

Berkeley Lab Welcomes NUG

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Computing Sciences Area Deputy

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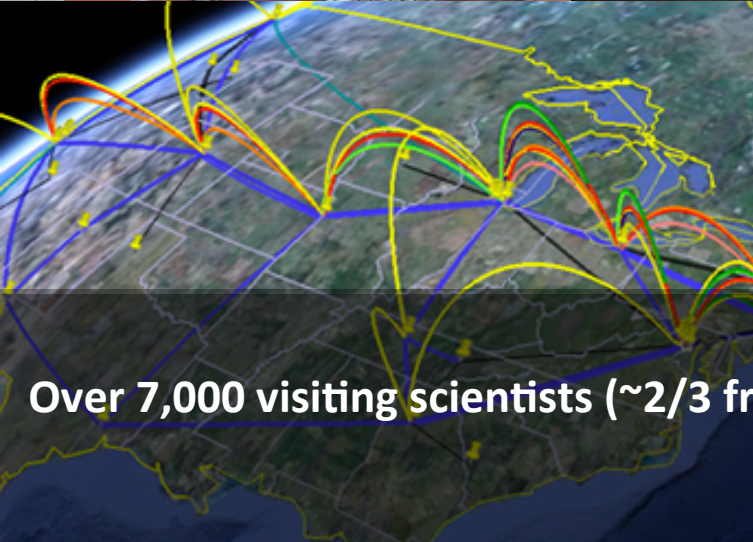
80 Years of World Leading Team Science at Lawrence Berkeley National Lab



- **Managed and operated by UC for the U.S. Department of Energy**
- **~250 University of California faculty on staff at LBNL**
- **4200 Employees, ~\$820M/year Budget**
- **13 Nobel Prizes**
- **63 members of the National Academy of Sciences (~3% of the Academy)**
- **18 members of the National Academy of Engineering, 2 of the Institute of Medicine**



World-Class User Facilities Underpin Today's Berkeley Lab



Over 7,000 visiting scientists (~2/3 from universities) use Berkeley Lab research facilities each year

Berkeley Lab Science Focus Areas



BIOSCIENCES



**ENERGY & ENVIRONMENTAL
SCIENCES**



PHOTON SCIENCES

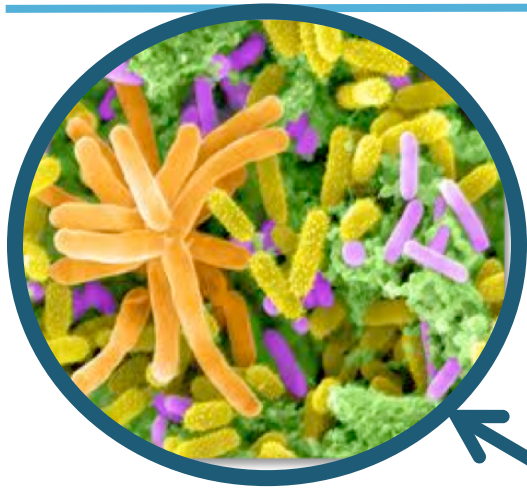


COSMOLOGY & PHYSICS



COMPUTING SCIENCES

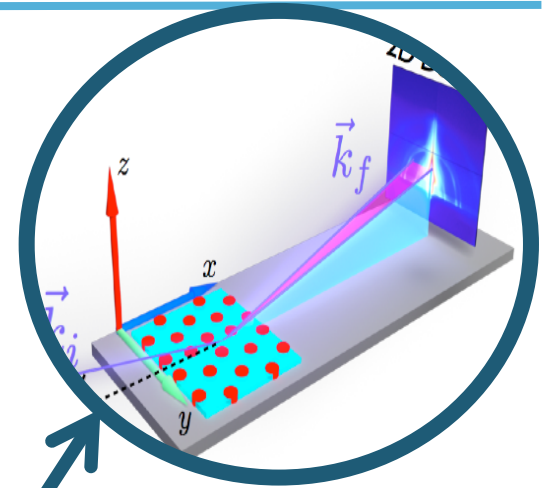
Computing is Essential for Science Programs in All Areas of the Lab



