Welcome to Berkeley Lab Computing Sciences

Deb Agarwal
Scientific Data Division Director
Computing Sciences Area

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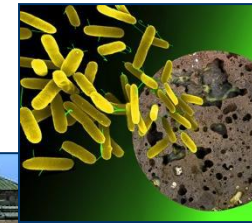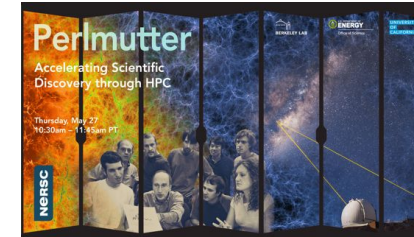
DOE multipurpose labs:

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

Pacific Northwest National Laboratory
Idaho National Laboratory
Ames Laboratory
Fermi National Accelerator Laboratory
Brookhaven National Laboratory
Argonne National Laboratory
National Energy Technology Laboratory
Lawrence Berkeley National Laboratory
SLAC National Accelerator Laboratory
Lawrence Livermore National Laboratory
Princeton Plasma Physics Laboratory
Thomas Jefferson National Accelerator Facility
Sandia National Laboratories
Los Alamos National Laboratory
Oak Ridge National Laboratory
Savannah River National Laboratory
National Renewable Energy Laboratory

- Office of Science laboratory
- National Nuclear Security Administration laboratory
- Office of Fossil Energy laboratory
- Office of Energy Efficiency and Renewable Energy laboratory
- Office of Nuclear Energy, Science and Technology laboratory
- Office of Environmental Management laboratory
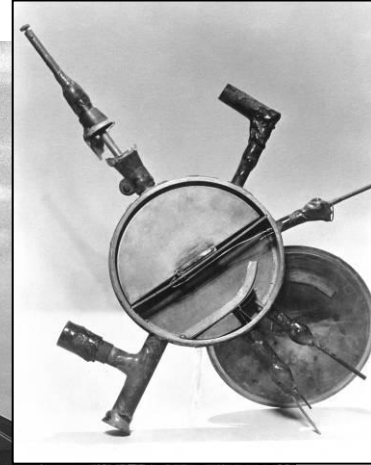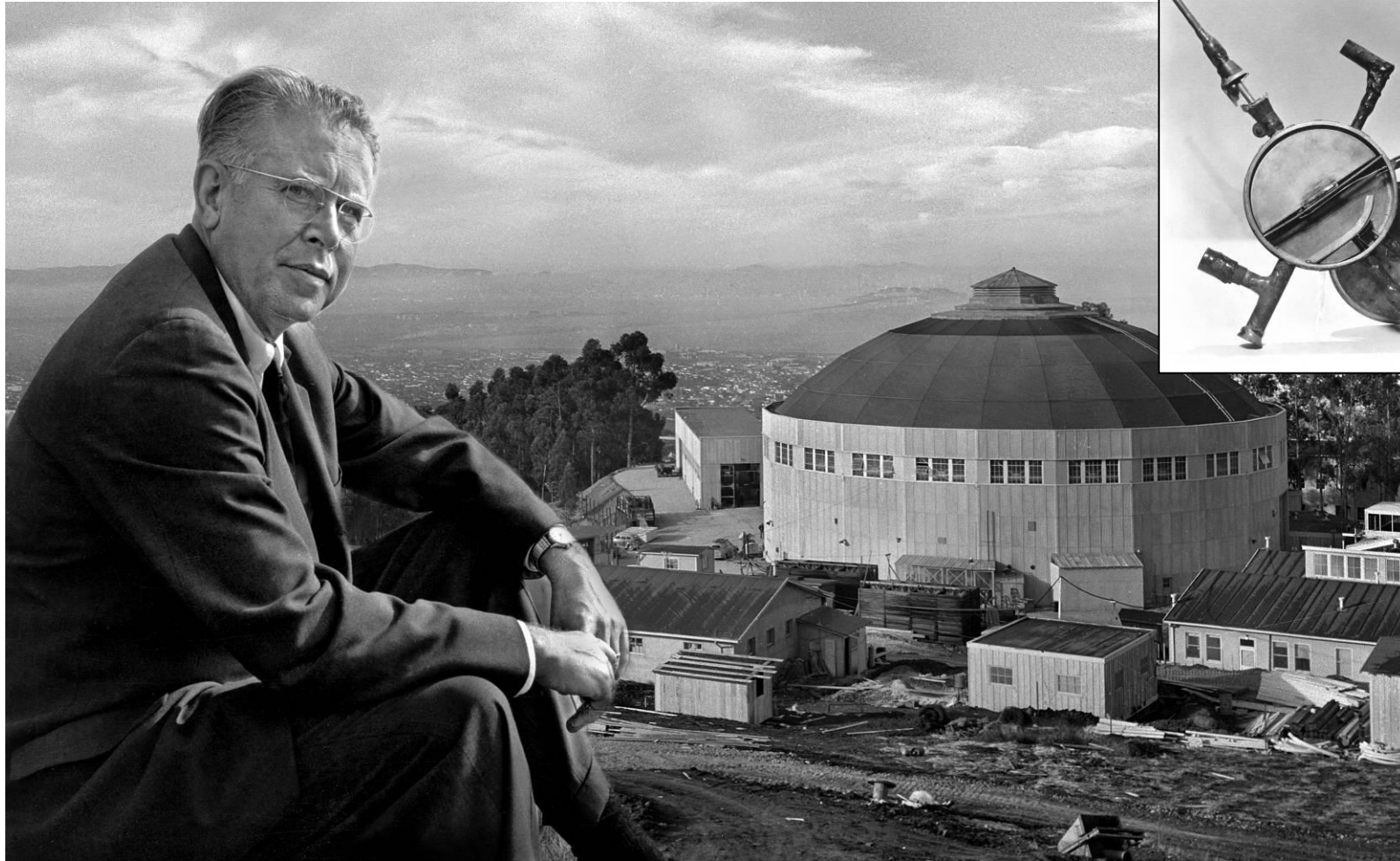
U.S. DEPARTMENT OF ENERGY

