Interdisciplinary computing-physics

Applied CS: Do research now!

Bookmark these slides at https://quincywofford.info/

Perhaps an interesting fact!

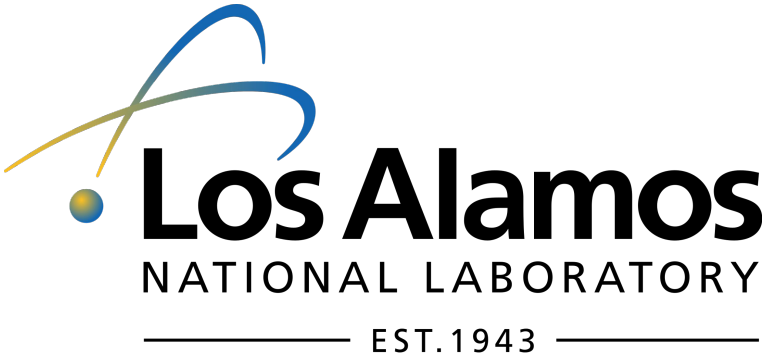
Business school dropout, failed professional musician and music publisher.

Quincy Wofford
Scientist at Los Alamos National Laboratory (LANL)

- Similar to academic research faculty, but I don't teach in classrooms and publishing papers is optional. Most of my time is spent engineering, building things, engaging with peers, reading papers, and attending conferences.

- I get to pick what to work on. Right now I have projects in:
  - Computational physics.
  - High Performance Computing (HPC) design.
  - Applied computer science.
- In the past I've worked on:
  - Data science at scale (in situ compression)
  - 3D visualization

- Live in the mountains, comfortable living.

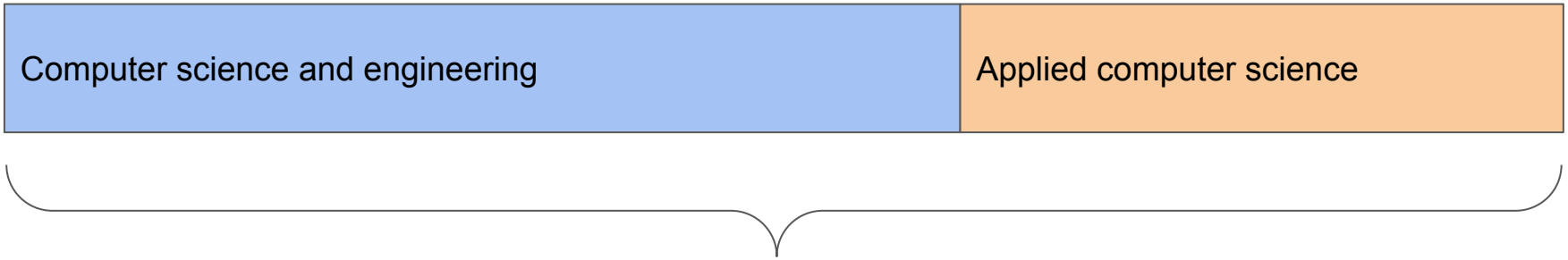


Los Alamos, New Mexico

Overview

1. Exploring the IC major.
2. The importance of undergraduate research.
3. Neutrinos on the moon.
4. Neutrinos at the South Pole.
5. Supercomputers in Kansas.
6. Supercomputers at LANL.
7. Fails!

Apply computer science somewhere *interesting to you*.



Astronomy: http://physics.ku.edu/people/faculty
Biology: http://eeb.ku.edu/faculty, http://molecularbiosciences.ku.edu/faculty
Chemistry: https://chem.ku.edu/people/faculty
Geography: https://geog.ku.edu/faculty, https://cresis.ku.edu/
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Physics: http://physics.ku.edu/people/faculty

