



U.S. DEPARTMENT OF
ENERGY

Office of
Science

DOE Interest for Supporting 5G Enabled Energy Innovation

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Office of Science
Advanced Scientific Computing Research

January 13, 2020

DOE Missions

Energy

Catalyze the timely, material, and efficient transformation of the nation's energy system and secure U.S. leadership in energy technologies.

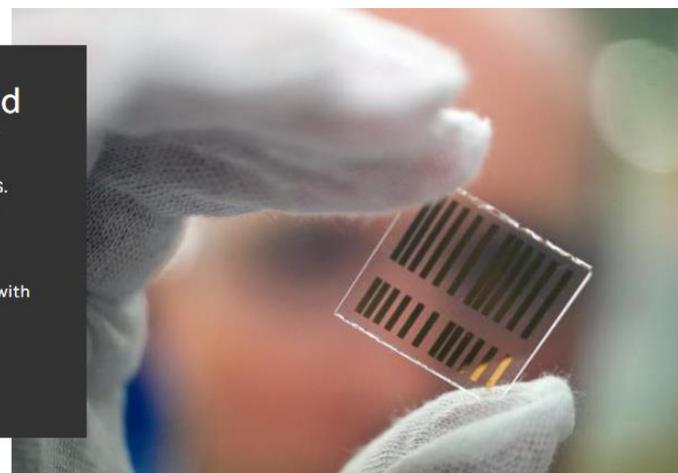
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Science and Innovation

Maintain a vibrant U.S. effort in science and engineering as a cornerstone of our economic prosperity with clear leadership in strategic areas.

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Nuclear Safety and Security

Enhance nuclear security through defense, nonproliferation, and environmental efforts.

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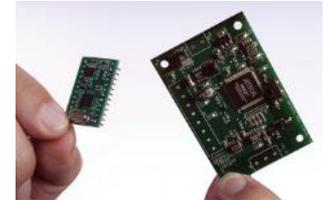
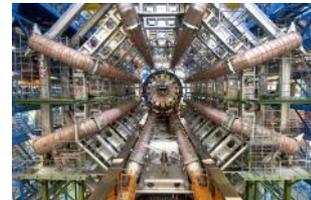


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Advanced Technologies Underpin DOE Mission

- Advanced scientific user facilities, tools, and infrastructure underpin DOE missions in energy, environment, and national security
- Emerging capabilities in communication, analytics, computing, and storage technologies (e.g., quantum, neuromorphic, probabilistic, wireless, etc.) hold promise for next-generation DOE mission applications
- In this talk, fifth generation (5G) cellular network (and others Wifi6, 6G,...) technologies may offer unique new opportunities and capabilities for the advancement of DOE Office of Science mission.



The DOE Office of Science Labs Today



\$858M in FY 2018



- Founded 1931
- 202 acres, 96 buildings
- 3,302 FTEs, including: 486 post-docs, 411 students, and 232 joint faculty
- 2,241 visiting scientists
- 11,403 facility users



\$887M in FY 2018



- Founded 1965
- 781 acres, 71 buildings
- 4,238 FTEs, including: 256 post-docs, 745 students, and 64 joint faculty
- 302 visiting scientists
- 1,742 facility users



\$56M in FY 2018



- Founded 1947 (1942)
- 10 acres, 13 buildings
- 307 FTEs, including: 46 post-docs, 174 students, and 43 joint faculty
- 321 visiting scientists



\$414M in FY 2018

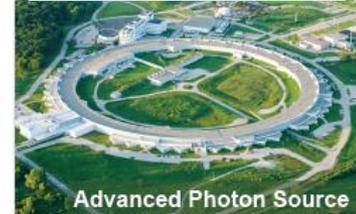


Wilson Hall

- Founded 1967
- 6,800 acres, 366 buildings
- 1,783 FTEs, including: 88 post-docs, 94 students, and 13 joint faculty
- 9 visiting scientists
- 3,472 facility users



\$782M in FY 2018

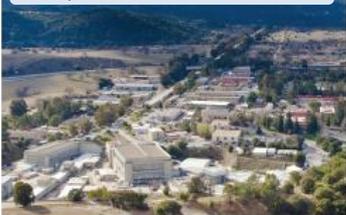


Advanced Photon Source

- Founded 1946 (1942)
- 1,517 acres, 154 buildings
- 3,225 FTEs, including: 273 post-docs, 569 students, and 274 joint faculty
- 1,107 visiting scientists
- 8,305 facility users



\$593M in FY 2018



- Founded 1962
- 426 acres, 149 buildings
- 1,531 FTEs, including: 152 post-docs, 299 students, and 36 joint faculty
- 19 visiting scientists
- 2,692 facility users



\$1,570M in FY 2018



Spallation Neutron Source

- Founded 1943
- 4,421 acres, 271 buildings
- 4,957 FTEs, including: 320 post-docs, 633 students, and 214 joint faculty
- 1,888 visiting scientists
- 3,248 facility users



\$172M in FY 2018



- Founded 1962
- 169 acres, 69 buildings
- 1678 FTEs, including: 34 post-docs, 53 students, and 27 joint faculty
- 1,438 visiting scientists
- 1,597 facility users