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

3,232 FTE

253 Joint faculty

500 Postdoctoral researchers

318 Graduate students

132 Undergraduates

1,674 Visiting scientists and engineers

9,484 Facility Users

FY 2021 Operating $960M

The Lab

At a Glance (FY 2020)

- <u>14 Nobel Prizes</u>
- 3,565 FTE
- 1,702 scientists and engineers
- 242 joint faculty
- 520 postdoctoral scholars
- 354 graduate students
- 164 undergraduate students
- 13,775 Facility users
- 1,728 visiting scientists and engineers

Berkeley Lab's facilities host visitors from university, industry, and research institutions

Selected Core Laboratory Strengths

- *Biological Systems Science*
- *Chemical and Molecular Science and Engineering*
- *Subsurface and Environmental Science*
- *Technologies for Energy Efficiency*
- *System Analysis for Energy Applications*
- *Photon Science*
- *Computational Science*
- *Particle- and Astro- Physics*
- *Climate Science*

Advanced Light Source

National Energy Research Scientific Computing Center

88-Inch Cyclotron

Molecular Foundry

Energy Sciences Network (ESnet)

Joint Genome Institute

National Center for Electron Microscopy

U.S. DEPARTMENT OF ENERGY | Office of Science
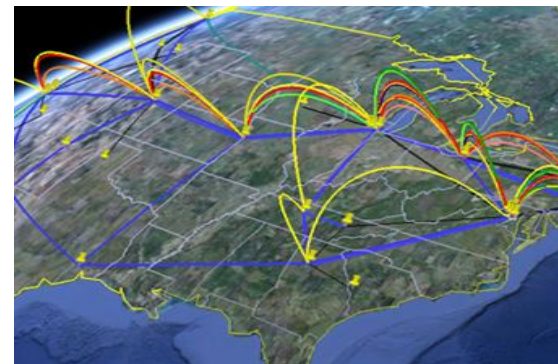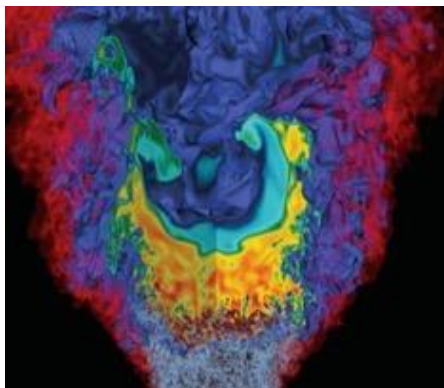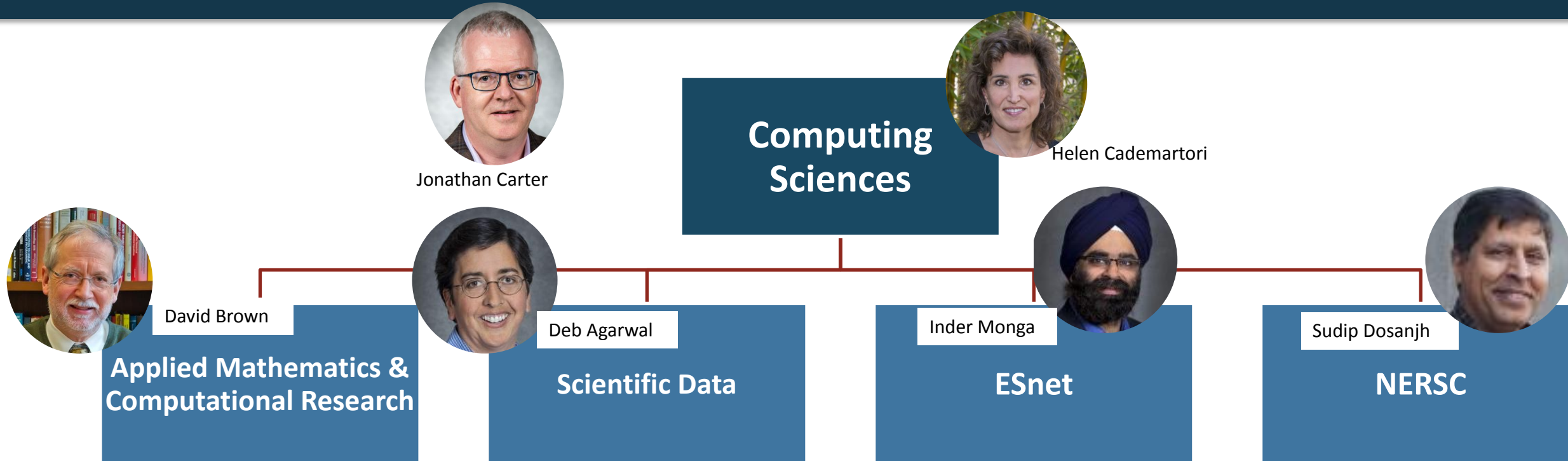
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Computing Sciences Mission