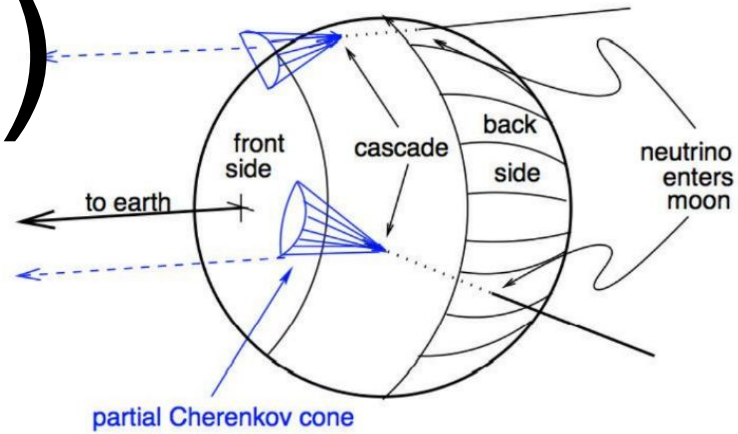
\+ scholar.google.com

Exploring the IC major … 2 … 3 … 4 … 5 … 6 … 7

Apply computer science somewhere *interesting to you*.

- Started as IC - Astronomy
- Found research by Dave Besson, jumped in Spring semester of freshman year.
- Swapped to IC - Physics

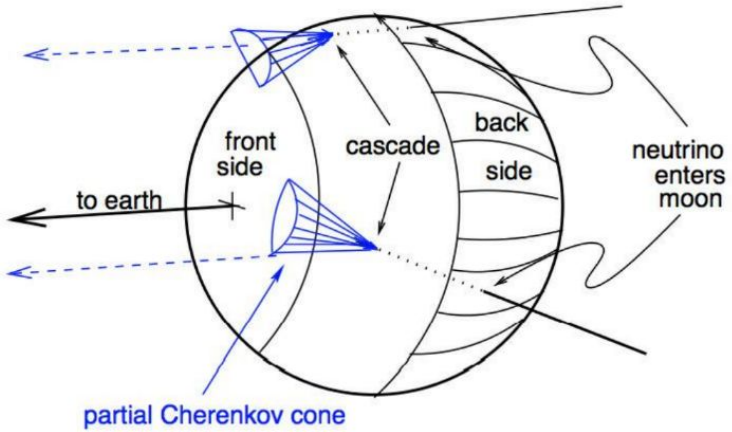
1.)

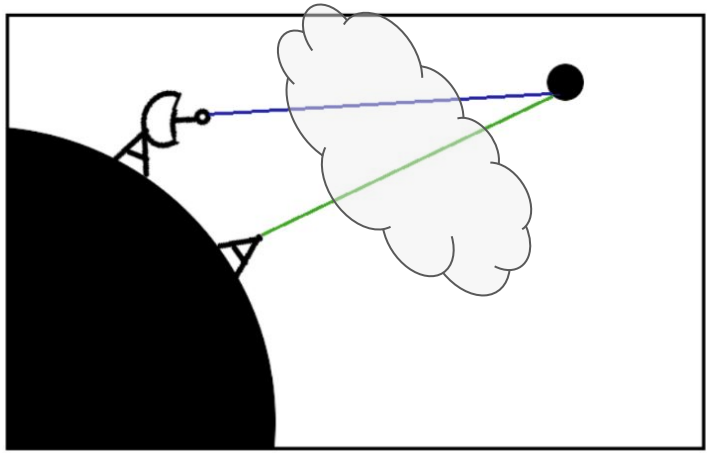


1 … The importance of undergraduate research … 3 … 4 … 5 … 6 … 7

Apply computer science somewhere *interesting to you*.

“Can neutrinos be detected in lunar regolith?”

