Welcome to Berkeley Lab Computing Sciences

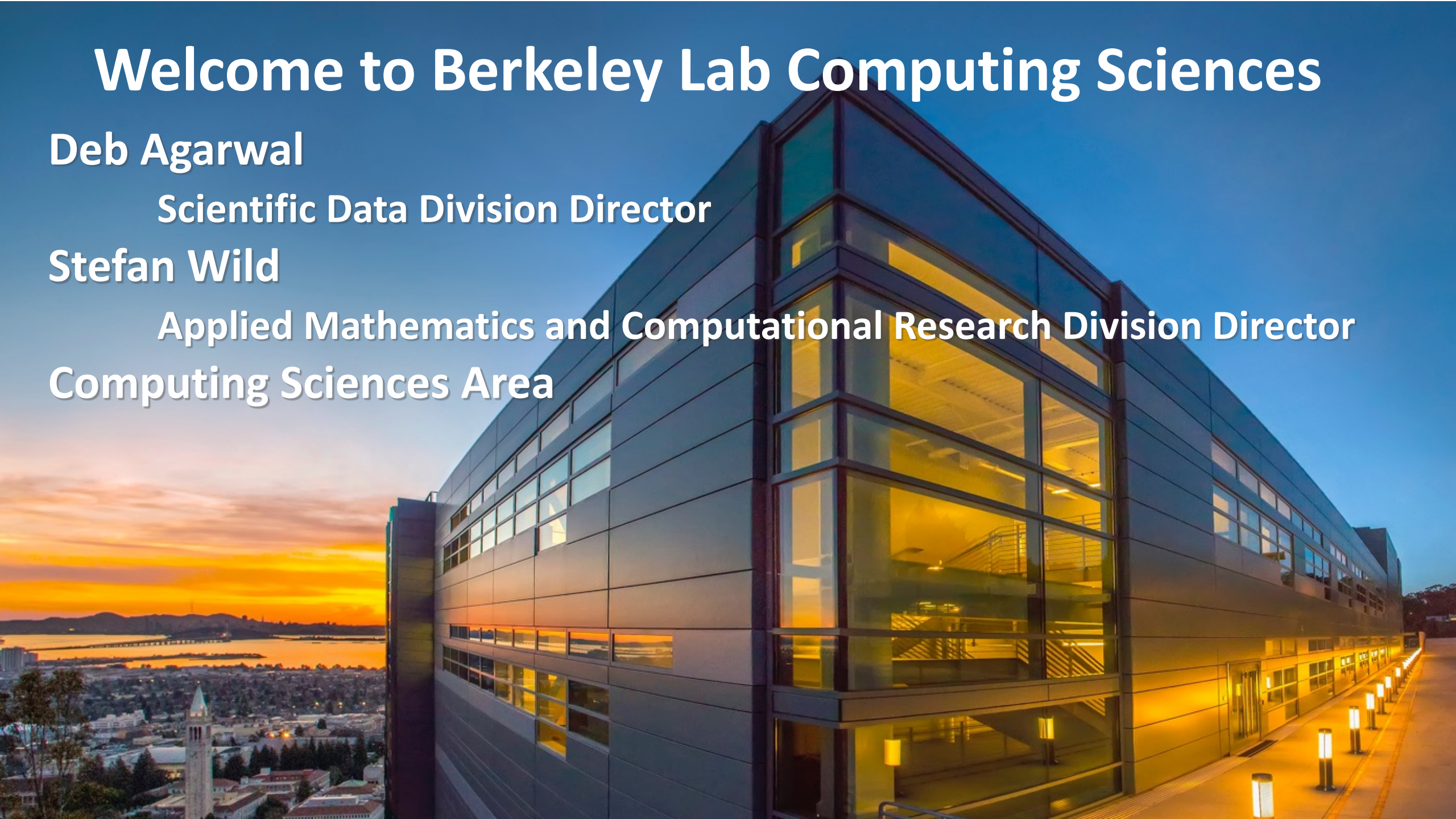
Deb Agarwal

Scientific Data Division Director

Stefan Wild

Applied Mathematics and Computational Research Division Director

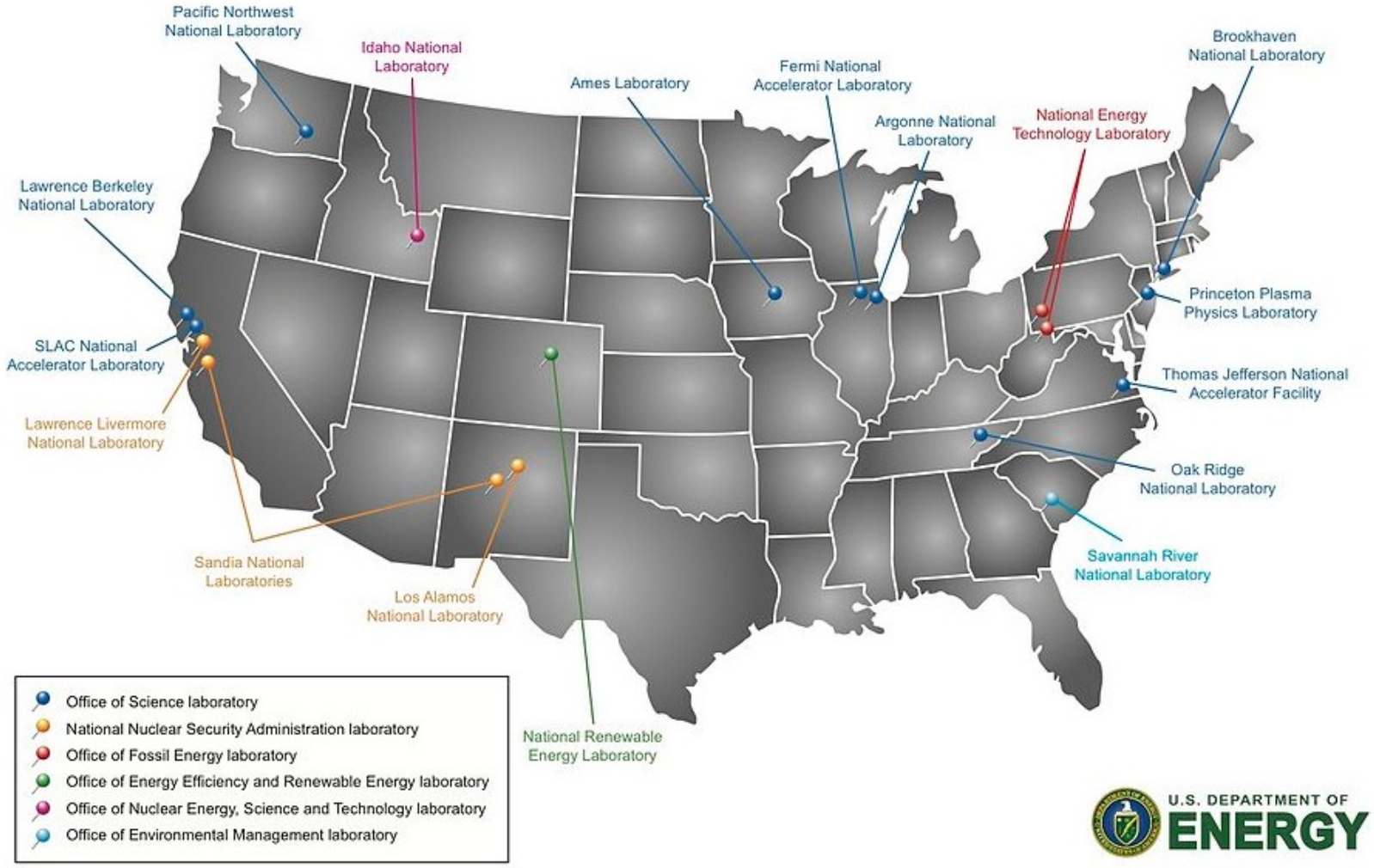
Computing Sciences Area



