previous Last Name(s):

Primary Email Address: serenity.engel@mines.sdsmt.edu

Alternate Email Address 1: serenitymengel@gmail.com

Alternate Email Address 2:

ORCID: [0000-0002-6700-7536](https://orcid.org/0000-0002-6700-7536)

Current Address

Primary Phone Number: 605-440-3091

Alternate Phone Number:

Citizenship/Languages/Eligibility Information

I will be 18 years of age or older by the time the internship begins: Yes

Are you a U.S. Citizen? Yes

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EDUCATIONAL BACKGROUND

Academic Information

Are you currently attending a community college or 2-year college?

No

Current academic status:

Junior

If you are selected as a participant in this DOE program, will you receive academic credit from your university/college for participating?

No

Undergraduate Institution Information

College/University Country: United States and U.S. Territories

College/University State/Province/Territory: South Dakota

College/University Name: South Dakota School of Mines and Technology

College/University Address: 501 E St. Joseph

College/University City: Rapid City

College/University Zip Code: 57701-3995

Expected/Declared Major: Physical Sciences - Physics

Expected Degree From This College/University: Bachelor's

Expected/Completed Graduation Date: May / 2023

Transcript: serenityengel-transcriptfall21.pdf

Does this institution provide grades? Yes

GPA Scale: 4.0

Total Attempted Credits: 102.00

Total Earned Credits: 94.00

Total Quality Points: 296.00

GPA: 3.15

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Science, Technology, Engineering and Mathematics (STEM) Courses

Course Title: Advanced Design Projects I

Course Number: 412

Enrollment Status: Recently Completed

Course Title: Advanced Design Projects II

Course Number: 414

Enrollment Status: Currently Enrolled

Course Title: Advanced Physics Laboratory

Course Number: 350

Enrollment Status: Recently Completed

Course Title: Atmospheric Science

Course Number: 201

Enrollment Status: Recently Completed

Course Title: Calculus I

Course Number: 123

Enrollment Status: Recently Completed

Course Title: Calculus II

Course Number: 125

Enrollment Status: Recently Completed

Course Title: Calculus III

Course Number: 225

Enrollment Status: Recently Completed

Course Title: Classical Mechnaics

Course Number: 451

Enrollment Status: Currently Enrolled

Course Title: College Algebra

Course Number: 102

Enrollment Status: Recently Completed

Course Title: Computer Science I/Lab

Course Number: 150/150L

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Enrollment Status:	Recently Completed
Course Title:	Condensed Matter Physics
Course Number:	439
Enrollment Status:	Currently Enrolled
Course Title:	Differential Equations
Course Number:	321
Enrollment Status:	Recently Completed
Course Title:	Electromagnetism
Course Number:	421
Enrollment Status:	Currently Enrolled
Course Title:	Experimental Physics Design I
Course Number:	312
Enrollment Status:	Recently Completed
Course Title:	Experimental Physics Design II
Course Number:	314
Enrollment Status:	Recently Completed
Course Title:	General Chemistry I/Lab
Course Number:	112/112L
Enrollment Status:	Recently Completed
Course Title:	Introduction to Modern Physics
Course Number:	331
Enrollment Status:	Recently Completed
Course Title:	Introduction to Probability and Statistics
Course Number:	381
Enrollment Status:	Currently Enrolled
Course Title:	Linear Algebra
Course Number:	315
Enrollment Status:	Recently Completed
Course Title:	Math Physics

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Course Number:	481
Enrollment Status:	Planning to Enroll
Course Title:	Nuclear and Particle Physics
Course Number:	433
Enrollment Status:	Planning to Enroll
Course Title:	Optics
Course Number:	361
Enrollment Status:	Planning to Enroll
Course Title:	Partial Differential Equations
Course Number:	432
Enrollment Status:	Recently Completed
Course Title:	Probability Theory and Statistics II
Course Number:	382
Enrollment Status:	Planning to Enroll
Course Title:	Programming Techniques
Course Number:	215
Enrollment Status:	Recently Completed
Course Title:	Quantum Mechanics
Course Number:	471
Enrollment Status:	Planning to Enroll
Course Title:	Statistical Physics
Course Number:	343
Enrollment Status:	Recently Completed
Course Title:	Technical (STEM) Communications I
Course Number:	279
Enrollment Status:	Recently Completed
Course Title:	Technical (STEM) Communications II
Course Number:	289
Enrollment Status:	Recently Completed

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Course Title:	Thermodynamics
Course Number:	341
Enrollment Status:	Recently Completed
Course Title:	Trigonometry
Course Number:	120
Enrollment Status:	Recently Completed
Course Title:	University Physics I
Course Number:	211
Enrollment Status:	Recently Completed
Course Title:	University Physics II/Lab
Course Number:	213/213L
Enrollment Status:	Recently Completed
Course Title:	Vibrations, Waves, & Optics
Course Number:	225
Enrollment Status:	Currently Enrolled