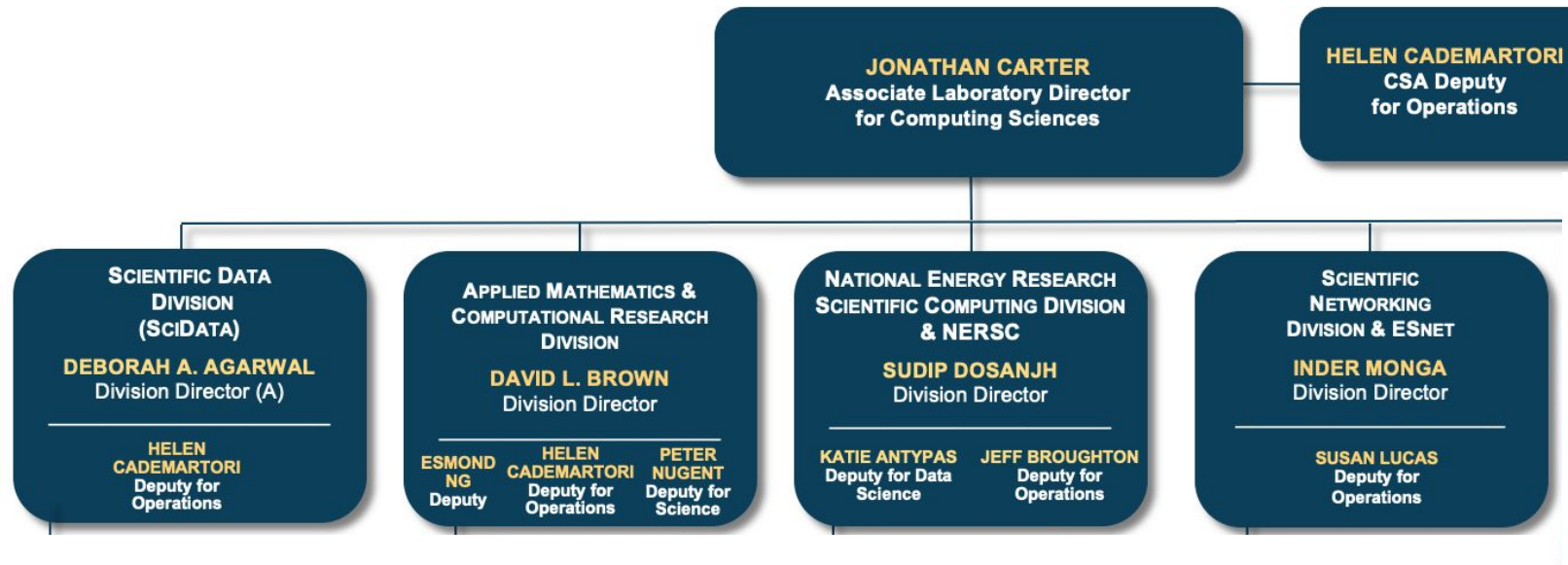**Achieve transformational, breakthrough impacts in scientific domains**

through the discovery and use of advanced computational methods and systems

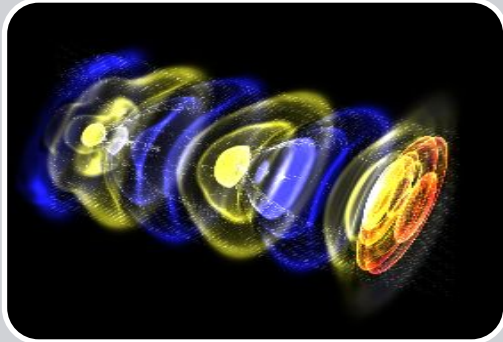**and make them accessible to the broad science community.**
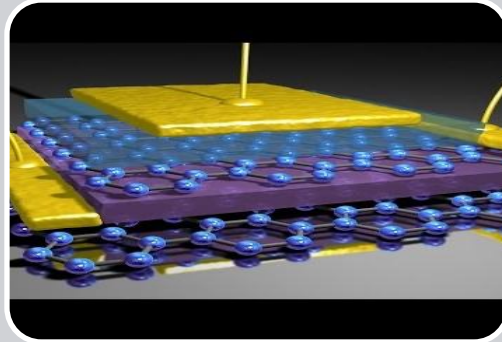
Computing Sciences Area at Berkeley Lab

