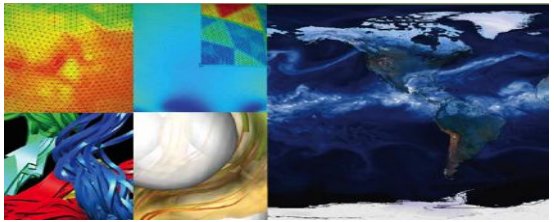
NERSC Quantum Day

Richard Gerber
NERSC Senior Science Advisor
NERSC HPC Department Head
Oct. 24, 2022

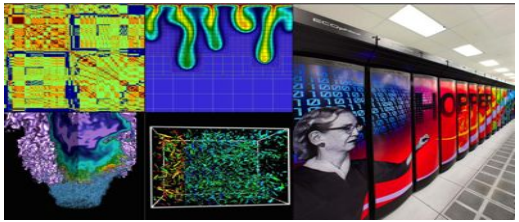
NERSC: Mission HPC for DOE Office of Science Research

U.S. DEPARTMENT OF ENERGY | Office of Science

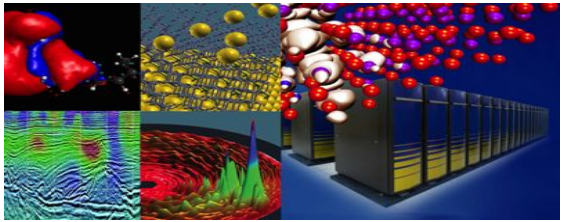
Largest funder of physical science research in the U.S.



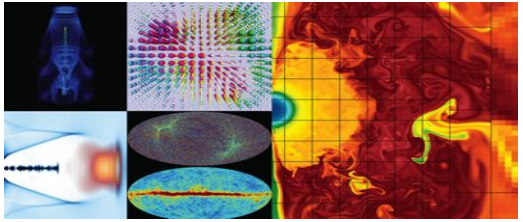
Bio Energy, Environment



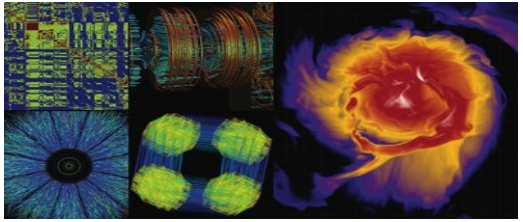
Computing



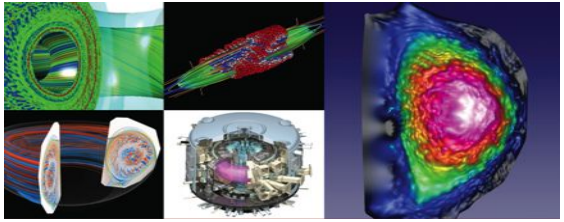
Materials, Chemistry, Geophysics



Particle Physics, Astrophysics



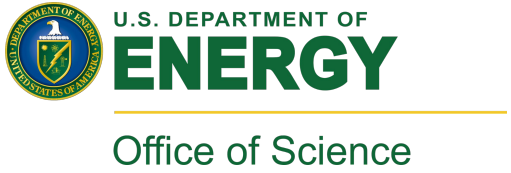
Nuclear Physics



Fusion Energy, Plasma Physics

NERSC Mission

The mission of the National Energy Research Scientific Computing Center (NERSC) is to accelerate scientific discovery at the DOE Office of Science through high performance computing and data analysis.



