Education Committee Report

Mary Kidd
With contributions from Brianna Mount, the 2023 Undergraduate Research Students, and everyone here who filled out the survey

Education Committee Activities

Two major efforts:

- STEM Undergraduate Program from Underrepresented Populations and High School Teachers
- Undergraduate Summer Research Program

Other efforts:

- Graduate student international research experience
- Development and mentoring of young scientists

STEM Student Trip to UK

STEM student trip to the UK

- 4 NSF/PIRE-funded students toured the UK for two weeks, travelling to different institutions along the way, with Boulby Underground Lab the main highlight of the trip
- 2 chaperones: Brianna Mount and Urla Marcus (Director, BHSU Center for American Indian Studies) chaperoned the trip
- There was also a "bonus" student: Urla's daughter, who also happened to be an exercise science student. She was not funded by the PIRE program, but participated in all the tours.
- The 4 NSF/PIRE-funded students will also participate in three weeks of research this summer in the US

Edinburgh/Scotland

- Tours/Talks
  - Highlands Wildlife Center guided tour
  - University of Edinburgh (UE) Anatomy Museum tour
  - Edinburgh Royal Observatory tour
  - Glaciology talk
  - Biochar facility tour
  - UE Center for Science of Extreme Conditions

Boulby Underground Lab

- Dinner with Boulby scientists and students
- Tour underground

UCL/Oxford

- UCL
  - HPGe lab and neutrinoless double beta decay discussion
  - 12pm-1pm: Lunch with UCL post-docs and students
  - Quantum sensors lab tour and search for exotic dark matter
  - Proton beam therapy lab and cancer treatment using high energy physics
- Oxford: Lunch and tour with LZ faculty and students

Sight-seeing and Cultural Activities

	Major	Institution	Gender	Race
Student 1	Physics	Black Hills State University	F	NA
Student 2	Physics	Black Hills State University	F	W
Student 3	Physics	Oglala Lakota College	M	NA
Student 4	Exercise Science	Black Hills State University	M	NA
"Bonus" student	Exercise Science	Grand Canyon College	F	NA

Student Demographics

Education Committee Activities

Two major efforts:

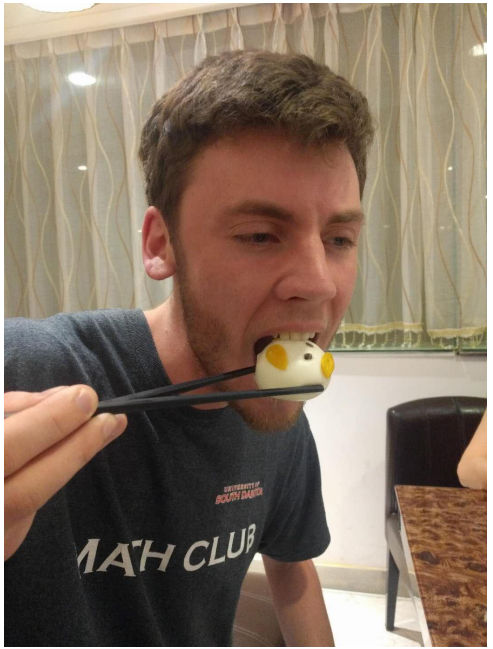
- STEM Undergraduate Program from Underrepresented Populations and High School Teachers
- Undergraduate Summer Research Program

Other efforts:

- Graduate student international research experience
- Development and mentoring of young scientists