Jonathan Carter

Helen Cademartori

Computing Sciences

David Brown

Applied Mathematics & Computational Research

Deb Agarwal

Scientific Data

Inder Monga

ESnet

Sudip Dosanjh

NERSC

Computing Sciences at Berkeley Lab

Applied Math & Computational Research
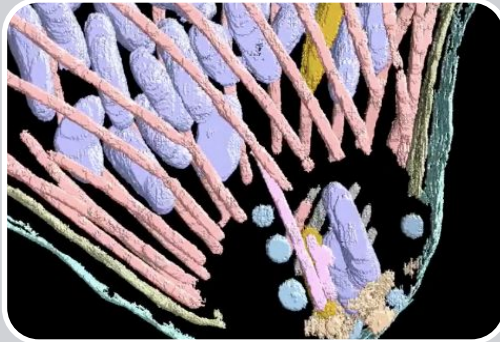

Applied Math

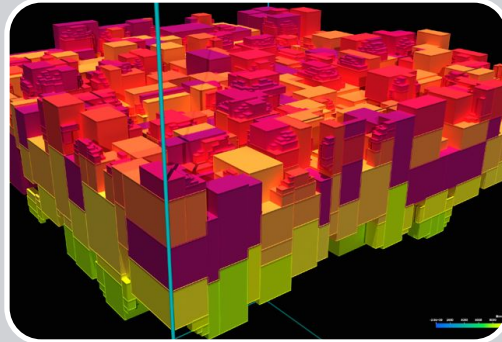**Computer Science:**

Architectures, Languages, Algorithms
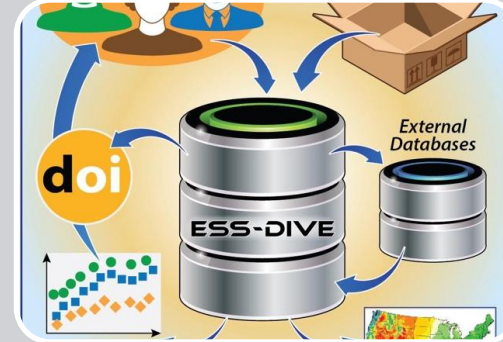
Science Partnerships: Simulation & QIS

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 <u>Office of Science</u> in the <u>U.S. Department of Energy</u>.**

- **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.
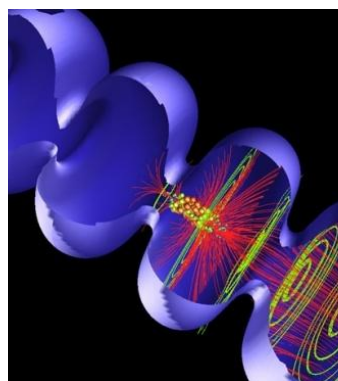
length, time →

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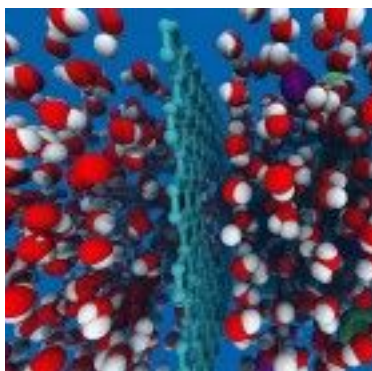
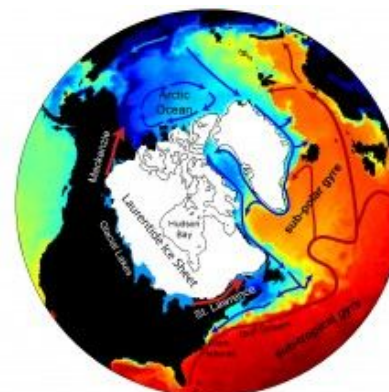MIT scientists show desalination using 1-atom thick graphene.
Nano Lett., **2012**, *12* (7)
Simsonthian Breakthrough of 2012
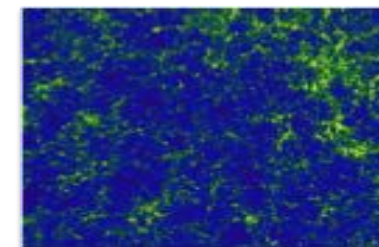
Accelerators