\$100M in FY 2018



NSTX Spherical Tokamak

- Founded 1961 (1951)
- 91 acres, 30 buildings
- 495 FTEs, including: 21 post-docs, 48 students, and 6 joint faculty
- 50 visiting scientists
- 292 facility users



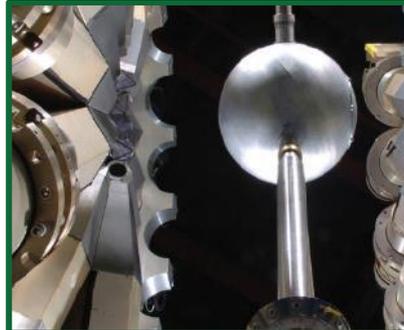
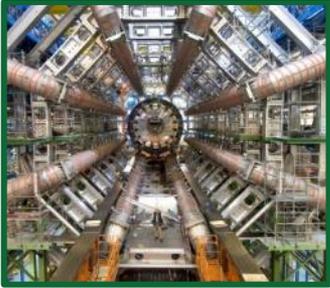
\$546M in FY 2018



Relativistic Heavy Ion Collider

- Founded 1947
- 5,322 acres, 315 buildings
- 2,527 FTEs, including: 116 post-docs, 395 students, and 123 joint faculty
- 2,313 visiting scientists
- 2,923 facility users

Office of Science User Facilities



27 world-leading facilities serving over 36,000 researchers annually

- supercomputers,
 - high intensity x-ray, neutron, and electron sources,
 - nanoscience facilities,
 - genomic sequencing facilities,
 - particle accelerators,
 - fusion/plasma physics facilities, and
 - atmospheric monitoring capabilities.
-
- **Open access; allocation determined through peer review of proposals**
 - **Free for non-proprietary work published in the open literature**
 - **Full cost recovery for proprietary work**