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Awards or Honors

Award Title: Honors & Awards Riter-Aldrich Technical Communications Award

Month & Year Received: April / 2021

Awarding Institution: South Dakota School of Mines and Technology

Award Title: Dean's List

Month & Year Received: May / 2020

Awarding Institution: South Dakota School of Mines and Technology

Award Title: High Plains Regional Science Fair Overall Winner

Month & Year Received: May / 2019

Awarding Institution: South Dakota School of Mines and Technology

Award Title: Intel International Science and Engineering Fair Finalist

Month & Year Received: May / 2019

Awarding Institution: The Society of Science and the Public

Award Title: Award for Outstanding Organization Leadership

Month & Year Received: March / 2021

Awarding Institution: South Dakota Board of Regents

Award Title: Award for Organizational Leadership

Month & Year Received: March / 2019

Awarding Institution: South Dakota Board of Regents

Award Title: Award for Academic Excellence

Month & Year Received: March / 2020

Awarding Institution: South Dakota Board of Regents

Award Title: South Dakota Regent Scholar

Month & Year Received: May / 2019

Awarding Institution: South Dakota Board of Regents

High School Graduation or GED

Date of High School Graduation or GED: May / 2019

Country: United States

City: Hot Springs

State/Province/Territory: SD

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WORK EXPERIENCE & SKILLS

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Work Experience	
Name of Place of Employment or Activity:	Research Assistant to Cabot-Ann Christofferson with LEGEND Experiment
Dates of Employment or Activity:	From 1/3/2022 To Present
Hours Per Week:	10.0
Primary Duties:	<ul style="list-style-type: none"> - Supporting a research team in the chemical recycling of metals for usage with the Majorana Demonstrator and the LEGEND experiment. - Electroforming ultra-pure copper for usage with the LEGEND experiment, of which Sanford Underground Research Facility is the only provider. - Setting up an extensive electrochemical system at the 4850 foot level underground at Sanford Underground Research Facility. - Accessing the underground lab space of Sanford Underground Research Facility and the Class-1,000 cleanroom for the Majorana Demonstrator on a weekly basis
Tasks Performed:	- Electroforming copper with purity better than 0.3 μBq Th or U per kg of copper for LEGEND-1000.
Name of Place of Employment or Activity:	American Physical Society (APS) Student Ambassador
Dates of Employment or Activity:	From 11/19/2021 To Present
Hours Per Week:	2.0
Primary Duties:	<ul style="list-style-type: none"> - Sharing APS resources at South Dakota Mines to provide students with valuable professional development opportunities. - Connecting with students who have specific questions about APS. - Promote opportunities to be actively involved in APS, especially by encouraging attendance at conferences, presenting research, and seeking out research job opportunities. - Foster a community of students within APS to understand problems that current physics students face and find ways to resolve those issues.
Tasks Performed:	<ul style="list-style-type: none"> - Arranging for travel and funding for undergraduate physics students attending South Dakota Mines to attend the 2022 Physics Convention in Washington D.C. - Speaking at the APS Congressional Visit Day at Capitol Hill, which is accompanied by hours of training on science policy so I can talk about my personal experiences as a first-generation bisexual woman in physics. - Engaging in the APS Annual Leadership Meeting to develop professional skills to help me complete my role as an ambassador and mentor.
Name of Place of Employment or Activity:	Sanford Underground Research Facility Intern
Dates of Employment or Activity:	From 5/17/2021 To 8/2/2021
Hours Per Week:	40.0
Primary Duties:	<ul style="list-style-type: none"> - Supporting the experimental facilities and groups (astrophysics, low-background counting, educational outreach) using the Sanford Underground Research Facility. - Understanding strict safety procedures to conduct oneself in an underground mine environment, especially through emergency prevention and by using proper personal protective equipment. - Understanding different cleanroom procedures in order to enter sensitive parts of the lab on a daily basis. - Attending "toolbox talks" to develop day-to-day plans, roles of each researcher, procedures being carried out, and potential hazards.
Tasks Performed:	<ul style="list-style-type: none"> - Authoring a poster that features research that I individually conduct using underground low-background Germanium detectors, which also features the research I complete on the surface with a campus Germanium detector. - Presenting the tasks that I complete over the 10-week internship period to Sanford Underground Research Facility staff and directors via PowerPoint. - Performing as one of the top three contributors to a self-pursued project dealing with fluid systems necessary for the completion of the LUX-ZEPLIN experiment. - Individually pursuing limited/emergency and overnight shifting of up to 14 hours with crews of only 6 staff members to ensure the success of the project, which needs to be tended to at all hours of the day to hit planned deadlines. - Completing tasks independently while in coordination with other researchers in separate drifts with radio