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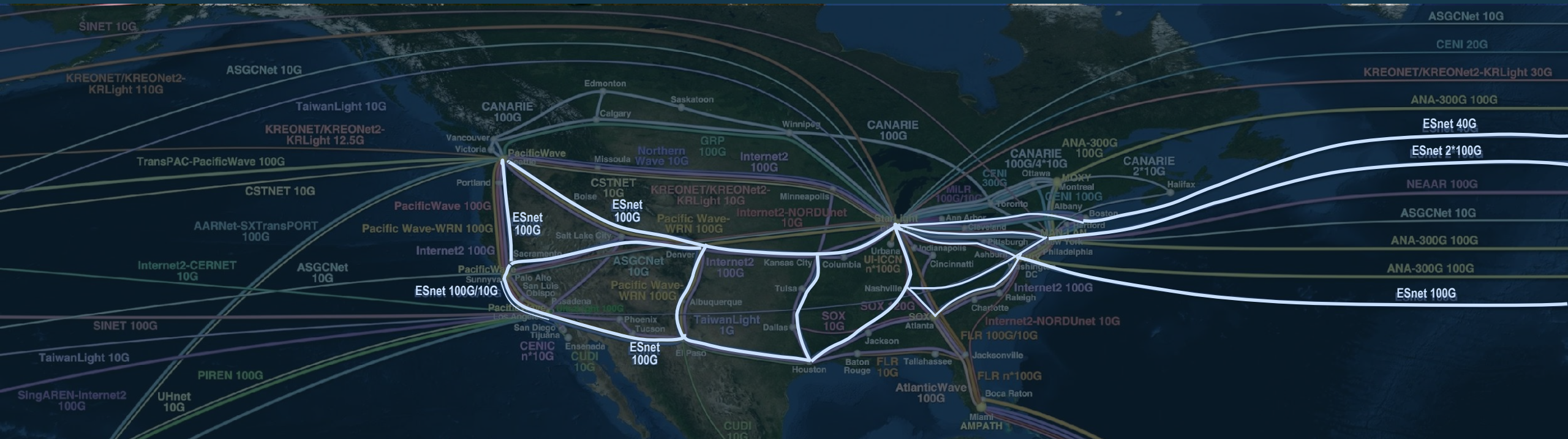
- **Networking tailored to science demands**
  - Bandwidth reservations, performance monitoring, Science "DMZ" model for the last mile,...
- **Upgrade (ESnet6) for terascale performance**
  - Driven by science data growth, new models of science, and hardware refresh
- *Quantum Networking Testbed*

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
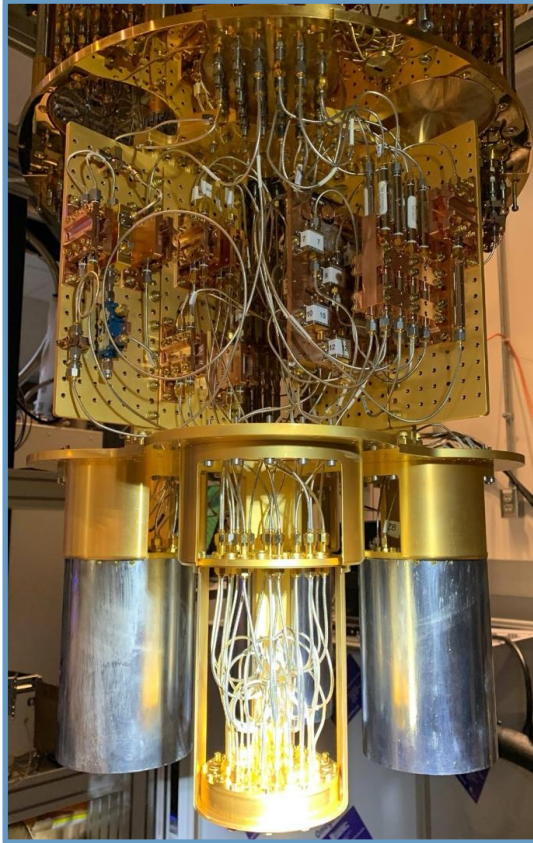 - *Now running five user projects*
- Quantum algorithms & software
- Quantum networking
- Quantum Coherence EFRC
- Quantum Imaging to Measure
  Quantum Sensing (LDRD)

- Molecular Foundry instruments
- Superconducting interfaces
- Quantum sensing, simulation, analytics for HEP
- Adiabatic Quantum Computing for Metabolite Dynamics and Geosciences
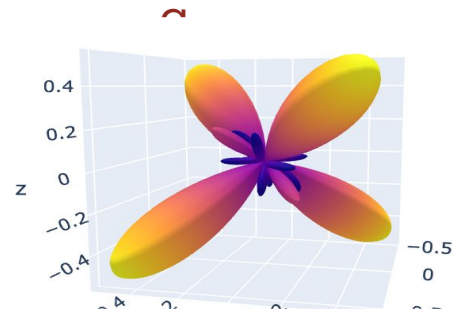- Qubit synthesis far from equilibrium