The 17 DOE National Laboratories are the crown jewels of the nation's research infrastructure

DOE multipurpose labs:

- Argonne
- Brookhaven
- Lawrence Berkeley
- Lawrence Livermore
- Los Alamos
- Oak Ridge
- Pacific Northwest
- Sandia



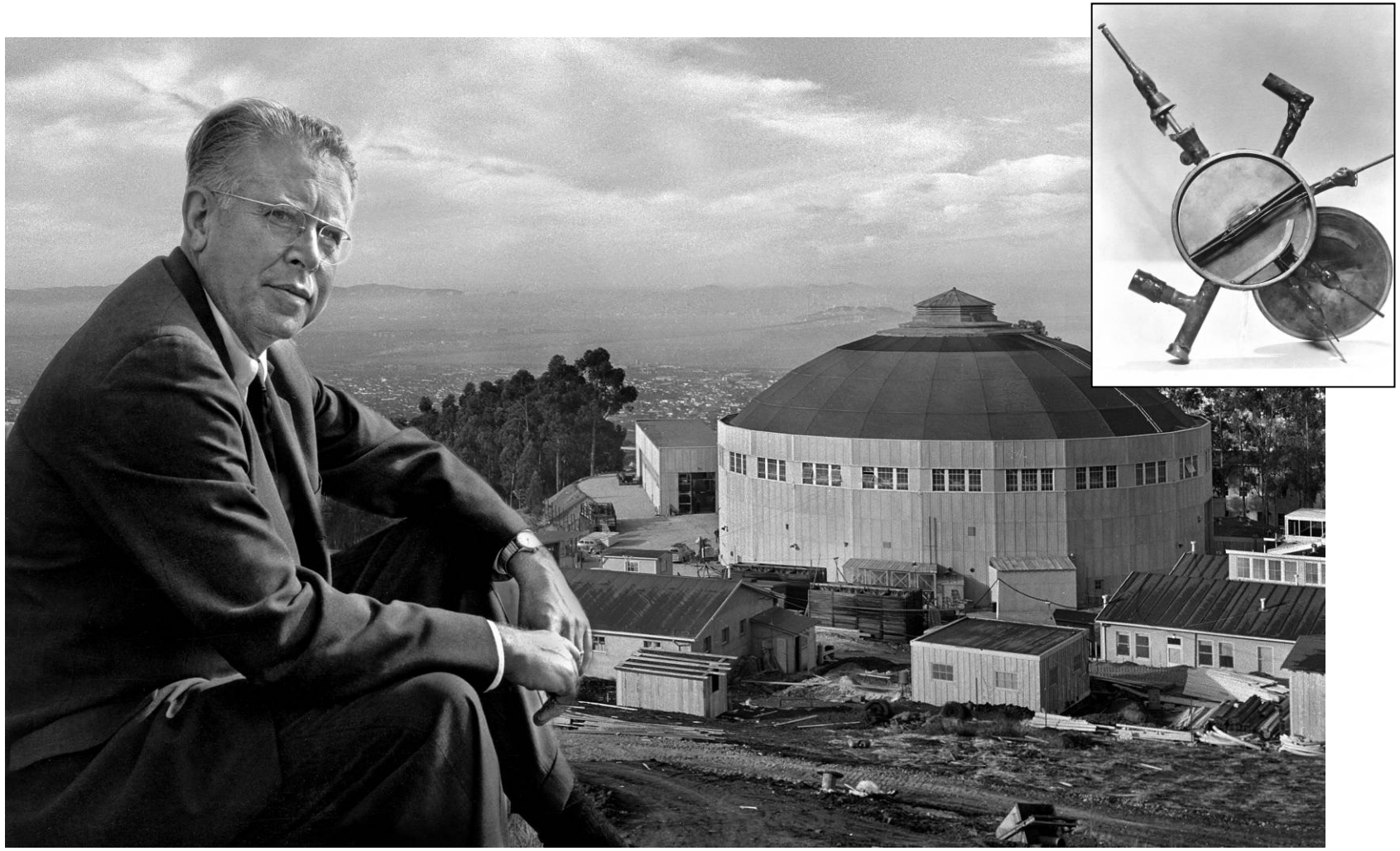
Lawrence Berkeley National Laboratory: *Bringing Science Solutions to the World*