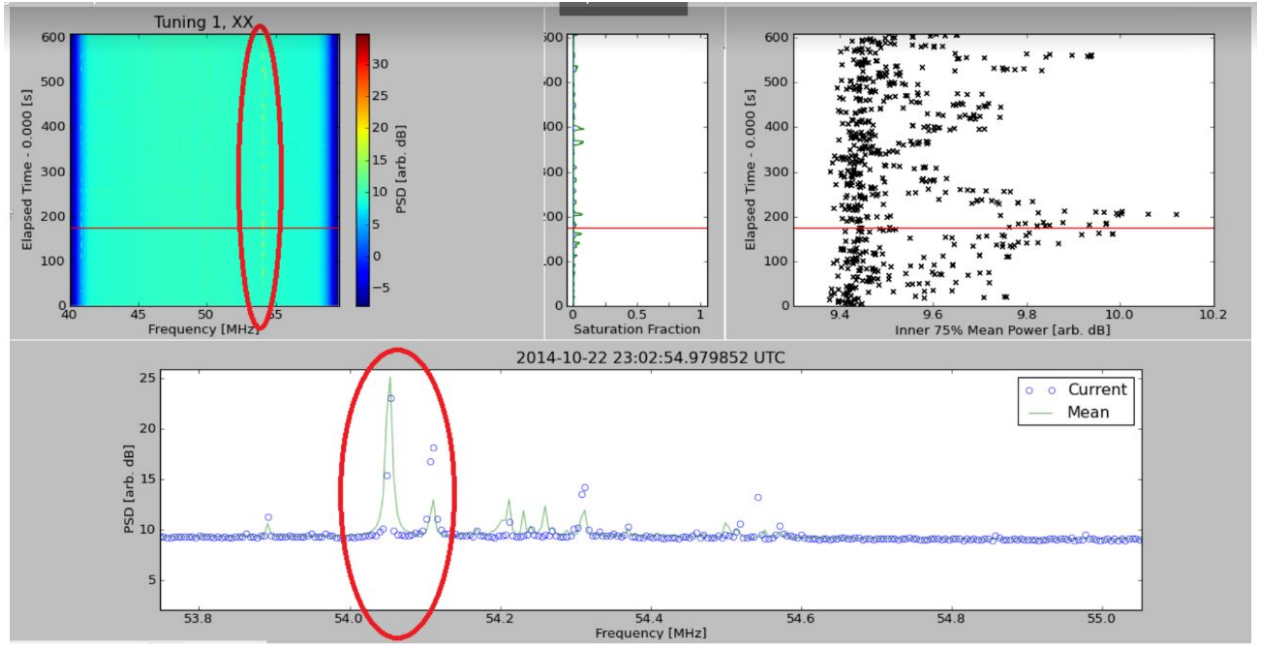




1 … 2 … Neutrinos on the moon … 4 … 5 … 6 … 7

Apply computer science somewhere *interesting to you*.

“Can neutrinos be detected in lunar regolith?”



1 … 2 … Neutrinos on the moon … 4 … 5 … 6 … 7

Apply computer science somewhere *interesting to you*.

“Can neutrinos be detected in lunar regolith?”

Nope. At least not by me…

But I did get 3 Undergraduate Research Awards (UGRA) to do the work! See: https://ugresearch.ku.edu/student/fund/research-awards

Went to radio astronomy conference in New Mexico, toured VLA and LWA site.