QUANTUM SYSTEMS ACCELERATOR

Catalyzing the Quantum Ecosystem

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Strategic Vision for the Future of Computing Sciences: Learning, Beyond-Moore, Superfacility

Learning

- Learn complex processes from limited, noisy or multi-resolution data
- Build domain-aware methods
- Control facilities, networks and complex systems
- Tools for new scientific discoveries

Beyond Moore

- Extreme hardware specialization
- New materials and computational models
- Algorithms for Quantum Advantage
- Methods, Software and Control Hardware for Quantum Computing
- Noise-resilient, Scalable, Qubit Architectures
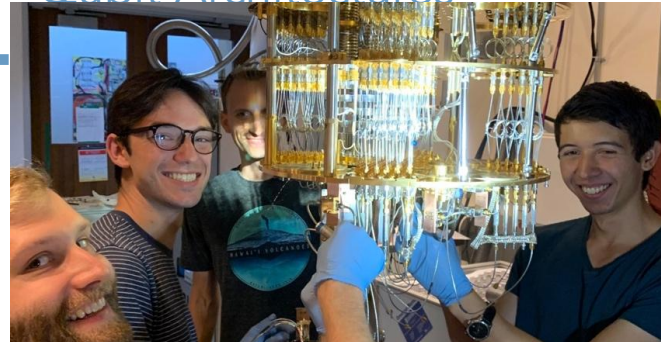
Superfacility

- Storage and analysis supporting FAIR data principles
- Automate data processing and management for science
- Dynamic reconfiguration of resources
- Integration of networking, storage, and computing
- Testbeds for exploring wireless, data caching, edge computing

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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**