Solve major problems in basic science, energy, and security

Design, build, and operate unique scientific facilities

Educate and train the next generation of scientists

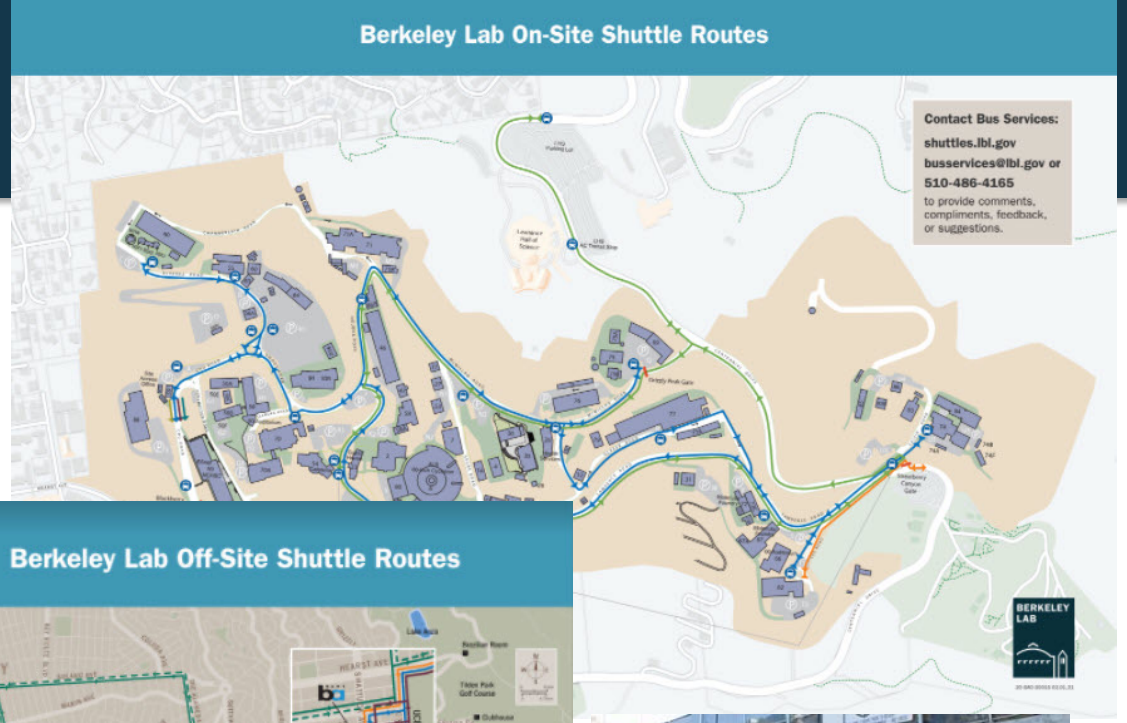
Founded on the Berkeley Campus in 1931, Moved to the Current Site in 1940



The Lab

At a Glance (FY 2022)

- 16 Nobel Prize winners + 15 National Medal for Science
- 3,663 FTE
- 1,781 scientists and engineers
- 242 joint faculty
- 503 postdoctoral scholars
- 297 graduate students
- 119 undergraduate students
- 13,990 Facility users
- 1,736 visiting scientists and engineers



https://commute.lbl.gov/resource/

Berkeley Lab: Home of NERSC and ESnet

The user facilities are collaboration centers, providing the tools and the expertise needed by a diverse research community to address the grand national challenges.

Bright x-ray beams and leading instruments for chemistry, materials, biology, and more. FY21 Users: 1,149