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	<p>communications to ensure safety and successful operations.</p> <ul style="list-style-type: none"> - Training other visiting researchers on a procedure to use a system so they could assist in opposite shifting. - Revising written procedures for clarity to ensure the safety of researchers and successful completion of tasks. - Checking P&IDs for complex systems of the LUX-ZEPLIN experiment. - Presenting to students involved in the American Indian Services Pre-Freshman Engineering Program to encourage seeking out physics as a profession with first-hand accounts of physics research and education.
Name of Place of Employment or Activity:	Resident Advisor
Dates of Employment or Activity:	From 10/12/2020 To Present
Hours Per Week:	10.0
Primary Duties:	<ul style="list-style-type: none"> - Assisting in the management of crises and reporting emergencies. - Serving as a resource and referral person in the academic, personal, and social advising of students. - Developing and hosting hall activities to promote a sense of community within the residence hall and university. - Working with advisors, faculty, or other staff to assist students with personal concerns, academic deficiencies, or academic difficulties. - Being on-duty and completing rounds in the residence hall for a designated period of time overnight and over weekends. - File detailed reports of work orders and of any major incidents within the residence halls.
Tasks Performed:	<ul style="list-style-type: none"> - Training in QPR (Question, Persuade, Refer) Institute Suicide Prevention, conflict management, and community building every semester to perform primary duties. - Arranging major community service contributions with local food banks, the campus food drive, and campus facilities for residents with a specific interest in volunteering for the campus and the community. - Creating material and events to spread messages corresponding to self-improvement, healthy habits, and professional development campaigns. - Collaborating with other Resident Advisors to create campus-wide events to promote student belonging on campus.
Name of Place of Employment or Activity:	Women in Science and Engineering Peer Mentor
Dates of Employment or Activity:	From 7/20/2020 To Present
Hours Per Week:	5.0
Primary Duties:	<ul style="list-style-type: none"> - Working both independently and as part of a team with fellow student peer mentors to engage students in the campus community and events. - Educating new students about various resources and student services available at South Dakota Mines. - Serving as a positive academic and social role model. - Discussing any mentee concerns with academic advisors, the program director, or other faculty members as necessary.
Tasks Performed:	<ul style="list-style-type: none"> - Proposing funding from the physics departments and student organizations in order to aid mentees to attend science-related talks and colloquia, especially promoting the Conference for Undergraduate Women in Physics. - Planning "WiSE Wednesday" events to connect with the other women on campus and share successful strategies to navigate male-dominated fields.
Name of Place of Employment or Activity:	Society of Physics Students Chapter President
Dates of Employment or Activity:	From 5/11/2020 To Present
Hours Per Week:	7.0
Primary Duties:	<ul style="list-style-type: none"> - Leading various projects and supporting campus community-initiated committees. - Directing weekly meetings. - Developing long-range, strategic planning for events throughout the year through self-made agendas. - Continually planning ways to increase the organization's engagement. - Creating and maintaining relationships with students, faculty, other departments, and other leading community members.
Tasks Performed:	<ul style="list-style-type: none"> - Lead a committee to assemble both a theremin and a Cosmic Watch muon counter for physics outreach demonstrations, which required soldering tools, Arduino, and some software skills.

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	<ul style="list-style-type: none"> - Designing and assembling a walking arm trebuchet for an annual trebuchet competition, using saws, drills, and various power tools. - Exhibiting the appeal of physics through interactive demonstrations, as a part of a panel, and through PowerPoint presentations for various K-12 schools and incoming university students, using adaptive audience tailoring and communication skills. - Formally proposing an annual budget and presenting the said budget to the South Dakota Mines Student Senate Finance Committee. - Arranging for travel and funding to attend the Society of Physics Students regional "Zone" meetings.
Name of Place of Employment or Activity:	Research Assistant to Dr. Juergen Reichenbacher
Dates of Employment or Activity:	From 2/18/2019 To Present
Hours Per Week:	10.0
Primary Duties:	<ul style="list-style-type: none"> - Programming macros for Dr. Juergen Reichenbacher, who has been dealing with personal matters and was unable to provide me a letter of recommendation, using ROOT (Object-Oriented Program and Library for Particle Physics Data Analysis). - Creating histograms based on CHN data files from the SD Mines "Rabbit" Germanium detector. - Analyzing large sets of data spanning over multiple years. - Calculated efficiencies, backgrounds, compositions, and levels of radiation for a vast array of materials. - Using specific filetypes, such as .chn, .dat, .csv, and .tdb. - Collaborating with researchers within the Davis Campus/Black Hills Underground Campus at Sanford Underground Research Facility to verify records. - Attending DUNE/LBNF Backgrounds Task Force meetings through Fermilab to understand results relevant to the project from other collaborators. - Using XRF and XRD data to understand compositions of environmental samples to be used in simulations.
Tasks Performed:	<ul style="list-style-type: none"> - Deciding on which materials from local contractors would be most suitable for usage in the Deep Underground Neutrino Experiment (DUNE) by studying gamma radiation levels through histograms. - Collecting samples from the excavation sites at Sanford Underground Research Facility to understand the environment around where the DUNE/LBNF experiment will take place. - Creating large tables of data in Microsoft Excel to understand correlations in data, especially looking into the effects of temperature and time on readings. - Programming a Toy Monte Carlo sensitivity study to further understand the precision of the SD Mines "Rabbit" Germanium detector. - Presenting in the SD Mines Research Symposium.
Professional Associations	
Are you a member of any professional organizations?	Yes
Professional associations you are affiliated with:	American Physical Society (APS), Sigma Pi Sigma, Society of Physics Students
Computer Skills	
Computer related skills:	<p>Software</p> <ul style="list-style-type: none"> • ROOT for CERN • Microsoft Excel • PeakEasy • LaTeX • GitLab • Maple • PASCO Capstone • Familiar with Windows Powershell <p>Programming Languages</p> <ul style="list-style-type: none"> • C++ • C • Familiar with Python