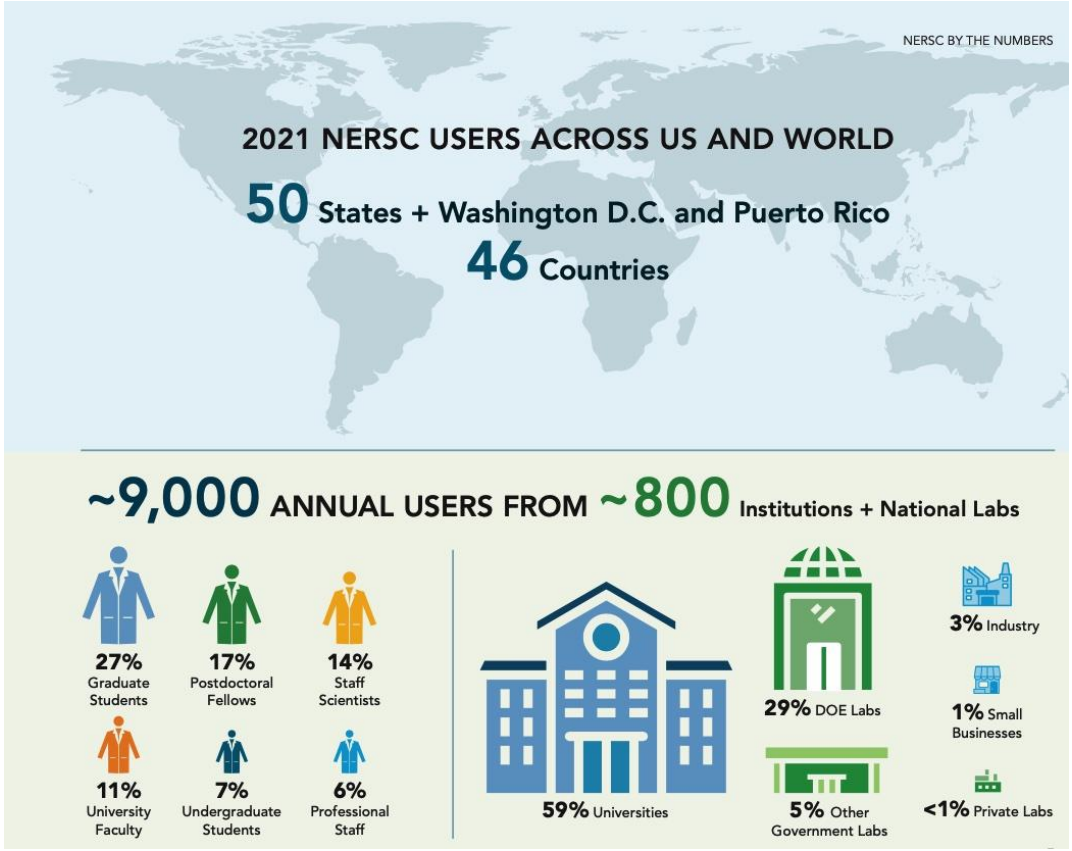
HPC for DOE Office of Science Mission Research

NERSC is the mission provider of high performance computing and data resources and services to Office of Science programs — Advanced Scientific Computing Research, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, High Energy Physics, and Nuclear Physics.