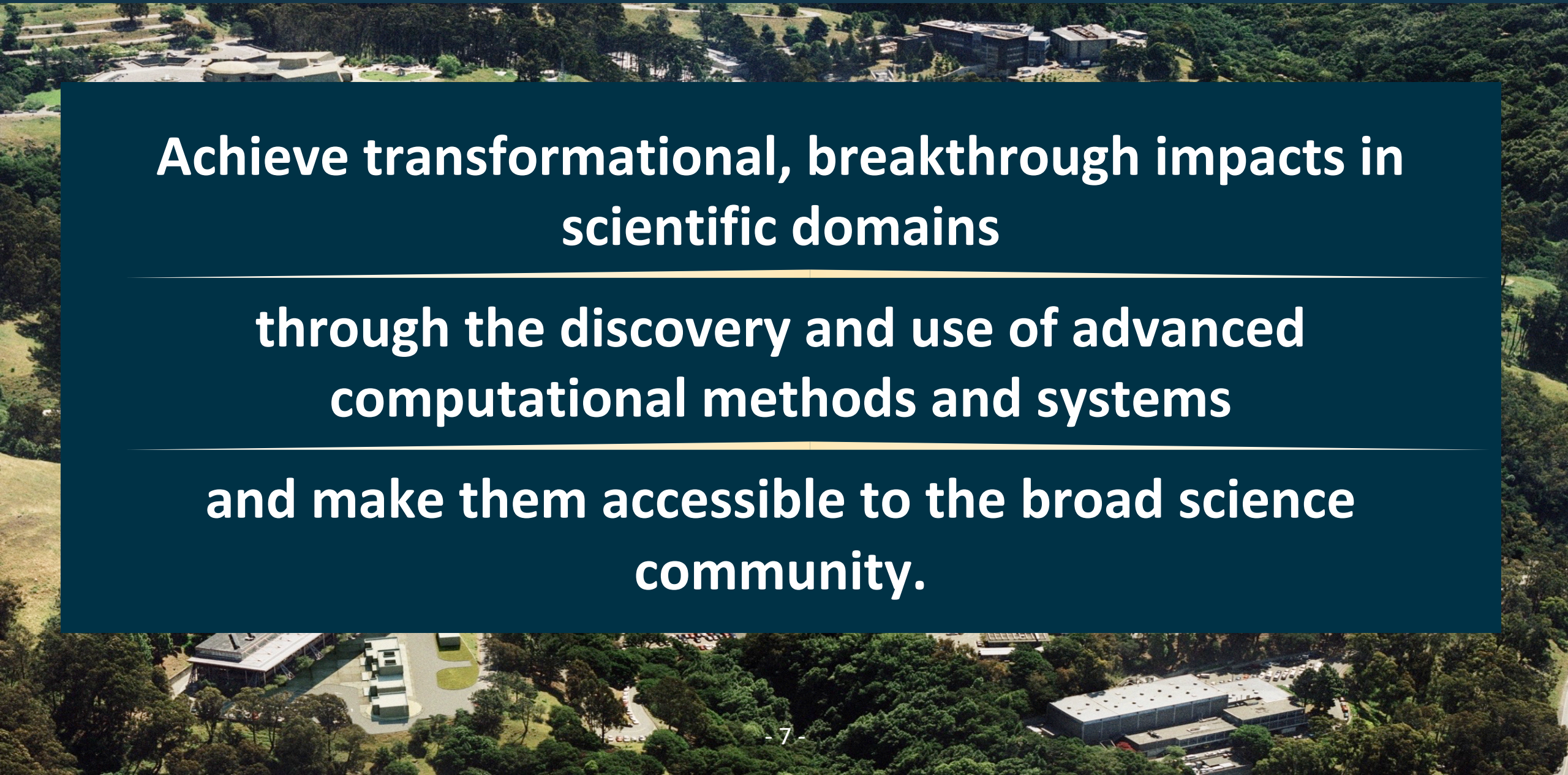
HPC for all DOE science: simulation, data analytics, and machine learning.
FY21 Users: 9,183

Integrative and collaborative genome science.
FY21 Users: 2,180

Expertise and instruments for nanoscale science, QIS, and electron microscopy. FY21 Users: 1,670

The leading research network connects DOE labs and experiments. 1,140 Peta-bytes/year in FY21

Computing Sciences Mission



Achieve transformational, breakthrough impacts in scientific domains

through the discovery and use of advanced computational methods and systems

and make them accessible to the broad science community.