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Laboratory/Technical Skills

Experience with advanced laboratory techniques or equipment:

Trained in:

- Electrical Safety for Non-Qualified Electrical Workers (through Lawrence Berkeley National Lab)
- Cryogen Safety (through Lawrence Berkeley National Laboratory)
- Pressure Safety Awareness (through Lawrence Berkeley National Laboratory)
- Compressed Gas Cylinder Safety (through Lawrence Berkeley National Laboratory)
- Chemical Hygiene and Safety (through Lawrence Berkeley National Laboratory)
- High Voltage Safety (through Lawrence Berkeley National Laboratory)
- Lockout/Tagout Awareness (through Lawrence Berkeley National Laboratory)
- Radiological Worker I Training (through Lawrence Berkeley National Laboratory)
- Underground/Mine Access (through Sanford Underground Research Facility)
- Oxygen Deficiency Hazard Training (through Sanford Underground Research Facility)
- Fall Prevention and Protection Training (through Sanford Underground Research Facility)
- Work Planning and Control (through Sanford Underground Research Facility)
- Fatigue Management (through Sanford Underground Research Facility)
- Incident Reporting and Notification (through Sanford Underground Research Facility)
- General First Aid (through Sanford Underground Research Facility)
- Bloodborne Pathogens (through Sanford Underground Research Facility)
- Ergonomics and Stretching Training (through Sanford Underground Research Facility)
- Fire Extinguisher Training (through Sanford Underground Research Facility)
- General Lab Safety (through SD School of Mines and Technology and Sanford Underground Research Facility)

Experience:

- Passivation
- Piping and Instrument Diagrams (P&ID)
- Assaying
- Creating Histograms
- Measuring
- Computerized Data Acquisition
- Computerized Data Processing
- Germanium Detector Building & Sample Loading
- Deionizing Water

Equipment Used:

- Self Contained Self Rescuer/Oxy-K
- Multimeters
- Germanium Detectors
- NaI Detector
- Multichannel Analyzer
- Van de Graaff Generator
- Hall Effect Probe
- Photoelectric Effect Apparatus
- Double-Slit Interface
- Grating Spectrophotometer
- Muon Detectors

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PROGRAM INFORMATION

Eligibility

Have you previously participated in 2
SULI appointments? No

Previous DOE Internship/Fellowship Experience

Have you ever had an
internship/fellowship with the
Department of Energy or any of its
National Laboratories? No

Availability

What is the earliest date you can
begin your internship? 5/23/2022

When do you need to complete your
internship? 8/10/2022

First Choice Host DOE Laboratory

DOE Laboratory: Brookhaven National Laboratory (BNL)

First Choice Research Area: Accelerator Physics/Science

Second Choice Research Area: High Energy Physics

Third Choice Research Area: Materials Sciences

Second Choice Host DOE Laboratory

DOE Laboratory: Thomas Jefferson National Accelerator Facility (TJNAF)

