

Early Science on NERSC's Cori: A Cray XC40 Intel Xeon Phi Based Supercomputer

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Office of Science

Bio Energy, Environment



Particle Physics, Astrophysics



Computing





Materials, Chemistry, Geophysics



**Nuclear Physics** 



Fusion Energy, Plasma Physics

7,000 users, 750 projects, 700 codes, 48 states, 40 countries, universities & national labs





Office of

Science

Cori





Cray XC40 : 9,688 Intel Xeon Phi (KNL) nodes : 2,388 Intel Xeon (Haswell) nodes #5 on list of Top 500 supercomputers in the world November 2016







# NERSC's KNL Challenge

Enable NERSC's diverse community of 7,000 users, 750 projects, and 700 codes to run on Cori's Intel Xeon Phi Knights Landing processors at high performance





### **NESAP Code Improvements on KNL**



National Energy Research Scientific Computing Center



### KNL Improvements vs. "Business as Usual"



National Energy Research Scientific Computing Center



### **KNL Usage**



#### Contrary to our concerns, demand for the KNL nodes is great.



Day



**KNL Science 2017** 



2.6 billion NERSC Hours to science in 2017 to date (June 9)

Boon to science: More than all 2016 NERSC Hours

KNL node "performance factor" = 1.2X Haswell dual socket node



Cori KNL Hours Used Jan-Jun 2017





## **Top NERSC KNL Projects**

min

BERKELEY LAB



Project	PI	NERSC Hours
Domain Wall Fermions & Highly Improved Staggered Quarks for LQCD	Christ, Columbia	420,058,594
Extending the capabilities of Quantum Espresso for Cori	Kent, ORNL	256,725,129
Quantum Chromodynamics with four flavors of dynamical quarks	Toussaint, Arizona	202,709,225
Catalyst Design for Environmentally Benign Energy Production	Mavrikakis, Wisc.	199,249,907
Wall-Resolved Large Eddy Simulations of Transonic Shock-Induced Flow Separation	Malik, NASA	146,650,664
The Materials Genome	Persson, LBNL	105,639,633
Accelerated Climate Modeling for Energy	Leung, PNNL	104,689,290
Version vormal Shock	Separation MATERIALS PROJECT	



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#### Summary of NERSC Experiences

Cori with light-weight Intel Xeon Phi processors provides unprecedented capability for DOE Office of Science research

NESAP has enabled large percentage of NERSC workload to run efficiently on new class of manycore system

Lessons learned and knowledge gained are being communicated to and applied by NERSC community

Collaborations with application teams, vendors, and HPC community are necessary for success