Computing Sciences Area at Berkeley Lab

Jonathan Carter

Helen Cademartori

580 Staff & Students

Computing Sciences

Stefan Wild

Applied Mathematics & Computational Research

Deb Agarwal

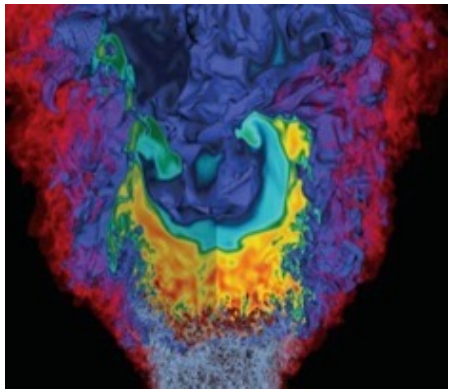
Scientific Data

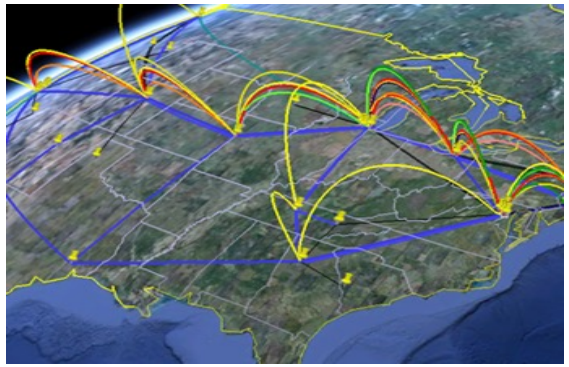
Inder Monga

ESnet

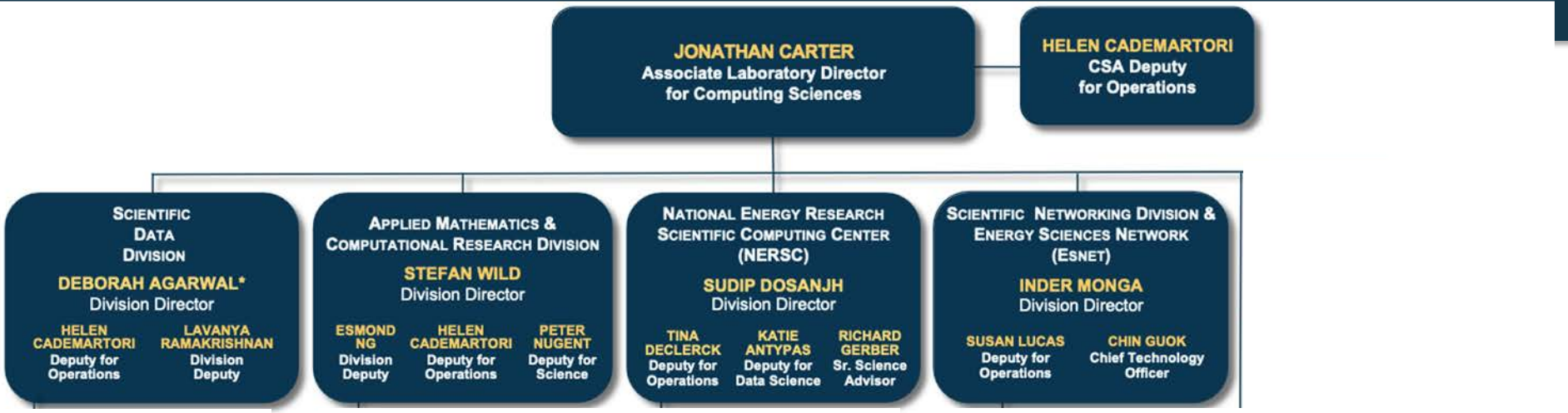
Sudip Dosanjh

NERSC

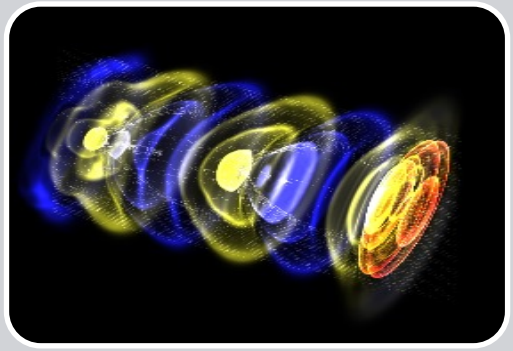




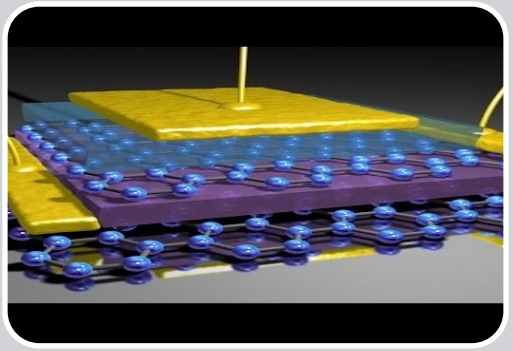
Computing Sciences at Berkeley Lab



Applied Math & Computational Research

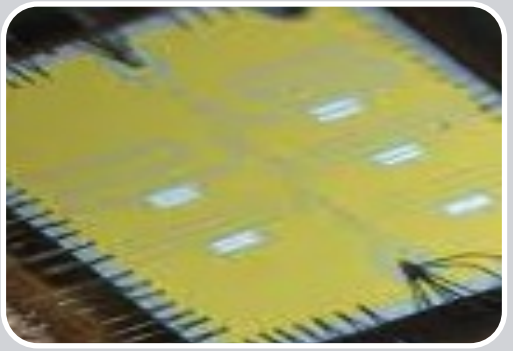


Applied Math



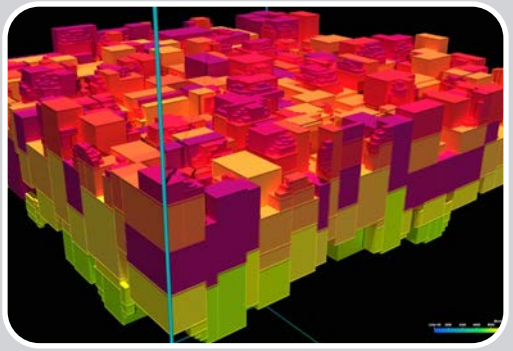
Computer Science:

Architectures, Languages, Algorithms



Science Partnerships: Simulation & QIS

Scientific Data



Data Science

Analytics and Machine Learning

Computer Science:

Software Solutions

Science Partnerships: Data Lifecycle

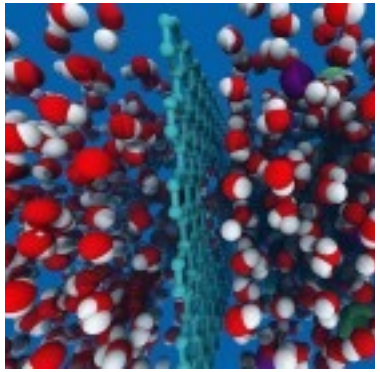
NERSC: The Primary HPC Center for Office of Science

- **The National Energy Research Scientific Computing Center (NERSC) is the primary scientific computing facility for the Office of Science in the U.S. Department of Energy.**
- **As one of the largest facilities in the world devoted to providing computational resources and expertise for basic scientific research, NERSC is a world leader in accelerating scientific discovery through computation.**

> 8,000 scientists use NERSC to perform basic scientific research across a wide range of disciplines.

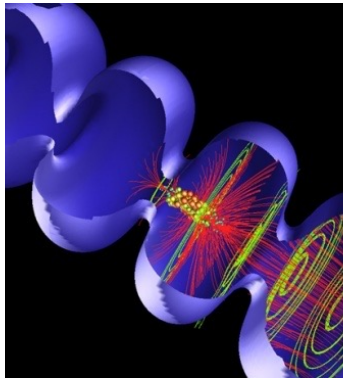
length, time →

Materials



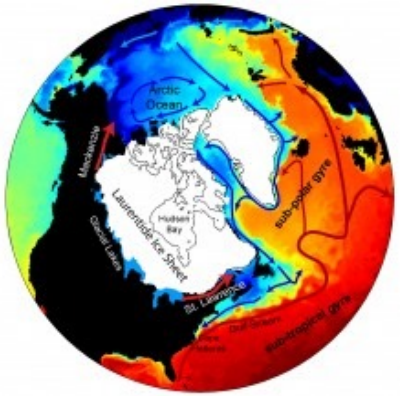
MIT scientists show desalination using 1-atom thick graphene.
Nano Lett., **2012**, *12* (7)
Simsonthian Breakthrough of 2012