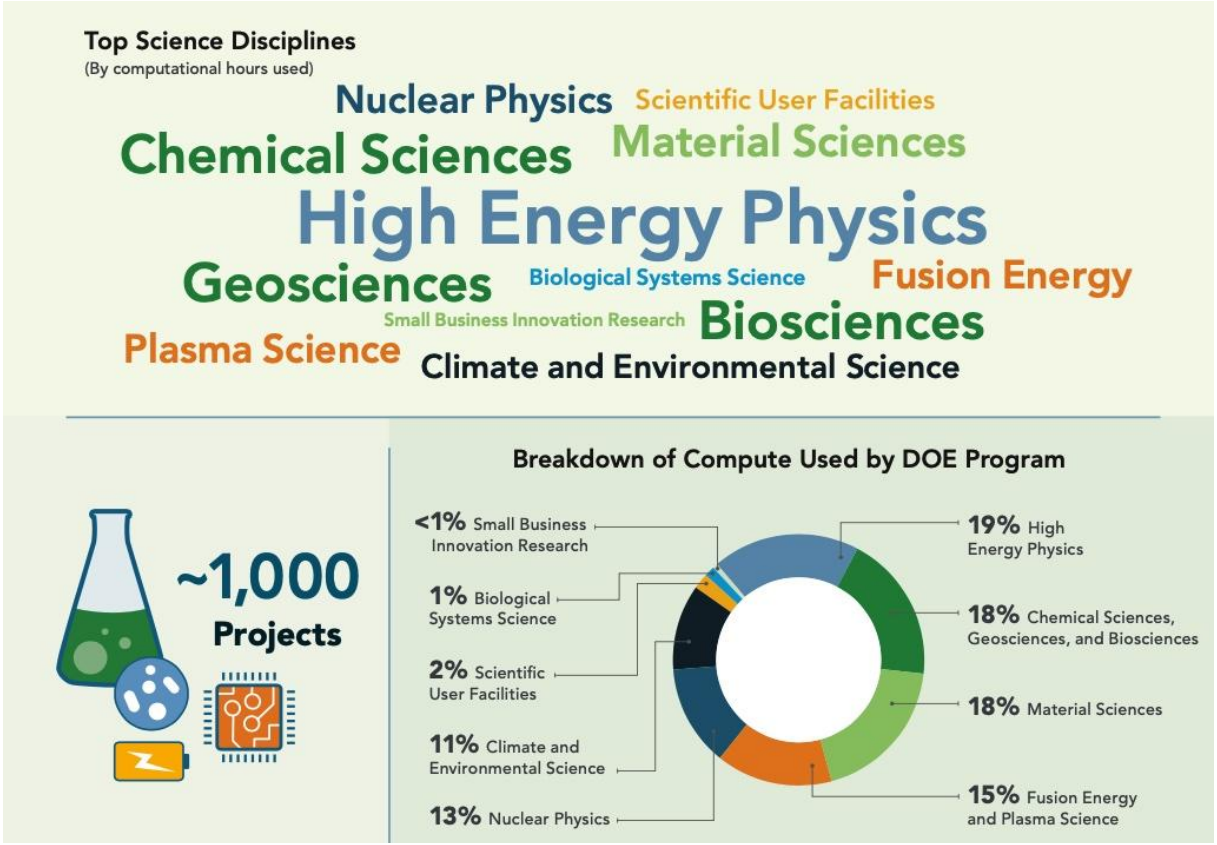
Collaboratory Science of Scale

Computing is a tool as vital as experimentation and theory in solving the scientific challenges of the twenty-first century. Fundamental to the mission of NERSC is enabling computational science of scale, in which large, interdisciplinary teams of scientists attack fundamental problems in science and engineering that require massive calculations and have broad scientific and economic impacts.

NERSC by the Numbers



NERSC by the Numbers



>2,000

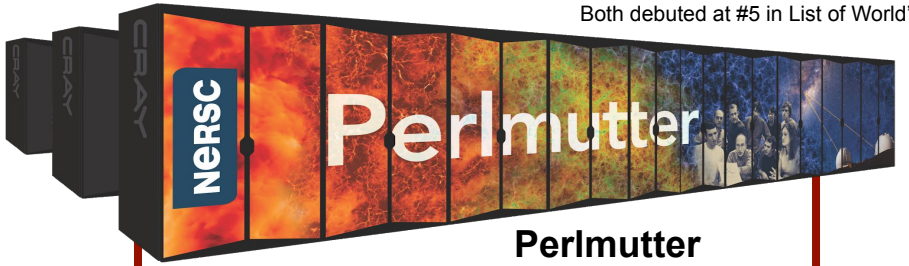
Scientific Journal Articles per Year

NERSC Systems Fall 2022

Still in Early Science
pre-production phase

Plan to retire
in early 2023

Both debuted at #5 in List of World's Most Powerful supercomputers



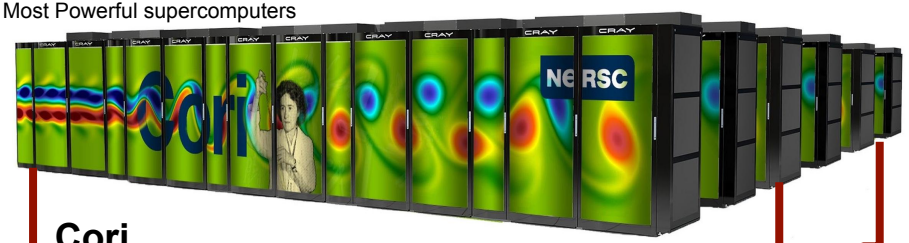
Perlmutter

1,536 GPU-accelerated nodes
4 NVIDIA A100 GPUs + 1 AMD "Milan" CPU
384 TB (CPU) + 240 TB (GPU) memory
3,072 CPU-only nodes
2 AMD "Milan" CPUs
1,536 TB CPU memory
HPE Slingshot 11 ethernet-compatible interconnect
4 NICs/GPU node, 1 NIC/CPU node