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?**

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**

- **Use the shuttle or a bike to get on site**

A Map of Berkeley Lab
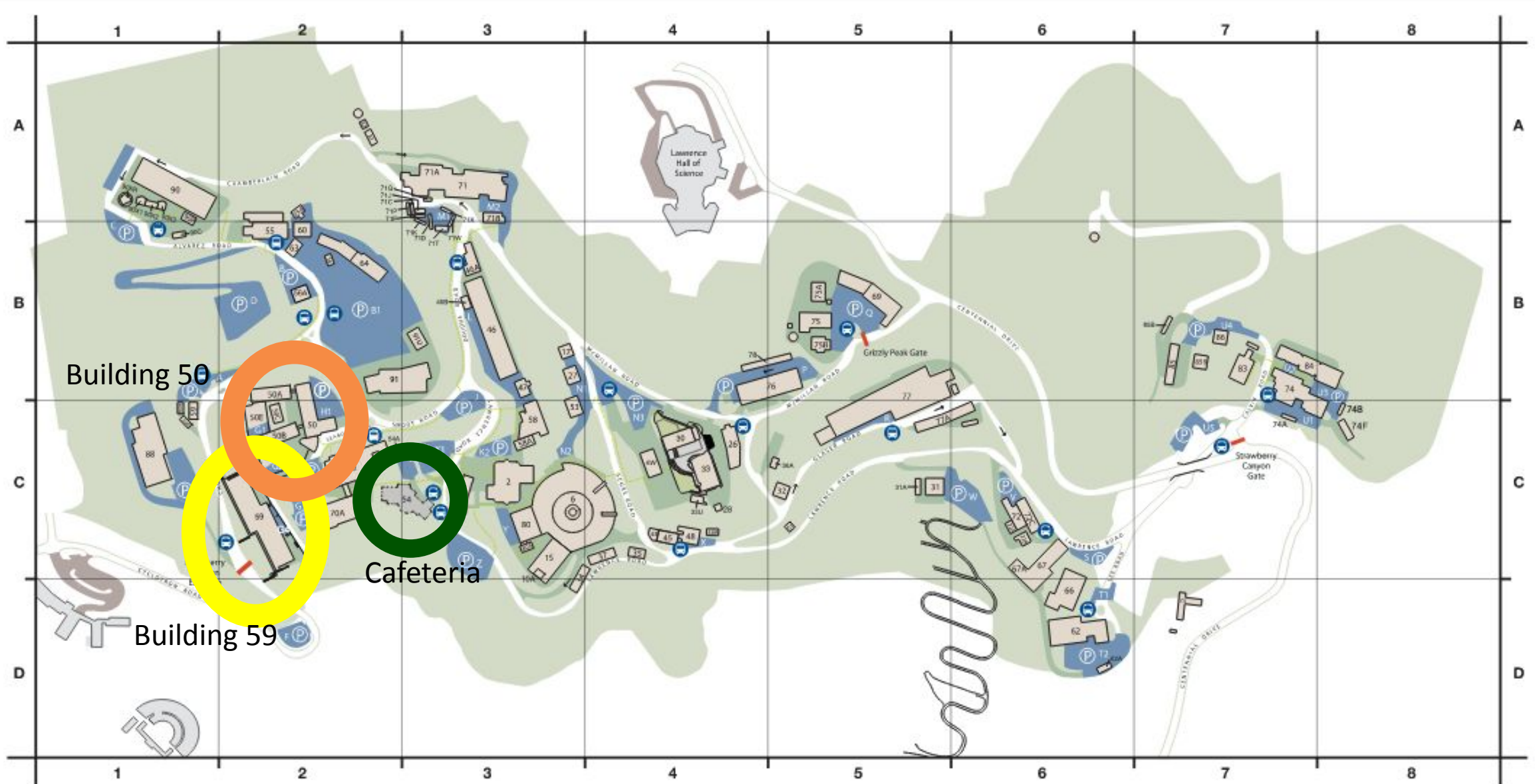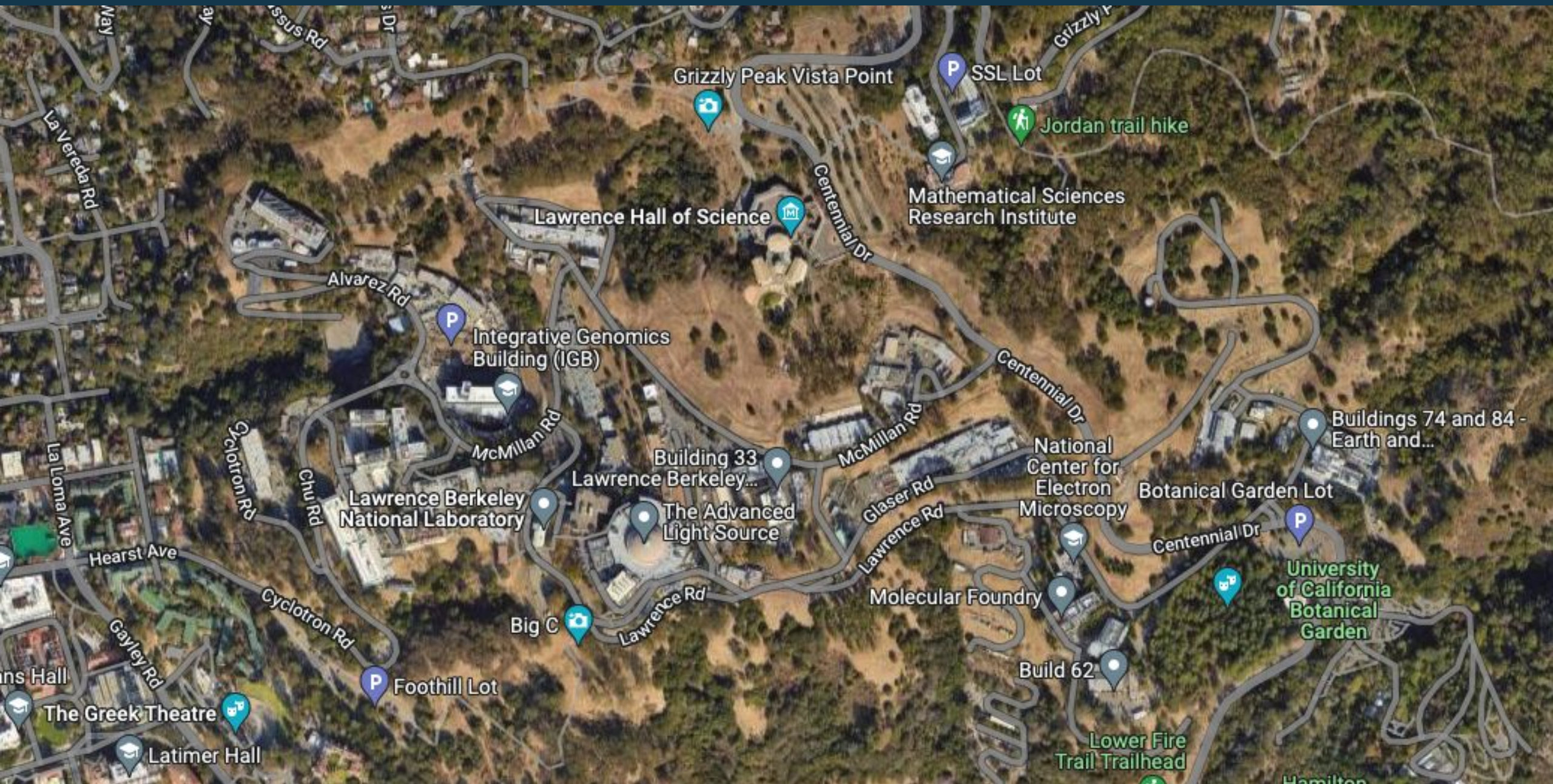
Building 50

Building 59

Cafeteria

2022 Summer Student Safety Orientation
June 1, 2022
Sarah McGinn - Division Safety Coordinator

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Incident Reporting

All injuries and near misses must be reported to your supervisor and DSC.

Timely reporting is critical in allowing us to ensure that the injured worker receives the necessary treatment and care; as well as allows us to correct any hazards in order to prevent the same injury from occurring again and disseminate lessons learned.