Accelerators



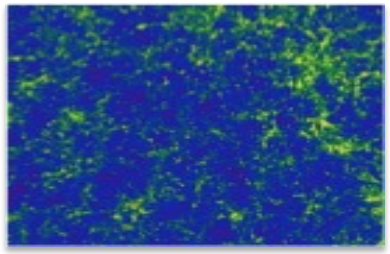
SciDAC simulations show fabrication errors cause Beam Breakup (BBU) instabilities

Climate



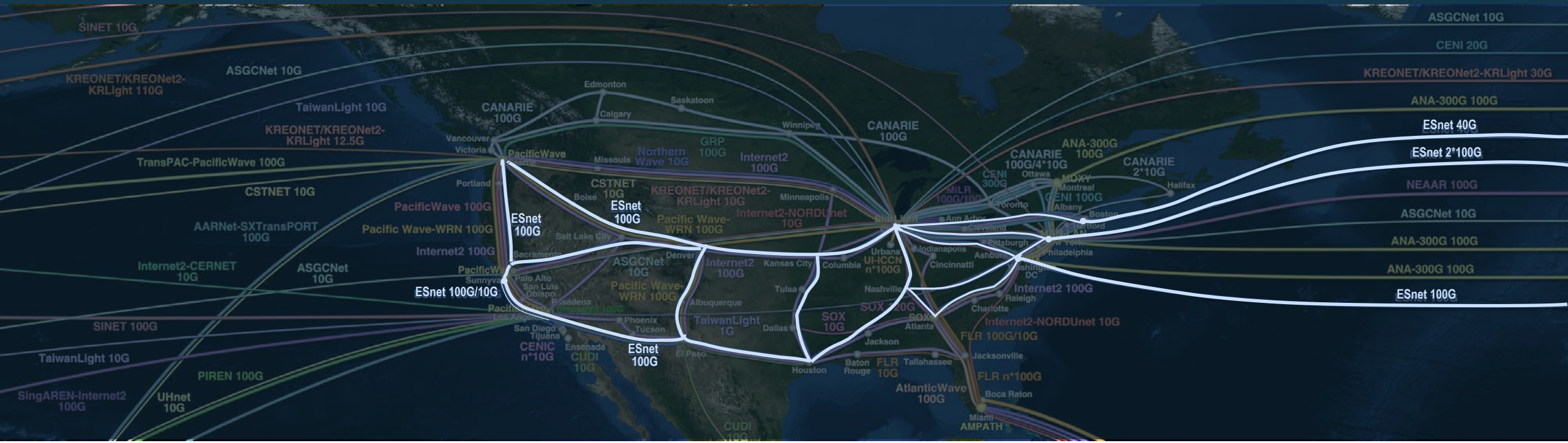
Regional Climate simulations explain flow leading to "Big Freeze" 1300 years ago

Astronomy



LBNL Scientists developed Nyx AMR software, now part of SciDAC-3 collaboration

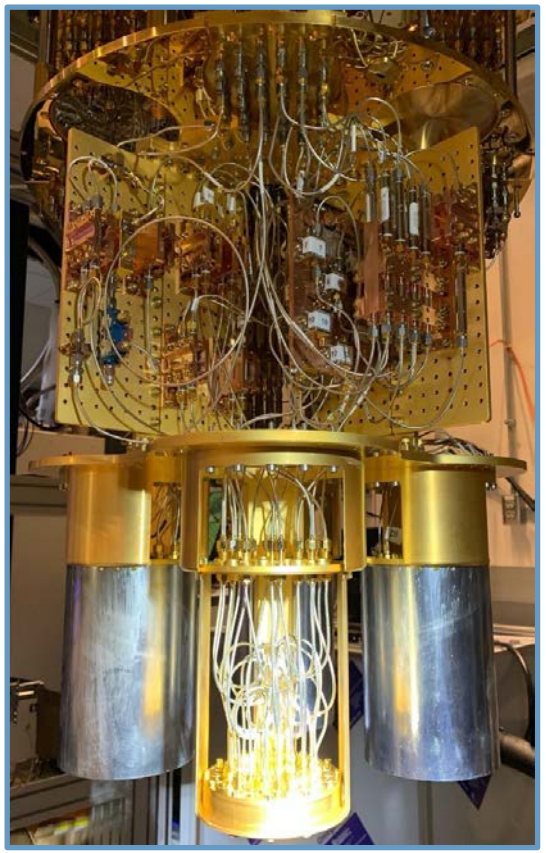
ESnet: A Capability for Collaborative Science



- **Networking tailored to science demands**
  - Bandwidth reservations, performance monitoring, Science “DMZ” model for the last mile,…
- **Upgrade (ESnet6) for terascale performance**
  - Driven by science data growth, new models of science, and hardware refresh
- ***Quantum Networking Testbed***