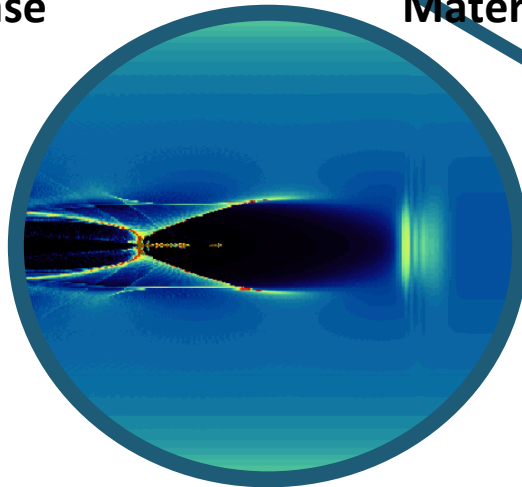
**BIOSCIENCES: JGI
& KBase**



**ENERGY & ENVIRONMENTAL:
Materials Genome**



**PHOTON SCIENCES:
CAMERA**



COSMOLOGY & PHYSICS: BELLA



COMPUTING SCIENCES

Computing Sciences at Berkeley Lab

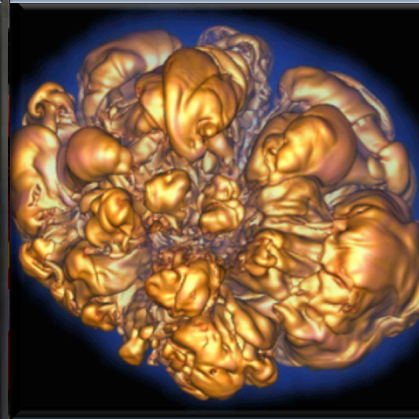
NERSC Facility



ESnet Facility



Computational Research



Applied Mathematics

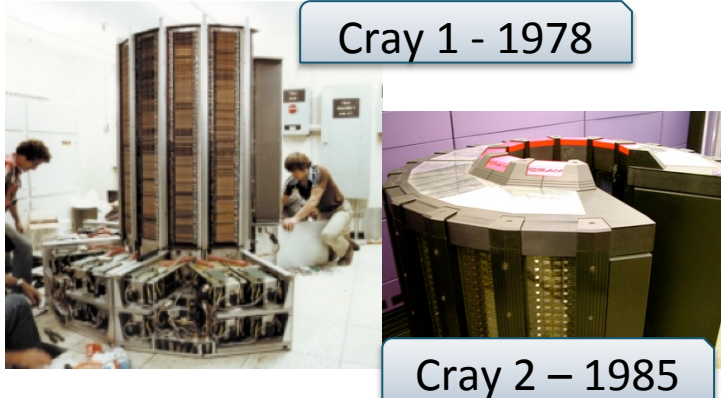


Computational Science

$$\begin{aligned} \frac{d\text{Var}(t)}{dt} &= \\ & -K^2 Fg + gK^2 F ds - \int_{s_2(t)}^{s_1(t)+S} -(g^{-1}F_s)_s - K \\ & = -\int_{s_2(t)}^{s_1(t)} (g^{-1}F_s)_s ds + \int_{s_2(t)}^{s_1(t)+S} (g^{-1}F_s)_s ds \\ & \left[g^{-1}F_s |_{s_2(t)} - g^{-1}F_s |_{s_1(t)} \right] + \left[g^{-1}F_s |_{s_1(t)+S} - g^{-1}F_s |_{s_2(t)+S} \right] \\ & = -2(g^{-1}F_K K_s) |_{s_2(t)} + 2(g^{-1}F_K K_s) |_{s_1(t)} \end{aligned}$$

Computer Science

NERSC History



Cray 1 - 1978

Cray 2 - 1985



Cray T3E Mcurie - 1996



IBM Power3 Seaborg - 2001

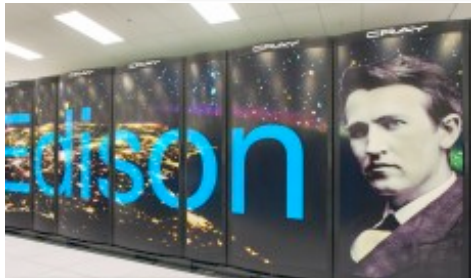
1974	Founded at Livermore to support fusion research with a CDC system
1978	Cray 1 installed
1983	Expanded to support today's DOE Office of Science
1986	ESnet established at NERSC
1994	Cray T3D MPP testbed
1996	Moved to Berkeley Lab
1996	PDSF Data intensive computing cluster for nuclear physics
1996	Cray T3E MMP production system
1994 - 2000	Transitioned users from vector processing to MPP
2001	IBM SP production system

NERSC History

Cray XT4 Franklin - 2007



Cray XE6 Hopper - 2010



Cray XC30 Edison - 2013

2005	HPSS becomes mass storage platform
2006	NERSC Global filesystem
2007	Cray returns to NERSC
2010	First petaflop system
2012	Genepool Cluster for Joint Genome Institute (JGI) biosciences computing
2013	Latest NERSC system, Edison, accepted

The Computational Research and Theory (CRT) building will bring NERSC back to the hill

- **Four story, 140,000 GSF**
 - 300 offices on two floors
 - 20K -> 29Ksf HPC floor
 - 12.5MW -> 42 MW to building
- **Located for collaboration**
 - CRD and ESnet
 - UC Berkeley
- **Exceptional energy efficiency**
 - Natural air and water cooling
 - Heat recovery
 - PUE < 1.1
 - LEED gold design
- **Initial occupancy Fall 2014**





In Memory of Mike Welcome, NERSC Storage Systems Group

During his 30-year career, Mike made significant contributions in applied math, system administration and improving the efficiency of HPC systems.

Some of his projects were:

- SISAL – an early parallel programming language
- Boxlib AMR library
- Job scheduling on the T3E
- GASnet for UPC on the Cray XT4
- HPSS tape archive software