First Choice Research Area: Accelerator Physics/Science

Second Choice Research Area: High Energy Physics

Third Choice Research Area: Nuclear Physics

Relatives Employed at DOE Laboratories

Are you a relative of an employee at
the proposed host DOE laboratories? No

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ESSAYS

Research Experience:	<p>While my experiences in my undergraduate career have been diverse, the most important (and most fun) component of my education has been the research I've been involved with.</p> <p>I am very fortunate to say that I worked as an intern at the Sanford Underground Research Facility (SURF) with the LUX-ZEPLIN (LZ) experiment. To premise, the information about my duties with LZ is still proprietary, so I want to respect my collaborators. With my specific project, I was within the top 3 contributors at SURF and committed to shifting during the day and overnight lasting up to 14 hours. I was also part of an emergency "skeleton crew" of 6 to tend to the experiment when primary access to the mine was unavailable. It was necessary to be extremely attentive while I worked alone on an individual fluid system, which needed to be coordinated with a separate fluid system at the same time in a different area. I helped the team to achieve the goal deadlines and helped to train opposite shifters of the process, also contributing to the procedure for system usage. This project is very important to the LZ's completion and was not something that I was assigned, but rather something I actively pursued myself.</p> <p>I work on my campus with Germanium detectors, where I am responsible for assaying materials, many for usage with the Deep Underground Neutrino Experiment (DUNE). After collecting samples from various contractors, I take the data from the assays of the materials and put them into ROOT-created histograms for analysis, looking at the gamma radiation levels that would interfere with DUNE as noise. I work fairly independently on this project, as I complete all analysis and present it to my advisor. I also spend time studying gain change correlation in the "Rabbit" BEGe detector and will begin producing a Toy Monte Carlo simulation to further the detector's performance this semester. I've also had the opportunity to reassemble a Ge detector underground at SURF, which has amplified my knowledge of their functionality.</p> <p>Recently, I've joined a research team that will work with ORNL on the LEGEND experiments. My role is to support the research team in the chemical recycling of metals. I will explore the process of electroforming ultra-pure copper and setting up an extensive electrochemical system at SURF.</p> <p>Though I have some research experience, I recognize that I need solid hands-on experience in experimental physics. I know that participating in an REU will provide that experience.</p>
Research Interests:	<p>I am forever grateful for my university's Women in Science and Engineering (WiSE) program, where I was able to connect with an undergraduate woman mentor from my major as a freshman, which was helpful in the unfamiliar environment that is a college campus. My mentor helped me to attend department events and get involved. The most important step of this developmental part of my life was when she asked me to attend her colloquium arranged by our physics department. Her colloquium was about her incredible experience as a SULI researcher at BNL, and since then, I've been inspired to follow in her steps and pursue my passion for physics research. Now 3 years later, I have experience and qualifications of my own, and I even took up her mantle as a WiSE mentor. I developed my own personal interests in physics, and although they differ from what my mentor did during her SULI, I found that national labs, especially BNL, were the perfect place to pursue these goals for me as well. I really admire the vast array of research going on across these major laboratories and dream to be a part of it.</p> <p>The National Synchrotron Light Source at BNL is the perfect match for my research interests and skillset. I've been studying the world through gamma-ray spectroscopy for 2 years now. I've analyzed how different conditions can cause unique results in assays, such as looking for how temperature and time can affect noise levels, how significantly different low background counting can be when compared to a surface Germanium detector, or even how different types of detectors can measure different things. The NSLS is something familiar, but completely new. As far as I understand, NSLS can analyze materials kind of like I've done in the past, but through beamlines, which is just exhilarating. I've always been excited about particle accelerators and I'm just aching for a chance to start working with one, especially if it's relevant to what I already do. This feels like the next step to take what I've learned and to apply it to something I can't wait to know more about. (It's also interesting that Ray Davis Jr. from BNL conducted his Nobel-winning research at SURF, a place I'm very familiar with.)</p> <p>I also chose TJNAF for accelerator research. TJNAF is a great place to learn about many operations related to particle accelerators. Particle physics is also one of my interests, so I'd love to see quarks from a new perspective by working on CEBAF to get a start in this exciting field of science.</p>
Personal Experience:	<p>Although all of the physicists I've met adore what they do for work, through long hours and so much focus on tiny details, it can be easy to get lost in the monotony. However, my positivity and enthusiasm are unmatched. I love to look at the bigger picture. I'll ask questions about everything. Because of these qualities, I have no trouble motivating myself and others. As demonstrated by my current experience, I have a voracious appetite to learn and I'm determined to try everything I can simply because I love it.</p> <p>I'm really proud of my dedication to this subject, especially considering my background. I grew up in tiny towns all across South Dakota and graduated with a class of around 60 people. I've always had an interest in science, from when "Santa Claus" brought me my first telescope, through five years of science fairs, to where I am now- I've always had the dream to do this professionally. The high school I attended didn't prepare students for higher education, and especially not for a four-year university in a STEM field and beyond. My high school didn't offer higher-level mathematics, so taking a physics class was entirely impossible for me.</p> <p>It took a lot of work to self-study physics and pursue this passion for it independently. It took even more courage to commit to choosing it as a major as a first-generational college student when all I had were some Youtube videos and books as a guide.</p>

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This proves that I'm highly motivated and I'm eager to take on challenges to achieve my goals.

I'm very grateful to say that it's all worked out so far and I am certain I'm doing the right thing. That's the best feeling. I know many in this community can relate to this and I hope that I'm able to remind them that what we get to do is just incredible.

I also work really well with other people in general, seeing as my experience extends to much more than just physics research. Inclusion means a lot to me and I work really hard to make sure everyone has the tools they need to succeed. I am a member of a few underrepresented groups especially in the field of physics, so I want to do what I can to be a positive role model and form connections with people like me and give that perspective a voice, which I do through APS by speaking to Congress about science issues.

Overall, I can provide to the SULI program a unique and refreshed perspective of physics itself!

Professional Goals:

To begin, I need to finish the rest of my undergraduate education in physics. I'm planning to graduate on time in May 2023 with as much research experience as I can get. Following that, I want to be admitted into a graduate school to pursue a Ph.D. in physics, working towards a career in experimental physics in the future. For a permanent career, I could see myself pursuing either accelerator physics, due to its many applications, or fusion research, since renewable energy is as important as ever.

It's exciting that the SULI program has a strong focus on hands-on experience and continued learning opportunities. One day, I'd love to play a more permanent role within a national lab. I'm excited about the prospect of working with different teams all united by a similar goal. This seems like a natural fit for me, since I can be self-motivated to complete my own work, but I also adore a team dynamic.

In addition, I am really excited about the prospect of creating a presentation for the work that I complete. I feel as though I don't have enough practice in those skills and I understand that being able to communicate science across a wide spectrum of audiences is highly critical. My goal is to develop my presentation skills by creating a poster and then taking my work with me to hopefully present it again at my home institution or at conferences I plan on attending (Physics Convention 2022, Conference for Undergraduate Women in Physics, Physics Departmental Colloquium, etc.). Not only does the SULI program provide opportunities for learning and experience in research, but they also emphasize the importance of technical communication skills, which I also am very enthusiastic to learn more about.

