



NERSC

**National Energy Research
Scientific Computing Center**

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High Performance Computing Department Head

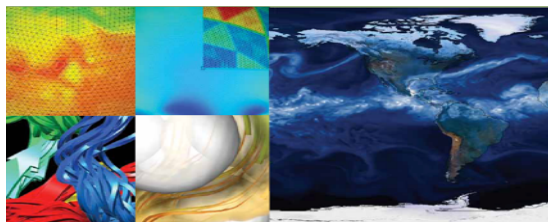
NERSC: the Mission HPC Facility for DOE Office of Science Research



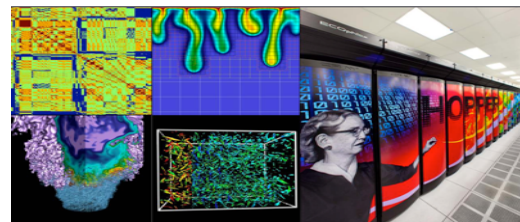
U.S. DEPARTMENT OF
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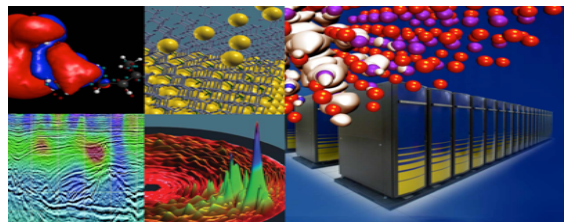
Largest funder of physical
science research in the U.S.



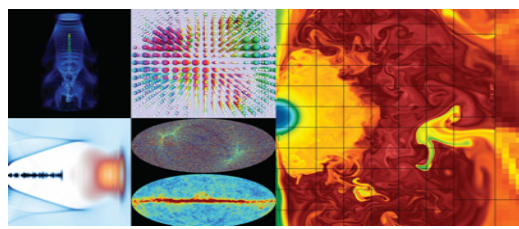
Bio Energy, Environment



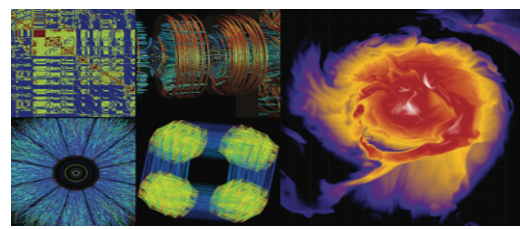
Computing



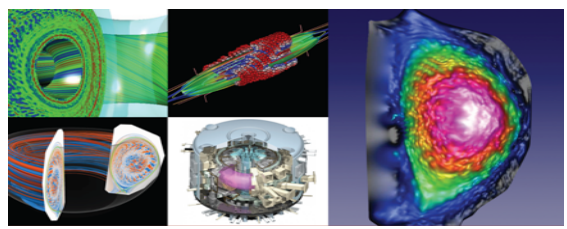
Materials, Chemistry, Geophysics



Particle Physics, Astrophysics



Nuclear Physics



Fusion Energy, Plasma Physics

6,000 users, 700 projects, 700 codes, 48 states, 40 countries, universities & national labs



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Focus on Science



NERSC supports the broad mission needs of the six DOE Office of Science program offices

6,000 users and 750 projects

Supercomputing and data users

NERSC science engagement team provides outreach and POCs

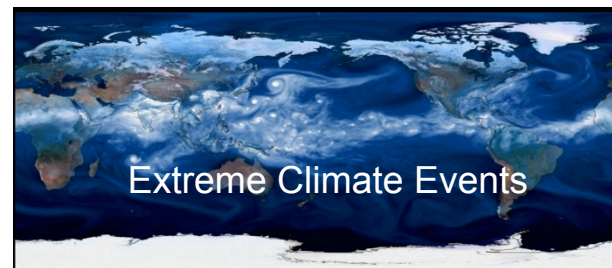
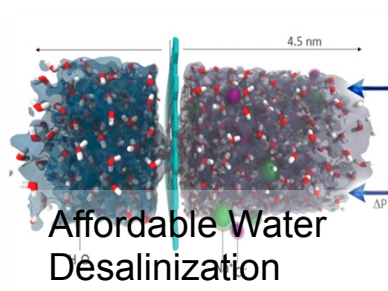
2,000 refereed publications in 2016



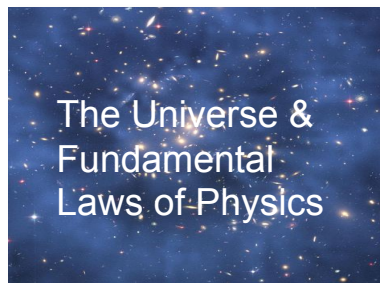
High Performance Computing (HPC) at NERSC is ...



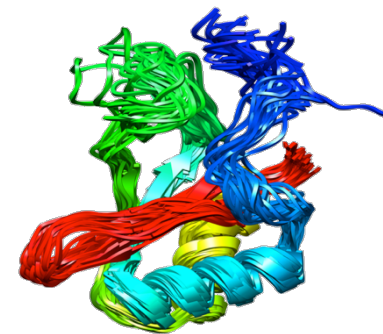
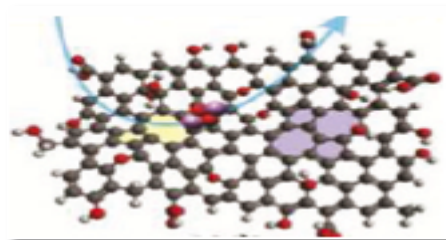
... the application of "supercomputers" and big data systems to computational and data problems that are too large for standard computers, would take them too long, would be too dangerous, or probe inaccessible realms.