1 … 2 … Neutrinos on the moon … 4 … 5 … 6 … 7

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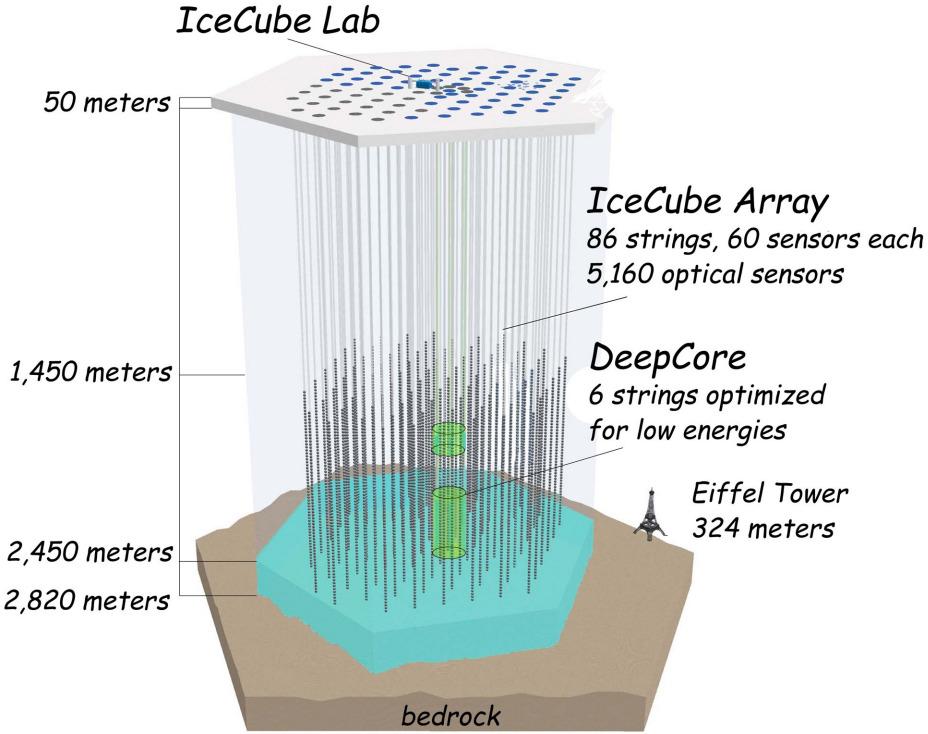
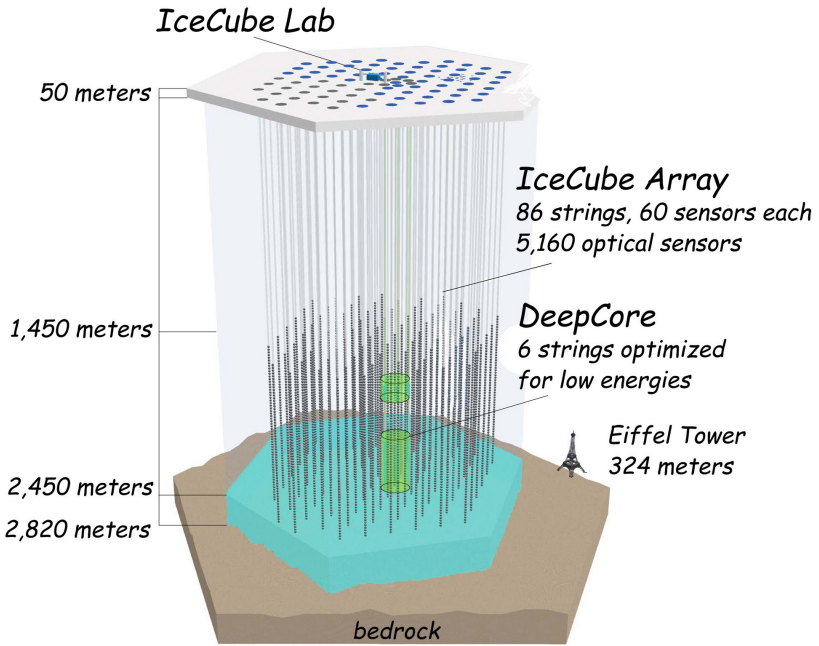
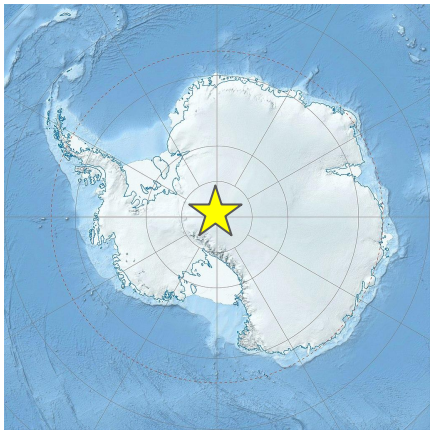


1 … 2 … 3 … Neutrinos at the South Pole … 5 … 6 … 7

Apply computer science somewhere *interesting to you*.