Though maybe a little unconventional, participation in a SULI program would also give me an idea of what it's like to leave the state I was born in. I've always lived and worked in South Dakota and I know that seeking out opportunities in new areas brings new knowledge, ideas, connections, and culture. I would love to experience living and working somewhere new so that I have a better idea of what it will be like when I head off to graduate school, which I plan to attend somewhere out of my home state.

Lastly, I think SULI would help me to expand my professional network. I receive so much useful advice from the physics faculty, researchers, and other students I know. I love to learn from these people and use what they teach me to successfully navigate my career in physics.

RECOMMENDATIONS

Recommendation 1:

First Name: Jaret
Last Name: Heise
Email: jheise@sanfordlab.org
Status: Received 1/10/2022

Recommendation 2:


First Name: Juergen
Last Name: Reichenbacher
Email: juergen.reichenbacher@sdsmt.edu
Status: Not Received

Recommendation 3:

First Name: Richard
Last Name: Schnee
Email: richard.schnee@sdsmt.edu
Status: Received 1/12/2022

Academic History - Courses and Grades

Serenity M. Engel
Dec 23, 2021 01:59 pm

 **This is not a transcript.** Courses that are in progress may also appear on this document.

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ATTENTION STUDENTS:

- **Enrollment Verification** link can be found on your Student Profile page, left column under your picture. Enrollment Verifications are available approximately 2-3 weeks after the start of each semester and are updated 4 additional times each semester.
- **Official Transcripts** can be ordered by selecting the blue text [|Request Printed Transcript|](#) at the bottom of this page

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Transcript Data

***Transcript type:WEB Self Service Unofficial is NOT Official ***

INSTITUTION CREDIT [-Top-](#)

Term: 2017 Fall

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
HIST	151	BHSU Black Hills State Univ	UG	United States History I	A	3.000	12.000	
PSYC	101	BHSU Black Hills State Univ	UG	General Psychology	A	3.000	12.000	

Term Totals (Undergraduate)

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	6.000	6.000	6.000	6.000	24.000	4.000
Cumulative:	6.000	6.000	6.000	6.000	24.000	4.000

Unofficial Transcript

Term: 2018 Spring

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
HIST	152	BHSU Black Hills State Univ	UG	United States History II	B	3.000	9.000	
POLS	100	BHSU Black Hills	UG	American Government	A	3.000	12.000	

State Univ

Term Totals (Undergraduate)

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	6.000	6.000	6.000	6.000	21.000	3.500
Cumulative:	12.000	12.000	12.000	12.000	45.000	3.750

Unofficial Transcript

Term: 2018 Summer

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ENGL	101	SDSU South Dakota State Univ	UG	Composition I	A	3.000	12.000	
MATH	102	BHSU Black Hills State Univ	UG	College Algebra	A	3.000	12.000	
SPCM	101	SDSU South Dakota State Univ	UG	Fundamentals of Speech	A	3.000	12.000	

Term Totals (Undergraduate)

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	9.000	9.000	9.000	9.000	36.000	4.000
Cumulative:	21.000	21.000	21.000	21.000	81.000	3.857

Unofficial Transcript

Term: 2018 Fall

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ENGL	210	BHSU Black Hills State Univ	UG	Introduction to Literature	A	3.000	12.000	
MATH	120	BHSU Black Hills State Univ	UG	Trigonometry	C	3.000	6.000	

Term Totals (Undergraduate)

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	6.000	6.000	6.000	6.000	18.000	3.000
Cumulative:	27.000	27.000	27.000	27.000	99.000	3.667

Unofficial Transcript

Term: 2019 Spring

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ART	111	SDSU South Dakota State Univ	UG	Drawing I	A	3.000	12.000	
CSC	150	DSU Dakota State University	UG	Computer Science I	A	3.000	12.000	

Term Totals (Undergraduate)

Attempt	Passed	Earned	GPA	Quality	GPA
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	Hours	Hours	Hours	Hours	Points	
Current Term:	6.000	6.000	6.000	6.000	24.000	4.000
Cumulative:	33.000	33.000	33.000	33.000	123.000	3.727

Unofficial Transcript

Term: 2019 Fall

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
AES	201	SDSMT School of Mines	SD UG	Intro to Atmospheric Science	B	3.000	9.000	
CHEM	112	SDSMT School of Mines	SD UG	General Chemistry I	C	3.000	6.000	
CHEM	112L	SDSMT School of Mines	SD UG	General Chemistry I Lab	B	1.000	3.000	
ENGL	279	SDSMT School of Mines	SD UG	Technical Communications I	A	3.000	12.000	
MATH	100	SDSMT School of Mines	SD UG	Math Recitation	LR	0.000	0.000	I
MATH	123	SDSMT School of Mines	SD UG	Calculus I	D	4.000	0.000	E

Term Totals (Undergraduate)						
	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	14.000	10.000	10.000	10.000	30.000	3.000
Cumulative:	47.000	43.000	43.000	43.000	153.000	3.558

Unofficial Transcript

Term: 2020 Spring

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ENGL	289	SDSMT School of Mines	SD UG	Technical Communications II	A	3.000	12.000	
MATH	123	SDSU South Dakota State Univ	UG	Calculus I	S	4.000	0.000	I
PHYS	211	SDSMT School of Mines	SD UG	University Physics I	A	3.000	12.000	
POLS	165	SDSMT School of Mines	SD UG	Political Ideologies	A	3.000	12.000	