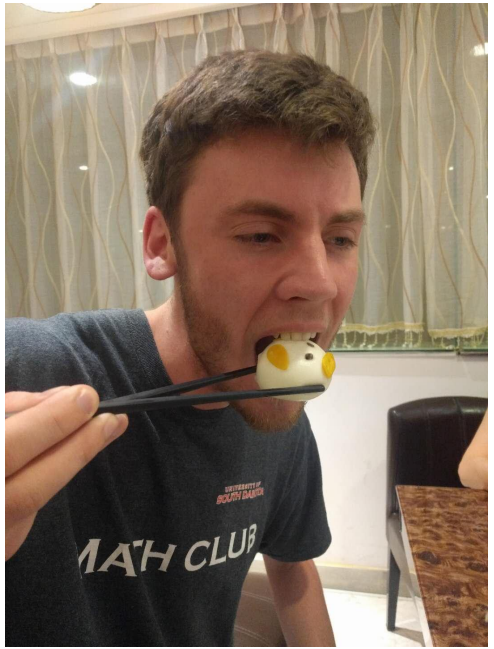
A retrospective

2018 - China



A retrospective

2018 - China

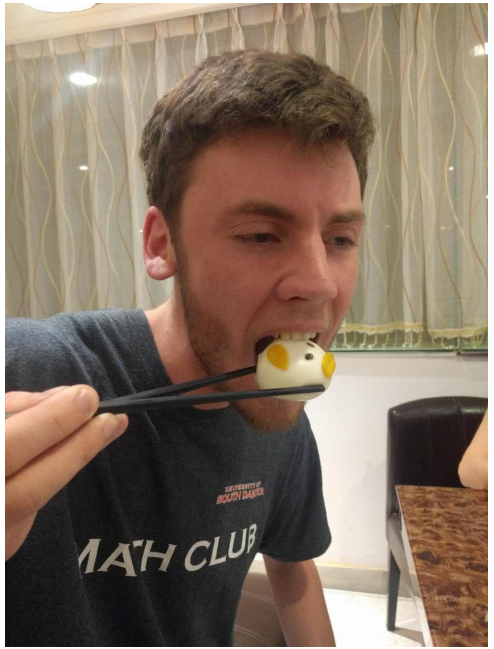


Kyler Kooi
Graduate Student at USD

Di'Arra Mostella: working in industry
Alya Sharbaugh: just graduated with BS in physics with aspirations to graduate school

A retrospective

2018 - China

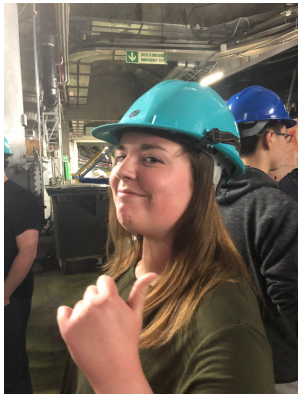


Omar Apke: Masters Student at GA Tech in Machine Learning

Corey Pahel-Short: Portfolio Analyst at NC's Electric Cooperatives
Alex Kirkvold: Technical writer at Medtronic

A retrospective

2019 - Munich



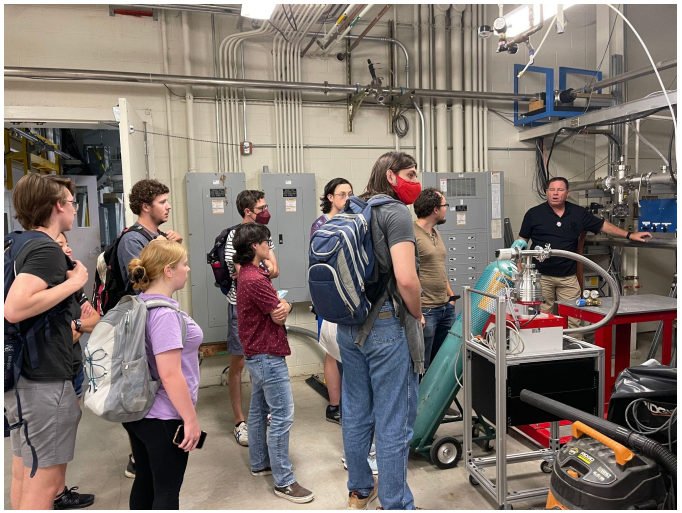
Ryan Albosta - graduate student in physics at UW-Madison
Trevor Edwards - student researcher at LANL
Lizzy Zink - Engineering trainer at B&R Industrial Automation
Zac LaPlant - System Admin at Averitt Express
Thomas Marshall - graduate student at UCLA
Giovani Leone - graduate student at University of Chicago

A retrospective

2022 - US/Canada

Some familiar faces here now!

- Andrew Mattson
- Abbie Song Woodard
- Sedonah Franzen



Luke Parsons and Abbie Song Woodard gave talks in the UG research session at APS April Meeting

Kevin Tanner is a summer research student at LANL this summer.

Saturday, April 15, 2023 4:09PM - 4:21PM	D16.00003: Data Analysis of Neutron Capture on 134Xe Luke Parsons, Mary F Kidd, Werner Tornow, Sean W Finch
Saturday, April 15, 2023 4:21PM - 4:33PM	D16.00004: Development of Germanium Detectors for Rare Event Physics Searches AbbieMarie S Woodard

2023 Summer Undergraduate Research Program

Caleb Eldridge

Tennessee Technological University

- Simulating collective flavor conversions of neutrinos at Academia Sinica Institute of Physics
- First time traveling overseas
- Looking forward to gaining scientific and cultural experience

Travis Ford

- Institution: Texas A&M University
- Project: Germanium Detector Characterization
  + Beyond Standard Model Search
- Fact: There are more planes in the ocean than submarines in the sky
- Another Fact: These meetings and the research opportunity will help prepare me for graduate school and an A&M research project

Sedonah Franzen

- University of South Dakota
  - I'll start my Ph.D. at the university in the fall.
- I'll be working on low energy event analysis, specifically Fast Fourier Transforms.
- My goal is turn learn more about using ROOT.
- An interesting fact about me is that I minored in German.