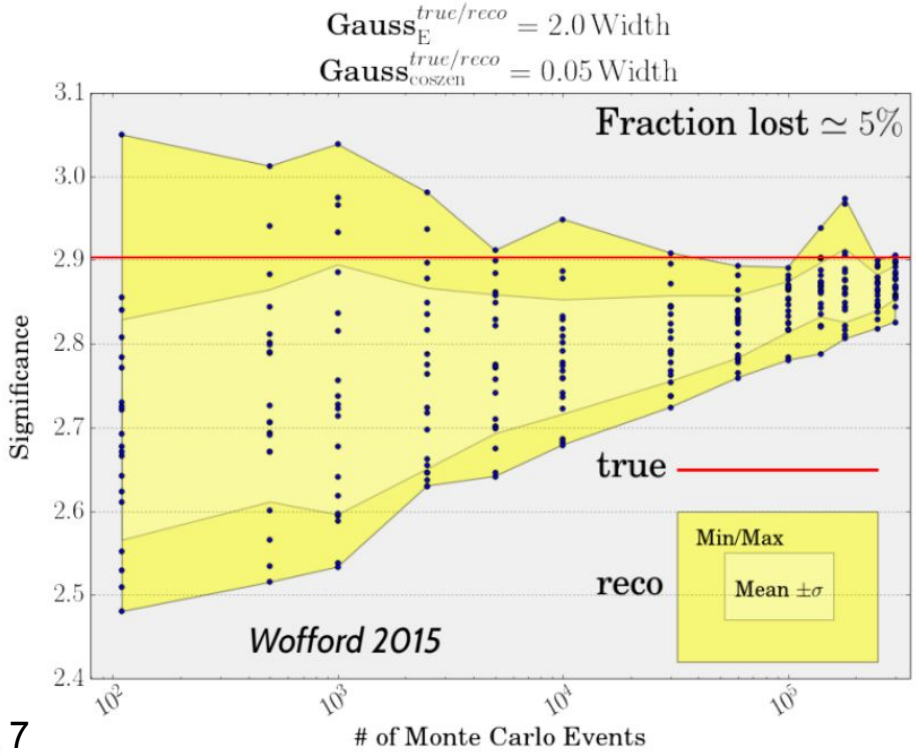
1 … 2 … 3 … Neutrinos at the South Pole … 5 … 6 … 7

Apply computer science somewhere *interesting to you*.

"How many neutrino detections are required to resolve the neutrino mass hierarchy?"

Too many, hopefully we were wrong…

...but I did get paid to live in Germany for 3 months to learn about neutrino physics.



Mass hierarchy still a mystery...but Germany was great!

National Science Foundation (NSF)

International Research Experience for Undergraduates (IRES)

Grant pays for travel, lodging, and includes a fair hourly rate.

1 … 2 … 3 … Neutrinos at the South Pole … 5 … 6 … 7

Meanwhile...learn basics about supercomputers at KU

Student system administrator at the ITTC.

If you want to learn how a supercomputer works, go talk to Wes Mason!

1 … 2 … 3 … 4 … Supercomputers in Kansas … 6 … 7

Meanwhile...learn basics about supercomputers at KU

With the support of ITTC, particularly Mike Hulett, I applied for and obtained funding to travel to SC16 as a student volunteer…

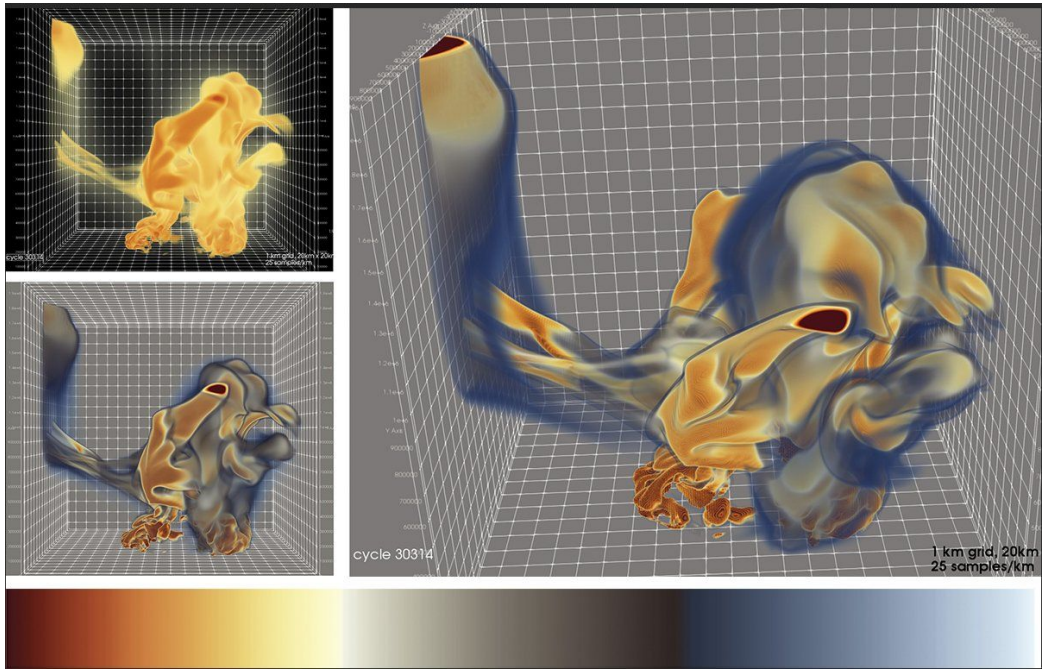
Met two LANL scientists from the same team, at two separate networking events. Hired!