Protein structure & function

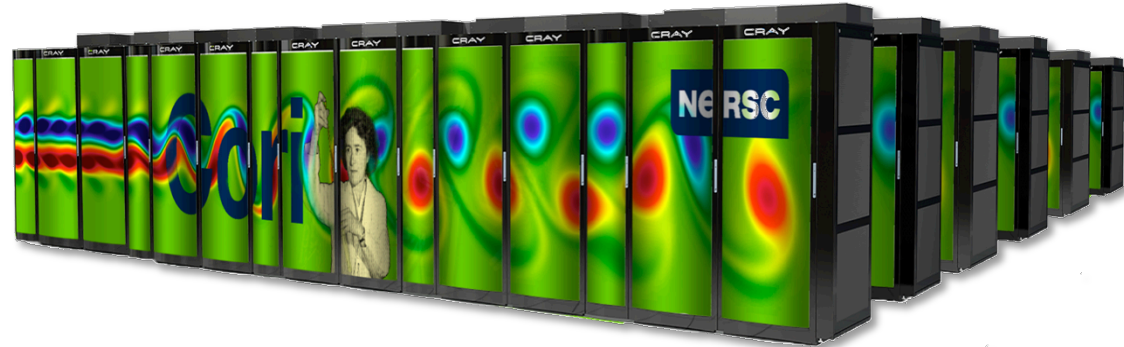


Better Batteries



Cori

9,300 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 PB Lustre Cray Sonexion scratch FS
1.5 PB Burst Buffer



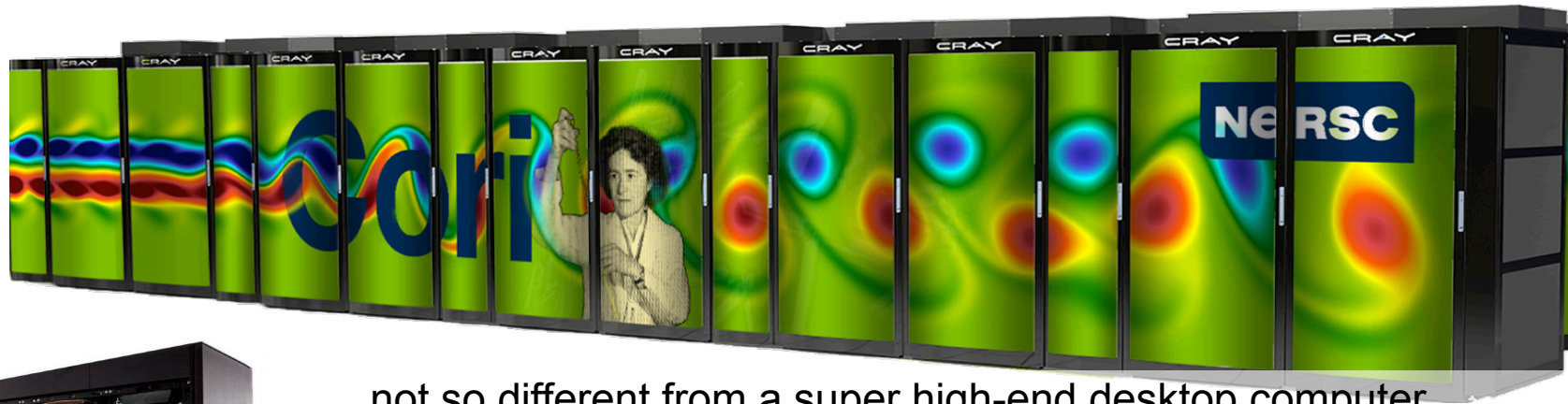
#6 on list of Top 500 supercomputers in the world



Edison

5,560 Ivy Bridge Nodes / 24 cores/node
133 K cores, 64 GB memory/node
Cray XC30 / Aries Dragonfly interconnect
6 PB Lustre Cray Sonexion scratch FS

A Supercomputer is ...



... not so different from a super high-end desktop computer.

Or rather, a lot of super high-end desktop computers.

Cori has 11,000 “nodes” (each ~a powerful high-end desktop)

700,000 compute cores
~ 30×10^{15} calculations/second



**7 billion
and counting**

∑ TheWorldCounts

7 billion people
on 4 million Earths
doing 1 calculation
each second
= 1 Cori

Custom Powerful Network



The nodes are all connected to each other with a high speed, low latency network.

This is what allows the nodes to “talk” to each other and **work together to solve problems** you could never solve on your laptop or even 150,000 laptops.

Typical point-to-point bandwidth

Supercomputer: 10 GBytes/sec

Your home: 0.02* GBytes/sec

5,000 X

Latency

Supercomputer: 1 μ s

Your home computer: 20,000* μ s

20,000 X



Cloud systems have slower networks

* If you're really lucky

How big is
26 PBs?

338 years of
HD video

1/2 the entire
written works
of mankind
ever, in all
languages

PBs of fast storage for files and data

Cori: 26 PB
Your laptop: 0.0005 PB
Your iPhone: 0.00005 PB

45,000 X

Write data to permanent storage

Edison: 140 GB/sec
My iMac: 0.01 GB/sec

14,000 X



Cloud systems
have slower I/O
and less
permanent
storage

HPSS tape library:
100 PB



NERSC at a Glance

A U.S. Department of Energy Office of Science User Facility
Provides High Performance Computing and Data Systems and Services
Unclassified Basic and Applied Research in Energy-Related Fields
6,000 users, 750 different scientific projects
Located at Lawrence Berkeley National Lab, Berkeley, CA
Permanent Staff of about 70