ESnet
ENERGY SCIENCES NETWORK

Quantum Information Science and Technology Across the Lab



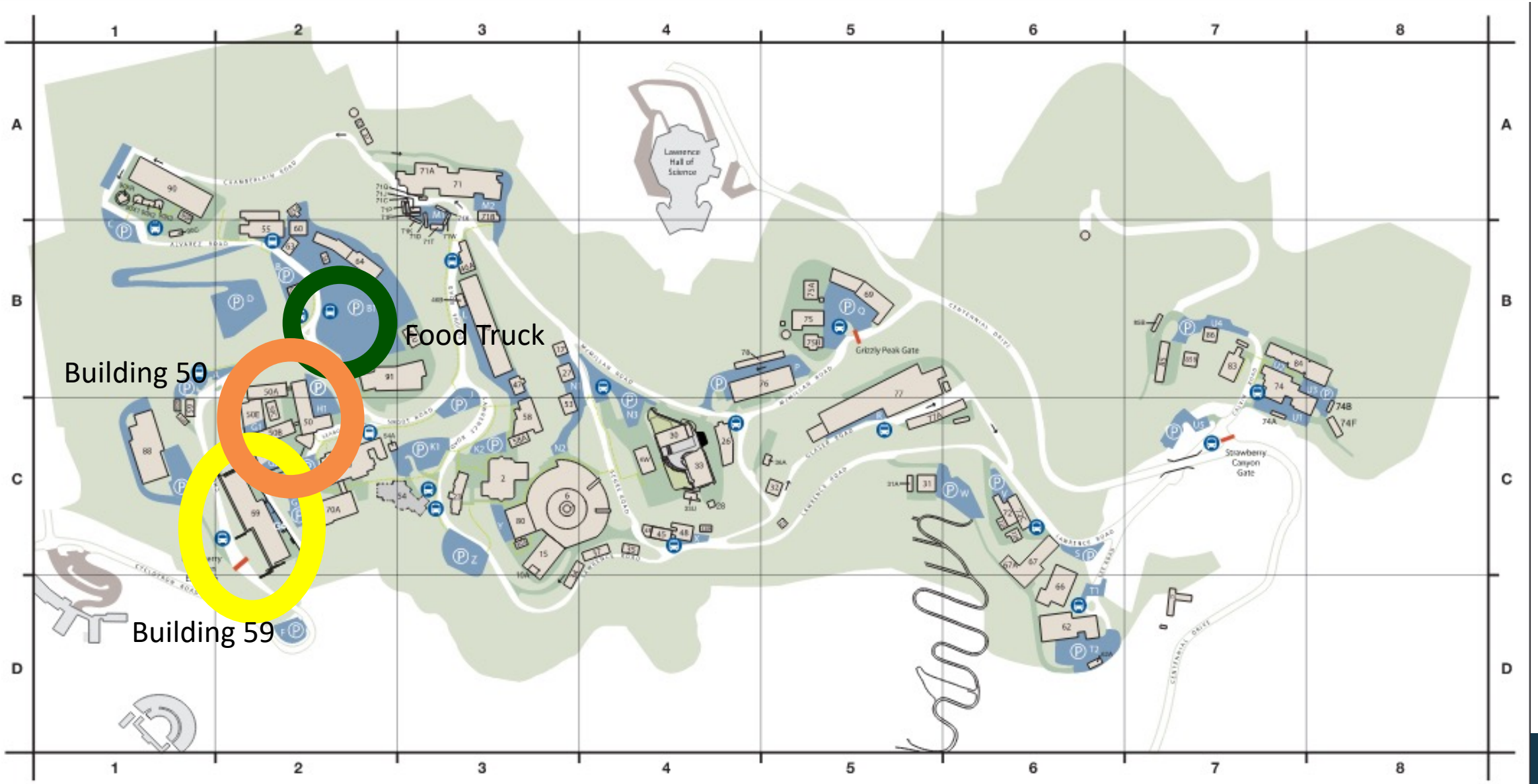
This lab-wide emerging capability is enabling fundamental advances for all SC Program Offices:

- **Advanced Quantum Testbed**
  - ***Now running five user projects***
- **Quantum algorithms & software**
- **Quantum networking**
- Quantum Coherence EFRC
- Quantum Imaging to Measure Metabolite Dynamics and Geosciences Quantum Sensing (LDRD)
- Molecular Foundry instruments
- Superconducting interfaces
- Quantum sensing, simulation, analytics for HEP
- Adiabatic Quantum Computing for NP
- Qubit synthesis far from equilibrium

QUANTUM SYSTEMS ACCELERATOR

Catalyzing the Quantum Ecosystem

A Map of Berkeley Lab



A Few Questions for You

- What is your goal for the summer?
- Name one fun thing you hope to do this summer?
- What do you want to take away from this experience?

How to Approach This Summer

- Define clear project goals and outcomes for the summer with your supervisor
- Don’t be afraid to ask questions if something is not clear or does not make sense
- Ask for the resources you need
- Be reliable and deliver on what you promise
- Participate in all the seminars and tours
- Be part of the poster displays
- Try to accomplish the goals you set out at the start

Work environment logistics

- Every conference room is set up to enable zoom
- Make sure your setup is ergonomic
- Identify your location each day on your calendar
- Carry your badge - you will need it to get into every building
- If you want to bring a visitor on-site, check with your supervisor

Advice . . . .

- Have a goal of coming away from the summer with a tangible product: code, paper, ???
- Give at least one talk/poster during the summer
- Learn about the different jobs available at the lab
- Make sure that someone at the lab knows you well enough by the end of the summer to be able to write you a reference

Advice (cont) . . .

- **Meet as many people as you can**
  - Ask them to meet you for 15-30 min (zoom or in person)
  - If in person, offer to buy them coffee or go for a walk together
  - Know some things about their research before you meet them
  - Be curious about their work and their career
  - Ask for advice
- **Don’t be afraid to contact someone you do not already know**
- **Imposter syndrome affects everyone – fake it until you make it**
- **You can do this! Have confidence in your abilities**
- **If you are at the lab – get out and explore - take walks around the hill**

Dr. Deb Agarwal

Purdue – Mechanical Eng. BS

General Motors Tech. Center

University of California, Santa Barbara – Computer Eng MS, PhD

Berkeley Lab

CTBTO – Vienna, Austria

Inria – Rennes, France

DHC at University Rennes

Retirement

AMCR & SDD

SCAVENGER HUNT

June 6 - 14

Explore the lab to find 10 locations. Look for a QR code at each location to upload a photo. Each person or group (10 max) participating should be in the photo.
Clues will be sent after this meeting.

Prizes will be awarded to the first person or group to succesfully submit all photos and the most creative photo!