Emerging applications will require new system/platform paradigms

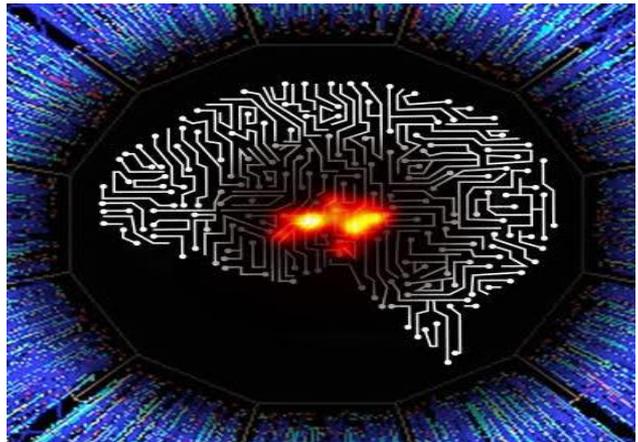
Autonomous Vehicles



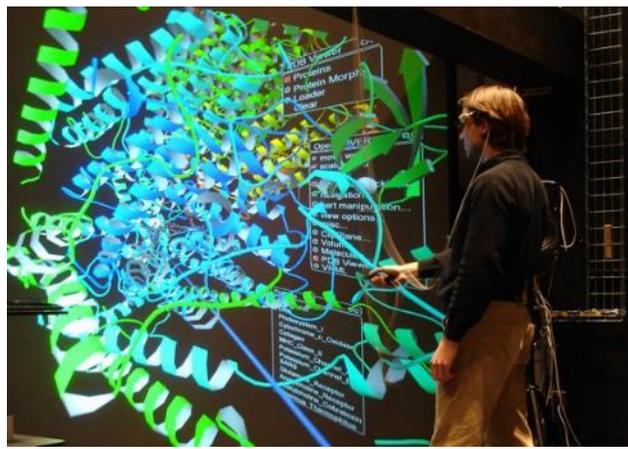
Smart Grid



Edge Computing



Artificial Intelligence

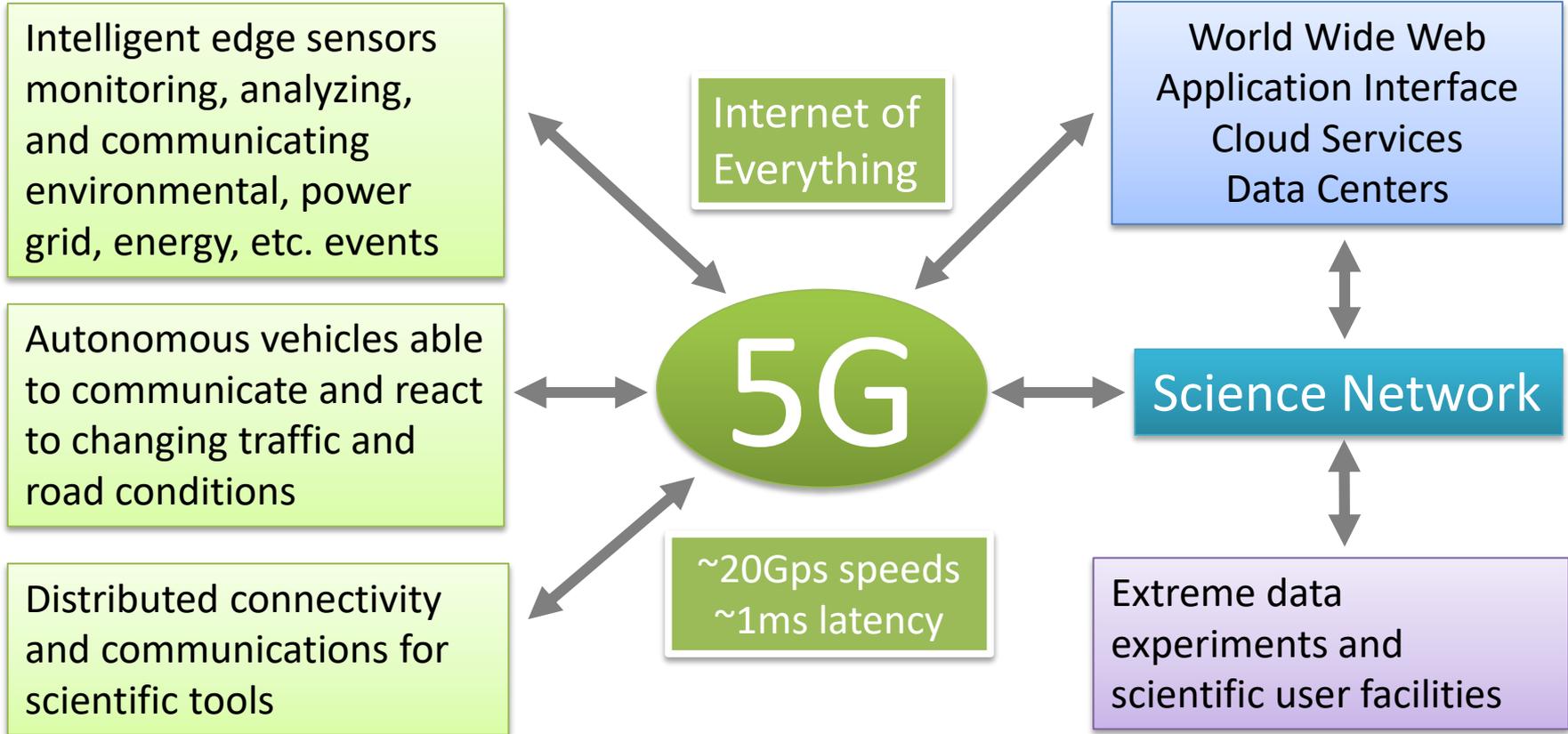


Machine Learning

Neuromorphic

Emerging Technology Potential for Scientific Innovation

Evolving discovery capabilities and tools to enhance our global scientific leadership



Advanced Microelectronics: Systems on chips delivering heteronomous integration of CPUs, GPUs, FPGAs, ASICs accelerators for Machine Learning, Neuromorphic, Quantum, etc.

5G Enabled Energy Innovation Workshop

Chicago, IL, March 10-12, 2020

- **Discussions with DOE program managers and national laboratory scientists provided rationale and ideas for a workshop**
 - The workshop will discuss R&D and innovation opportunities enabled by 5G and similar technologies such as WiFi 6, 6G, etc.
 - For the advancement of existing and emerging DOE scientific domains, infrastructure, and applications.
- **The workshop will deliver a community-based report highlighting basic R&D, applications, technology transition, infrastructure, and demonstration opportunities in support of the U.S. DOE mission.**
 - The report will help the DOE Office of Science understand both the challenges and the opportunities offered by emerging advanced wireless technologies in the areas of basic research, development, and integration into scientific user facility operations.

Workshop Technical Focus Areas

- **The workshop will address a number of technical focus areas that span the scientific domains and activities where 5G technology could have the largest impact for the DOE.**
 - These technical focus areas will also form the basis for breakout group discussions and help organize the material in the workshop report.
- **The technical areas are:**

Advancing Science Missions	Edge Computing
Cybersecurity	Distributed Instruments
Critical infrastructure	New Science Exploration Paradigms
Extreme Environments	Software Architectures
Scientific User Facilities	Data Management

Call to Participate

- **Interested participants are welcome to submit online a one- to two-page white paper providing technical material relevant to the workshop addressing a specific technical area.**
 - Participation in the workshop will be based on the relevance of the submitted white paper to the stated goals of the workshop. *Any submitted materials may be made available for unlimited public distribution.*
- **Timeline and Deadlines:**
 - Whitepaper submission deadline: Jan. 31, 2020
 - Whitepaper decision notification Feb. 7, 2020
 - Registration deadline Mar. 4, 2020
 - Workshop takes place during Mar. 10-12, 2020

Information and Logistics

- **The Director and all science programs support the workshop:**
 - ASCR, BES,
- **Website:** www.ornl.gov/5GScience
- **Venue:** Westin Michigan Avenue Hotel

- **Address:** 909 N Michigan Avenue, Chicago, IL 60611

- **When:** March 10-12, 2020

Thank You

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