Julius King

- Institution: Rising Senior at University of North Carolina at Chapel Hill
- Hometown: Durham, NC, US
- Project: Germanium Detector Characterization/ Beyond Standard Model Searches
- Fun Fact: I have played Mario Kart on every single platform that it is available on
- Goals: I hope to get more experience with coding in C/C++ this summer!

Andrew Mattson

- *Institution:* University of North Carolina at Chapel Hill
- *Research project:* Muon detector simulation and development
  - GEANT4
  - Resistive Plate Chamber (RPC) fabrication
- Looking to gain experience applying simulated models to build optimized components

Hayden R. Nelson - Texas A&M

Major - Nuclear Engineering

Research Project: *Muon Identification Detector Design*

Fact: I **did** take that photo in the hotel.

Fact #2: I dreamed of being an astronaut as a kid and never grew out of it.

Joel Watson

- Tennessee Tech University
- Junior
  - 2nd year of college
- Supernova Neutrino Simulation
- 3rd international Trip & 1st physics related trip
  - Hoping for a taste of what physics work is like

Name: Ethan White

University: Tennessee Technological University, first year physics student

Research Project: Beyond standard model physics searches with germanium data

Fact: I collect queen ants and watch them grow their own colonies under my guide.

Another fact: I am excited get my hands into software/coding analysis for germanium detectors so I can have a better grasp on what they are.

Abbie Woodard

- Institution - University of South Dakota
- Project - Ge-Detector Pulse Shape Analysis
- Summer Goals - I hope to gain more experience in detector characterization

Education Committee Activities

Two major efforts:

- STEM Undergraduate Program from Underrepresented Populations and High School Teachers
- Undergraduate Summer Research Program

Other efforts:

- Graduate student international research experience
- Development and mentoring of young scientists

One UNC graduate student David Hervas continues to engage in international research at the Max-Planck-Institut für Physik in München, Germany. David is working in a team at MPI developing and using a high-purity germanium Compton scanner designed to provide insight into gamma-induced bulk recoils in a LEGEND detector.

Education Committee Activities

Two major efforts:

- STEM Undergraduate Program from Underrepresented Populations and High School Teachers
- Undergraduate Summer Research Program

Other efforts:

- Graduate student international research experience
- Development and mentoring of young scientists

PIRE GEMADARC promotes the professional development of young members of the collaboration. The young members elect two representatives to be their voice to the Steering Committee.

We also invite young scientists to give talks at our collaboration meetings and summer schools, and they also plan our winter collaboration meeting.

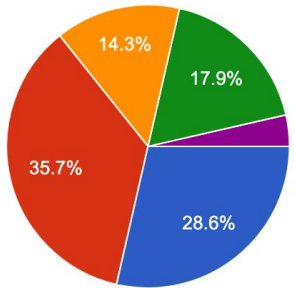
We invite young members to contact us if they wish to be matched to a postdoc or faculty member mentor outside their institution.

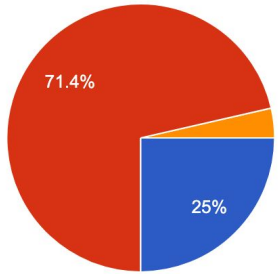
Survey Initial Responses

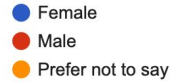
as of May 31 evening

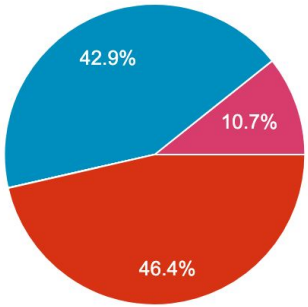
Demographics - 28 responses as of May 31 evening

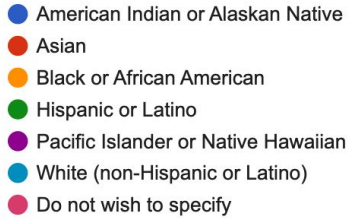
28 responses











Demographics

Of the undergraduates:

1 freshman

3 juniors

5 seniors

Majors: astrophysics, physics, math, nuclear engineering

Please rate how useful you found the following sessions to your learning about frontier physics research.