➔ For life-threatening emergencies, please **contact 911**.

➔ Report all non-life threatening injuries and illnesses (including all positive COVID-19 cases) to Health Services at **510-486-6266**.

➔ If experiencing ergo discomfort, please reach out to myself or ergo@lbl.gov

NOTICE

All Injuries, No Matter How Slight, Must Be Reported Immediately.

When to Contact Health Services (COVID-19)

You are required to contact Health Services at 510-486-6266 if:

- You have COVID symptoms
- You have a positive test for COVID
- You have close contact with someone who has COVID or has COVID symptoms.

In all three instances **DO NOT COME TO THE LAB. CALL Health Services at 510-486-6266 for guidance. ALL CALLS TO HEALTH SERVICES ARE CONFIDENTIAL.**

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In the event of Fire

- **ALWAYS** call 911 if you see smoke or flames. Even if you are present and safely able to extinguish the fire, still report the incident to 911 so the fire department can follow up and confirm it's completely out.

  - ➔ From a landline, you can dial 911, 7911, 9911. All will reach the 911 dispatcher and building and room information will be provided to them for the landline location you are calling from.
  - ➔ From a cell phone, the cell phone number is passed to the dispatcher but the exact location will not be passed. You can dial 510-486-7911 or 911.
  - ➔ If you are near a landline use the landline. In an emergency, if a cell phone is closer (i.e. you are outside) use the cell phone. The dispatcher will confirm with you the location you are calling from.

- If you see evidence that fire took place but the fire is not currently active (including within electrical equipment) please report immediately to your supervisor and DSC. Reporting these events as early as possible will allow us to align with the Electrical Safety Team and Facilities to ensure that additional hazards aren't present and the appropriate corrective actions are taken. All deranged equipment must be reported to EHS electrical safety so that we can stay compliant with the Electrical Equipment Safety Program, as well as to share lessons learned across the Lab.

Wildfire Prevention: Smoking at the Lab

It is anticipated that 2022 will be the worst wildfire season in CA to date, but unfortunately we've seen a high degree of carelessness when it comes to smoking and disposing of cigarettes onsite. Only smoke in **designated areas** and properly dispose of cigarette butts in the designated receptacles. Smoking is prohibited in Lab vehicles. Per the Fire Marshal, anyone caught violating the smoking protocols onsite will be reported through the HR disciplinary process. **See the RPM for further details.**

DO NOT:

- Dispose of cigarettes in the dry brush
- Dispose of cigarettes in the trash receptacles at the building entrances
- Smoke in restrooms and/or dispose of your cigarette in the bathroom trash can
- Dispose of cigarettes in wooden posts

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Working Onsite During the Pandemic

Requirements:

- [Weekly Symptom Check](#)
- WPC acceptance (Division specific activity)
- [LBL0012](#) Online Training
- Masks/Testing/Distancing*
- Wear your badge at all times

Resources:

- [covid.lbl.gov](#)
- [EHS COVID Site](#)

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Integrated Safety Management (ISM)

The objective of ISM is to perform work in a safe and environmentally sound manner.

Each employee is responsible for ensuring their own safety.

ISM Checklist:

1. What will I be doing?
2. Do I know what the hazards are?
3. Do I have everything I need to do the job safely: training, tools, time, and authorization?
4. Am I doing the job safely?
5. What can we do better?

https://cs.lbl.gov/safety-and-health/resources/introduction-to-safety/overview-of-ism-integrated-safety-management/

Work Planning and Control (WPC)

What is WPC?

Work Planning and Control (WPC) is a program to implement integrated safety management (ISM). The main goals of WP&C are the following:

- All hazards are analyzed and controlled
- All workers demonstrate that they are qualified to perform activities
- All work is authorized
- All authorizations (job hazard analysis, activity hazard documents, biological use authorizations, rad work authorization) are combined in a single program

https://wpc-am.lbl.gov/Activities/Workers/WorkerSummary

Berkeley Lab Training (BLT)

What is BLT?

Berkeley Lab Training (BLT) is the training platform that houses all training courses, both safety-related and those driven by institutional requirements.

Whereas WPC only shows you courses driven by your Work Activities, BLT is a one-stop shop for all Berkeley Lab training courses.

https://blt.lbl.gov/start.aspx

Questions for Sarah?

Advice . . . .

- **Have a goal of coming away from the summer with a tangible product: code, paper, ???**

- **Give at least one talk 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 . . .

- **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**

Fun Exploration on the site

- **The buildings are not laid out in order, how are they organized?**
- **How many stairways are there at the lab?**
- **Why are there so many different part to building 50?**
- **Where can you see the Cal C from the lab?**
- **How do you get to the UCB botanical garden?**
- **What is the weirdest plant at the botanical garden?**
- **Why does the ALS building have that dome and why is the building shaped the way it is?**
- **How many nobel prize winners currently work at LBL?**
- **Where can you buy Berkeley Lab gear?**

- **Questions?**