TOP 500 The List.
#7, 93.8PF Peak

5 TB/s

35 PB
All-Flash
Scratch



Cori

9,600 Intel Xeon Phi "KNL" manycore nodes
2,000 Intel Xeon "Haswell" nodes
700,000 processor cores, 1.2 PB memory
Cray XC40 / Aries Dragonfly interconnect
30 PF Peak

1.5 TB/s

2 PB
Burst Buffer

700 GB/s

28 PB
Scratch

50 GB/s

HPSS Tape Archive ~200 PB

DTNs, Spin, Gateways

ESnet ENERGY SCIENCES NETWORK
2 x 100 Gb/s
SDN

Ethernet & IB Fabric
Science Friendly Security
Production Monitoring
Power Efficiency
LAN

100 GB/s

120 PB
Common
File
System

5 GB/s

275 TB
/home

Leadership in HPC

NERSC provides leadership in providing world-class HPC capabilities and preparing Office of Science research teams for next generation technologies.

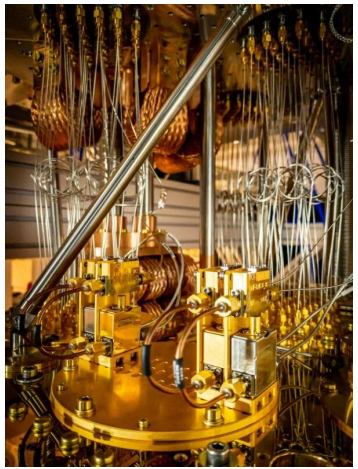
For 35 years the science community has come to expect exponential growth in HPC capability. How do we continue to meet these expectations?

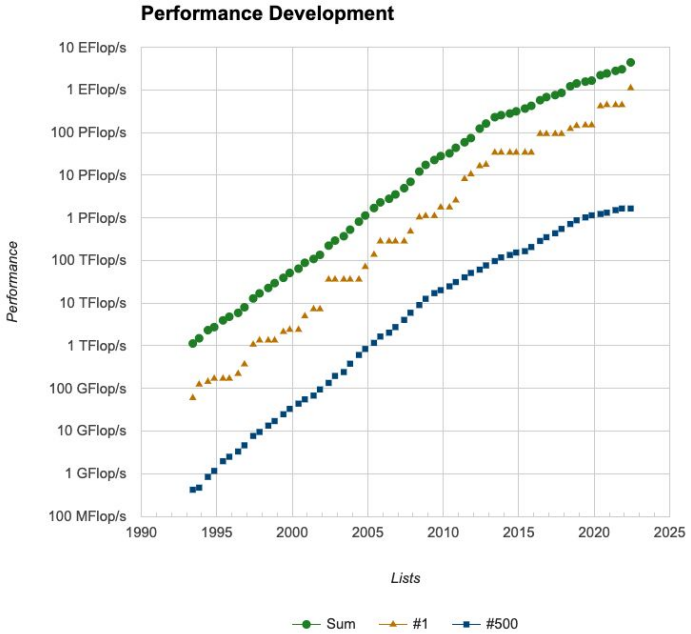
A large fraction of NERSC projects are doing research into systems that are fundamentally quantum in nature.

- 279 (30%) project descriptions contain the word (“quantum”)

We’re looking into how NERSC will contribute to providing leadership computing QIS capabilities for our users.

- Hiring
- Collaboratory research
- Using our resources to support QIS research





Welcome and Enjoy The Day!

Thank you to those who inspired the day and organized the event.

Katie Klymko

Daan Camps

Neil Mehta