Term Totals (Undergraduate)						
	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	13.000	13.000	13.000	9.000	36.000	4.000
Cumulative:	60.000	56.000	56.000	52.000	189.000	3.635

Unofficial Transcript

Term: 2020 Fall

Term Comments: Completion of WICHE Passport

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
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CSC	215	SDSMT SD UG School of Mines	Programming Techniques	C	4.000	8.000
MATH	100	SDSMT SD UG School of Mines	Math Recitation	LR	0.000	0.000 I
MATH	125	SDSMT SD UG School of Mines	Calculus II	C	4.000	8.000
PHYS	213	SDSMT SD UG School of Mines	University Physics II	B	3.000	9.000
PHYS	213L	SDSMT SD UG School of Mines	University Physics II Lab	A	1.000	4.000
PHYS	312	SDSMT SD UG School of Mines	Experimental Physics Design I	A	2.000	8.000

Term Totals (Undergraduate)						
	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	14.000	14.000	14.000	14.000	37.000	2.643
Cumulative:	74.000	70.000	70.000	66.000	226.000	3.424

Unofficial Transcript

Term: 2021 Spring

Subject	Course	Campus	Level	Title			Grade	Credit Hours	Quality Points	R
MATH	225	SDSMT School of Mines	SD UG	Calculus III			D	4.000	4.000	
MATH	321	SDSMT School of Mines	SD UG	Differential Equations			B	3.000	9.000	
PHYS	314	SDSMT School of Mines	SD UG	Experimental Physics Design II			A	2.000	8.000	
PHYS	350	SDSMT School of Mines	SD UG	Advanced Physics Laboratory			A	3.000	12.000	
Term Totals (Undergraduate)										
				Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA	
Current Term:				12.000	12.000	12.000	12.000	33.000	2.750	
Cumulative:				86.000	82.000	82.000	78.000	259.000	3.321	

Unofficial Transcript

Term: 2021 Fall

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
MATH	315	SDSMT SD UG School of Mines		Linear Algebra	F	3.000	0.000	
MATH	432	SDSMT SD UG School of Mines		Partial Differential Equations	C	3.000	6.000	
PHYS	331	SDSMT SD UG School of Mines		Introduction to Modern Physics	B	3.000	9.000	
PHYS	341	SDSMT SD UG School of Mines		Thermodynamics	C	2.000	4.000	
PHYS	343	SDSMT SD UG School of		Statistical Physics	B	2.000	6.000	

		Mines					
PHYS	412	SDSMT SD UG School of Mines	Advanced Design Projects I	A	3.000	12.000	
Term Totals (Undergraduate)							
			Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points
Current Term:			16.000	13.000	13.000	16.000	2.313
Cumulative:			102.000	95.000	95.000	94.000	3.149

Unofficial Transcript

TRANSCRIPT TOTALS (UNDERGRADUATE) -Top-							
			Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points
Total Transfer:			0.000	0.000	0.000	0.000	0.000
Overall:			102.000	95.000	95.000	94.000	3.149

Unofficial Transcript

COURSES IN PROGRESS -Top-							
Term: 2022 Spring							
Subject	Course	Campus	Level	Title	Credit Hours		
PHYS	225	SDSMT SD UG School of Mines		Vibrations, Waves, and Optics	3.000		
PHYS	414	SDSMT SD UG School of Mines		Advanced Design Projects II	4.000		
PHYS	421	SDSMT SD UG School of Mines		Electromagnetism	4.000		
PHYS	439	SDSMT SD UG School of Mines		Condensed Matter Physics	4.000		

Unofficial Transcript

Term: 2022 Fall							
Subject	Course	Campus	Level	Title	Credit Hours		
MATH	381	SDSMT SD UG School of Mines		Introduction to Probability and Statistics	3.000		
PHYS	451	SDSMT SD UG School of Mines		Classical Mechanics	4.000		

Unofficial Transcript

SULI PROGRAM APPLICATION RECOMMENDATION FOR SERENITY MAY ENGEL

Recommender Contact Information

- **First Name:** Jaret
- **Last Name:** Heise
- **Title:** Science Director
- **Department:** Science
- **Institution/Organization:** Sanford Underground Research Facility
- **Telephone:** 605-722-8650
- **Email:** jheise@sanfordlab.org

Applicant Information

Association

Describe your relationship to the applicant, including how long you've known the applicant, where, and in what capacity.

It is with great pleasure that I highly recommend Serenity Engel for the DOE Office of Science Undergraduate Laboratory Internships (SULI) program. During the period May – July 2021, Serenity completed a Science internship at the Sanford Underground Research Facility (SURF) in Lead, SD, where, as Science Director, I supervised her work.

Applicant Comments

Please provide substantive comments about the applicant's education, training, aptitude, or promise relevant to the SULI program. Include any relevant additional detail or perspective regarding the applicant's research experience or equivalent experience on complex projects, including the level of independence or other factors that would contribute to the applicant's ability to make an excellent contribution to the SULI program.