Not at all : slightly : somewhat : very : extremely : did not participate

Looking at the selection as a whole*:

- Extremely = 35.1%
- Very = 42.2%
- Somewhat = 16.4%
- Slightly = 5.0%
- Not at all = 1.3%

* contact me if you'd like to know how your talk/session performed

Neutrinos and Dark Matter - to what extent has your participation enhanced your understanding of the following

Not at all : a little : somewhat : moderately : extensively : did not participate

Neutrino mass and properties	24 of 28 answered moderately or extensively
Neutrino experiments and applications	26 of 28 answered moderately or extensively
Introduction and Theory	22 of 28 answered moderately or extensively 4 of 28 answered somewhat or a little
Survey of dark matter experiments and technologies	23 of 28 answered moderately or extensively 3 of 28 answered somewhat or a little

* missing responses are “did not participate”

Understanding of Semiconductor Detectors

Not at all : a little : somewhat : moderately : extensively : did not participate

Theory of Semiconductor Detectors	21 of 28 answered moderately or extensively 5 of 28 answered somewhat, a little, or not at all
Readout electronics for semiconductor detectors	16 of 28 answered moderately or extensively 10 of 29 answered somewhat, a little, or not at all
Digital pulse processing	17 or 28 answered moderately or extensively 9 of 28 answered somewhat, a little, or not at all
Pulse shape simulation	19 of 28 answered moderately or extensively 5 of 28 answered somewhat or a little

* missing responses are “did not participate”

Rare Event Backgrounds

Not at all : a little : somewhat : moderately : extensively : did not participate

Sources of background	24 of 28 answered moderately or extensively 2 of 28 answered somewhat
Background mitigation techniques	21 of 28 answered moderately or extensively 5 of 28 answered somewhat

* missing responses are “did not participate”

Software and Simulation

Not at all : a little : somewhat : moderately : extensively : did not participate

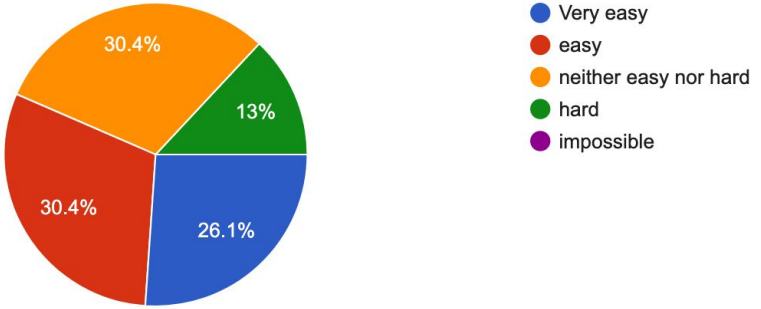
Understanding the basic principle of Geant4 operation	13 of 28 answered moderately or extensively 9 of 28 answered somewhat or a little 6 of 28 did not participate
Understanding the basic principle of pulse shape simulation	13 of 28 answered moderately or extensively 7 of 28 answered somewhat or a little 8 of 28 did not participate

* missing responses are “did not participate”

Software and Simulation

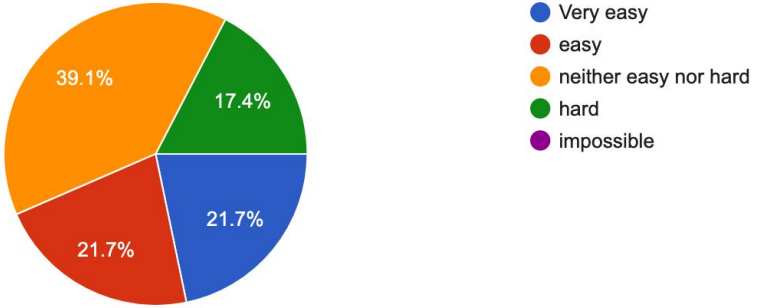
How easy was it for you to follow the Geant4 hands-on instruction?

23 responses



How easy was it for you to follow the pulse-shape simulation hands-on instruction?

23 responses



Thinking over the summer school as a whole, to what extent has your participation enhanced the following?