AMCR AND SDD

Lunch Around the Lab

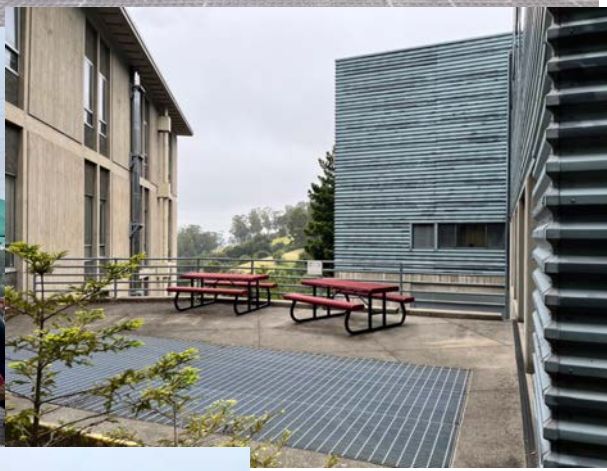
PICNIC TABLE

Palooza

14 JUNE

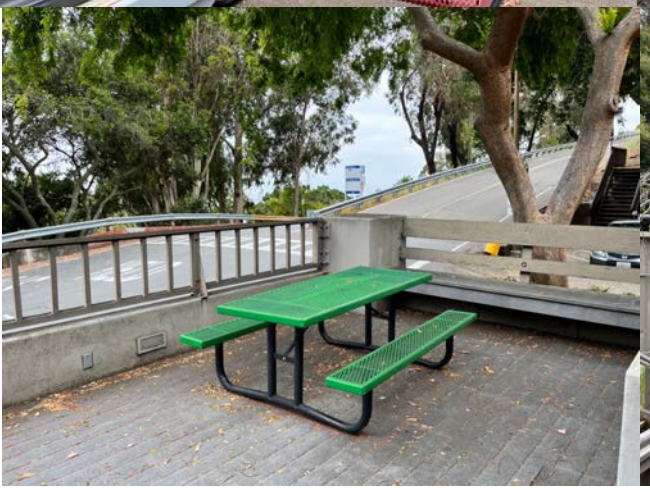
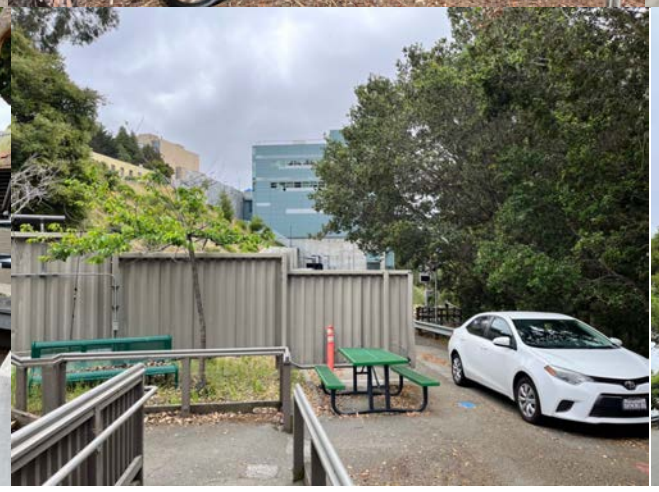
08 AUG

USE THE PICTURE CLUES TO FIND THE PICNIC TABLES ALL AROUND THE LAB. BRING LUNCH AND EAT AT A NEW LOCATION. TAKE A PICTURE TO BE ELIGIBLE FOR A PRIZE.

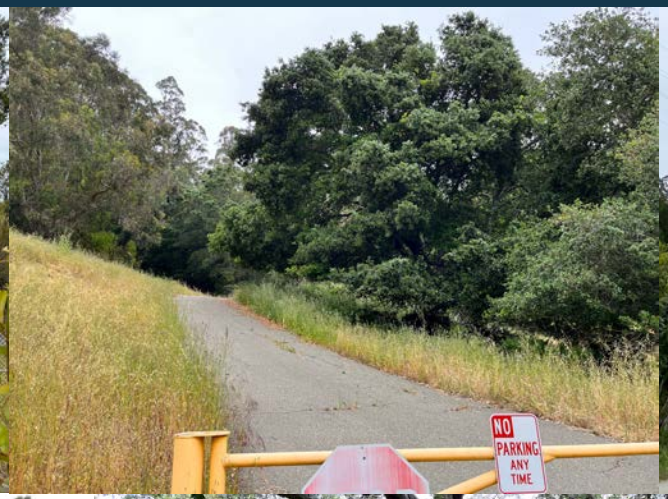


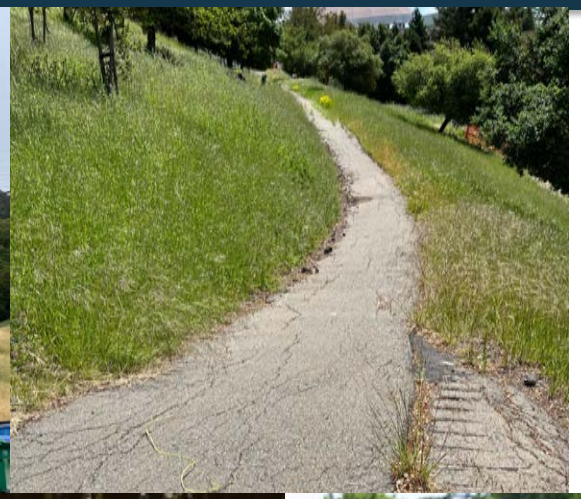
Larger Spots

Bonus Locations

Other Places Around the Lab





BERKELEY LAB

Questions?

daagarwal@lbl.gov

Please share photos of events and adventures with us:

CS Research Summer Students 2023: https://photos.app.goo.gl/C3dfpBJM4Lzu2J2NA (https://bit.ly/LBNLCSsummer23)

CS Research Week (June 6-10): https://photos.app.goo.gl/CrAgFc3yCDyH6Tau7 (https://bit.ly/LBNLcsRWJun23)