Serenity was the top candidate in a field of twenty science applicants, and she is one of the strongest students we have had in the program since it began (top ~25% all time).

One of our goals for the Science intern program is to help the students develop additional skills. To that end, science interns worked on an introduction to programming with Python as well as compiling and analyzing environmental data. Serenity was a quick learner and her self-motivation allowed a strong degree of independence. During her time at the Laboratory, Serenity's initiative and willingness to take on a variety of tasks allowed her to make strong contributions in a number of areas. At the Davis Campus laboratory, which is 4850 feet below surface, Serenity worked alongside physics researchers from all over the world mainly on the LZ[1] dark matter experiment, during which time she gained expertise operating the water purification system for the main background shield.

Serenity was the most enthusiastic interns we've ever had in the program, both for performing the science as well as a passion for communicating the science. In addition to technical assistance with the LZ experiment mentioned above, a portion of Serenity's summer project was to develop a scientific poster on a topic of her choosing. Serenity chose radioactive background and assays that showcased efforts as SURF as well as work she was introduced to at SD Mines where she is working on her degree. The SURF Communications team, in particular, was very impressed! Further evidence of Serenity's drive includes participation in the Society of Physics Students (President) as well as various activities associated with the American Physical Society.

While SURF is a national facility in its own right, I believe Serenity's perspective would benefit from immersion in programs associated with one of the larger U.S. national laboratories outside of South Dakota.

In summary, I highly recommend Serenity for your consideration. During her short time at SURF, she demonstrated many qualities that I believe qualify her to both appreciate and benefit from the DOE SULI program. I hope that SURF continues to attract strong interns like Serenity in the future, and I fully expect that Serenity will succeed in her next endeavors and in her professional career that follows.

[1] The LUX-ZEPLIN collaboration is searching for dark matter that is thought to pervade our universe.

Applicant Rating

In comparison to other undergraduate students, please rate the applicant relative to his/her peers on the following qualifications:

	Do Not Know	Below Average	Average	Above Average	Superior
Analytical and Mathematical				X	
Experimental Research				X	
Overall Academic				X	
Initiative and Self Reliance					X
Motivation toward Scientific Career					X
Originality of Thought				X	
Emotional Maturity				X	
Ability to Work with Others					X
Potential for Leadership					X
Oral Communication Skills					X
Written Communication Skills					X

SULI PROGRAM APPLICATION RECOMMENDATION FOR SERENITY MAY ENGEL

Recommender Contact Information

- **First Name:** Richard
- **Last Name:** Schnee
- **Title:** Professor and Head
- **Department:** Physics
- **Institution/Organization:** SDSM&T
- **Telephone:** 605-394-5206
- **Email:** richard.schnee@sdsmt.edu

Applicant Information

Association

Describe your relationship to the applicant, including how long you've known the applicant, where, and in what capacity.

I first met Ms. Engel in 2019 when she was a high school senior on her visit to South Dakota Mines as a prospective. During the lab tour, she asked excellent questions and showed great interest in the research work that we were doing. I was aware that she had won the Great Plains Science Fair and was impressed with her immediately. As a student at Mines, Serenity has interacted with me often at events sponsored by the Society of Physics Students or other department functions. She has actively participated in our three recent faculty hires by attending teaching demonstrations and meeting with candidates, and she regularly attends department colloquia. In Spring 2020, when we asked students to record videos describing what they liked about Mines or the Society of Physics students for remote recruiting, Serenity recorded testimonials that were truly inspiring. This past spring, she was elected president of our Society of Physics Students, which has won national awards each of the past five years. This academic year, she is serving as the peer mentor for our female first-year physics majors.

I have not worked with Serenity on research, but I am aware second-hand that she has done very well, having heard many compliments about her from her research advisor Dr. Juergen Reichenbacher. Unfortunately, Dr. Reichenbacher has been traveling to Germany and apparently has been unable to write this letter, which I am confident would be far more positive than I am able to write (especially given the short time I have to write it).

Applicant Comments

Please provide substantive comments about the applicant's education, training, aptitude, or promise relevant to the SULI program. Include any relevant additional detail or perspective regarding the applicant's research experience or equivalent experience on complex projects, including the level of independence or other factors that would contribute to the applicant's ability to make an excellent contribution to the SULI program.

Serenity Engel has been working with Dr. Reichenbacher on radioactive assays for the DUNE project. Dr. Reichenbacher has high standards, but she has been earning A's in her research with him, so I am confident she is doing a very strong job. Furthermore, Serenity's infectious passion for physics, initiative to help others, and good organization skills will make her an ideal student in any program she works. Finally, I comment that I received specific praise from a collaborator on the job Serenity did with the filling of the outer detector for the LZ experiment.

Applicant Rating

In comparison to other undergraduate students, please rate the applicant relative to his/her peers on the following qualifications:

	Do Not Know	Below Average	Average	Above Average	Superior
Analytical and Mathematical				X	
Experimental Research				X	
Overall Academic				X	
Initiative and Self Reliance				X	
Motivation toward Scientific Career					X
Originality of Thought				X	
Emotional Maturity				X	
Ability to Work with Others					X
Potential for Leadership					X
Oral Communication Skills					X
Written Communication Skills				X	