Understanding of the different technologies being applied to fundamental physics measurements	23 of 28 answered moderately or extensively 3 of 28 answered somewhat
Awareness of analysis methods being used in fundamental physics measurements	21 of 28 answered moderately or extensively 5 of 28 answered somewhat
Opportunity to read and understand the scientific literature	16 of 28 answered moderately or extensively 9 of 28 answered somewhat, a little, or not at all

* missing responses are “did not participate”

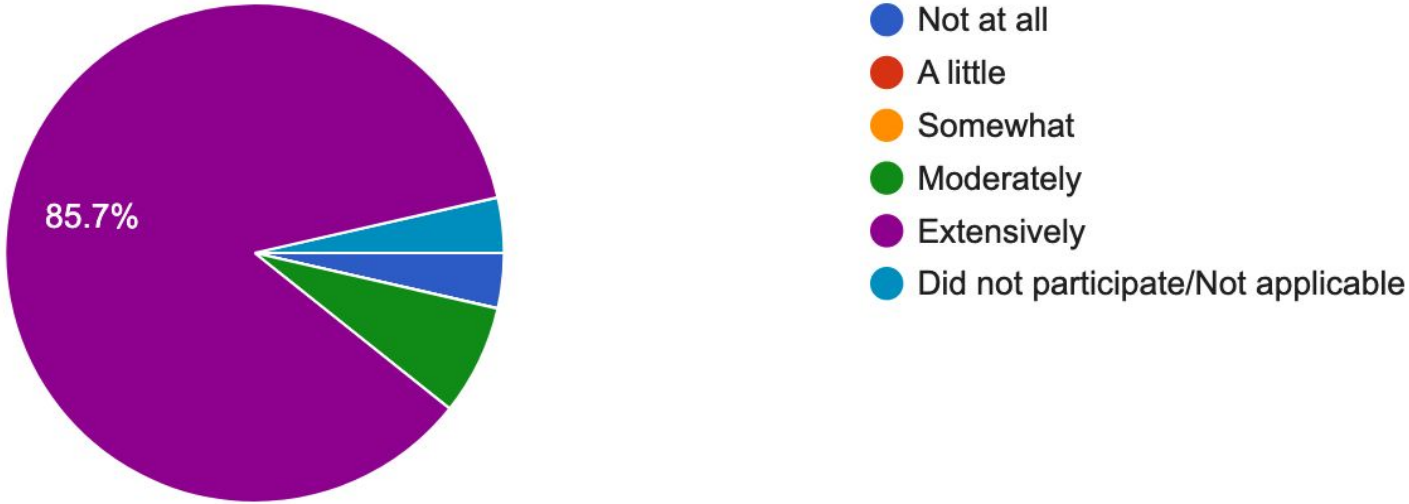
Thinking over the summer school as a whole, to what extent has your participation enhanced the following?

Participation in international science discussions	19 of 28 answered moderately or extensively 8 of 28 answered somewhat, a little, or not at all
Opportunity to gauge the level of understanding expected of experts	20 of 28 answered moderately or extensively 6 of 28 answered somewhat, or a little

* missing responses are “did not participate”

EXCURSIONS!

28 responses



Most Useful Session - Open Ended

- Colloquia of Broad Subjects
- Neutrino Physics Lecture Series ****
- Dark Matter Lectures
- Germanium crystal growth and detector fabrication
- Neutrino Physics Session: Discussions of Fundamental Physics
- hands-on session, detector session
- Cosmology for Particle Physicists
- **Discussions during breaks, interaction with students is important**
- **I enjoyed being able to ask questions, so I could gain a deeper understanding of the topics.**
- **Discussion among scientists**

Requested Future Topics

- Statistics in Analysis in Particle Physics Experiments
- Sterile Neutrinos, Bosonic Dark Matter, Theoretical and Experimental aspects of Neutrinoless Double Beta Decay
- Hands on experience in detector/electronics development
- detector and electronics
- Beginning analysis techniques for rare event research
- Ge detector
- More in depth discussions of large scale projects like Ice Cube
- Germanium detectors for nuclear physics like gretina
- Front End electronic of Detectors
- Standard Model basics might be useful
- As a program designed for students I would have liked a talk discussing industry applications.
- I think an introductory/refresher session on particles and semiconductor/band theory could be helpful.
- A general introduction talk into how germanium detectors work (for undergraduate students) where the senior people can use the time to discuss something else
- Machine Learning part

Suggestions for Improvement

- Some preparation prior to the school to enhance students' participation.
- More lectures about Germanium detector technology (e.g. Purification, Enrichment)
- Everything was wonderful, no suggestion.
- Don’t have the day last so long for lectures. By 3pm students begin tapping out.
- I suggest having more down-time for relaxation. I liked the lectures and school. I learned so much
- Perhaps basic lectures should come to first
- The hours are sometimes a bit too long
- I thought it was very well organized.
- Shorter breaks during the day and ending earlier might help keep people from getting fatigued.
- Add more time to recap/work on things. The breaks were quickly over.

Survey is still open! Please add your responses :-)

Thank you!