1 … 2 … 3 … 4 … Supercomputers in Kansas … 6 … 7

LANL scientist in 3 parts

1. Post-baccalaureate intern.

   “How much compression should be applied to visualization data products?”



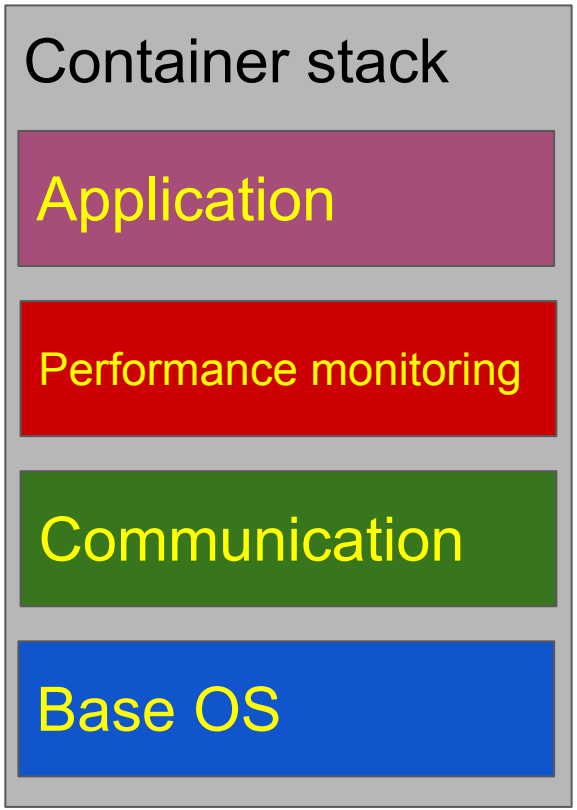
1 … 2 … 3 … 4 … 5 … Supercomputers at LANL … 7

LANL scientist in 3 parts

2. National Physical Science Consortium (NPSC) Fellow (graduate student)

   “How do we build portable software environments for supercomputers?”

   Modular, extensible container image layers.



LANL scientist in 3 parts

3. Scientist

   “How do we build portable software environments for supercomputers ***<u>at LANL</u>***?”

- Open question, but today I think:
  - Continuous integration (Gitlab runners)
  - Containerization (Clear application / kernel interface)
  - Unprivileged container runtimes (Charliecloud / Podman / Singularity)
  - Next generation package management (Spack)

Fail! Not everything works out and that's ok...

A brief excursion into FinTech…

"What factors lead to customer's paying back debt?"

If they paid debt back before, they're likely to do so again. Not exactly the kind of insight a CEO loves…

A failed interview at TradeBot…

Fun fact, as an undergraduate, "Python expert" should probably not appear on your resume...

1 … 2 … 3 … 4 … 5 … 6 … Fails!

Questions?

Timeline

- 2012-2017: Interdisciplinary Computing - Physics major.
- 2013-2014: Learn how to assist a researcher!
- 2012-2017: System administrator at ITTC.
- 2016-2017: “Student hourly” employee at the Center for Research Methods and Data Analysis (CRMDA).
- 2014: 2x Undergraduate Research Award (UGRA) awards. 1x UGRA travel award.
- 2015: NSF International Research Experience for Students (IRES) recipient.
- 2016: Data science intern at C2FO (fintech startup).
- 2016. Failed interview at TradeBot.
- 2016: Student volunteer at Supercomputing conference.
- 2017: Post-baccalaureate intern at Los Alamos National Laboratory (LANL).
- 2018: National Physical Science Consortium (NPSC) Fellow at LANL, UNM.
- 2020: Scientist at LANL. Projects funded by applied computer science, high performance computing (HPC), and computational physics.