美國能源創新動態報導

DOE National Laboratories/
DOE Energy Innovation Hubs

No. 3　　2018 年 06 月 28 日

Department of Energy to Invest $30 Million in Quantum Science Initiative

美國能源部投資 3 千萬美元於量子科學計畫

WASHINGTON, D.C. – Today, U.S. Secretary of Energy Rick Perry announced that the Department of Energy (DOE) plans to invest up to $30 million over the next three years in Quantum Information Science (QIS). QIS is a new, wide-ranging area of research that is expected to lay the groundwork for the next generation of computing and information processing, as well as an array of other innovative technologies.

This new initiative will provide up to $10 million per year for three years on a competitive basis for research and new equipment at DOE's five Nanoscale Science Research Centers (NSRCs)

本期摘要(KEY INFORMATION)

◎美國能源部長里克佩里(Rick Perry)於 5 月 2 日宣布，美國能源部（DOE）計劃在未來三年內於量子資訊科學（QIS）上投入 3 千萬美元，資金將運用於阿崗國家實驗室(ANL)等國家實驗室的 5 個奈米科學研究中心（NSRC）。QIS 是一個新的、廣泛的研究領域，預計將為下一代計算和資訊處理以及其他一系列創新技術奠定基礎。奈米科學和尖端的奈米技術研究設施（如 NSRC）的出現為量子實相(quantum reality)提供了一個重要的起點，這就是美國能源部在量子研究領域邁出下一步的原因。預計這項工作將產生許多具有前所未有特性的新奇材料，並有助於開發許多新技術。

◎美國橡樹嶺國家實驗室(ORNL)於 6 月 8 日公布了名為「Summit」的最新一代超級電腦，號稱是世界上最強大、最具智慧的超級電腦，能達到每秒 20 萬兆次的計算峰值，是 ORNL 上一代超級電腦 Titan 的 8 倍，能為能源、先進材料和人工智慧(AI)等領域提供前所未有的計算能力，且足以在一個小時內計算出在桌上型電腦保存 30 年的數據。美國能源部長里克佩里(Rick Perry)認為，Summit 將對能源研究、科學發現、經濟競爭力和國家安全產生深遠的影響，有助於科學家因應各種新挑戰、推動創新，讓美國人民受益。ORNL 表示，除了科學上的模型與模擬之外，Summit 還能整合 AI 與科學發現，讓研究人員將機器學習和深度學習應用於人類健康、高能物理、材料發現以及其他技術。

located at DOE National Laboratories around the nation. It will enable these facilities to take their first steps into the new quantum era. Out-year funding will be dependent on congressional appropriations.

"Quantum Information Science represents the future in a wide range of fields from computing to physics to materials science, and it will play a major role in shaping the technologies of tomorrow," said Secretary Perry. "It's vital that American science and American scientists lead the way into this new era, and these planned investments in our DOE Nanoscale Science Research Centers are an important first step."

The NSRC QIS initiative is one of a series of funding awards in QIS that DOE's Office of Science plans for Fiscal Year 2018. Awards under these other solicitations are expected to provide additional funds in support of QIS research to institutions across the nation before the end of FY 2018.

The growing interest in QIS has been driven by both need and opportunity. The need comes from the slowing of Moore's Law—the famous 1965 prediction by Intel co-founder Gordon Moore that computing power would double each year (later amended to eighteen months) because of the doubling of transistors on microchips. In recent years, as the number of transistors per chip has approached physical limits, the doubling has slowed. The expectation is that at some point, such doubling will cease to be possible within the world of "classical physics," or the normal physical world.

This has led researchers to probe the world of "quantum physics," or subatomic reality, in search of alternative answers. In the quantum world it is possible for things to seem to be and not be at the same time, and to encounter what are called nonlocal effects. The thought is that these strange quantum effects, phenomena such as "superposition" and "entanglement", may provide an alternative approach to information processing and other technologies.

This alternative opportunity has come from scientists' increasing ability to probe the quantum world with precision. The emergence of nanoscience and cutting-edge nanotechnology research facilities such as the NSRCs have provided a major starting point into quantum reality, which is why DOE is taking the next step in quantum studies. The effort is expected to generate a multitude of new, exotic materials with unprecedented properties as well as contribute to the development of many new technologies.

NSRC users, which together serve a community of over 3,000 researchers from universities, National Laboratories, nonprofits, and industry annually are expected to benefit from the development of new NSRC capabilities that result from the QIS initiative.

The five NSRCs invited to submit proposals for QIS funding include the Center for Nanoscale Materials at Argonne National Laboratory; the Center for Functional Nanomaterials at Brookhaven National Laboratory; the Molecular Foundry at Lawrence Berkeley National Laboratory; the Center for Nanophase Materials Sciences at Oak Ridge National Laboratory; and

the Center for Integrated Nanotechnologies jointly managed by Sandia National Laboratory and Los Alamos Laboratory.

原始連結：

https://www.energy.gov/articles/department-energy-invest-30-million-quantum-science-initiative

Oak Ridge National Laboratory Launches America's New Top Supercomputer for Science

橡樹嶺國家實驗室推出美國科學新型超級電腦

OAK RIDGE, TENNESSEE – Today, the U.S. Department of Energy's Oak Ridge National Laboratory (ORNL) unveiled Summit as the world's most powerful and smartest scientific supercomputer. Secretary of Energy Rick Perry attended the debut to meet with the ORNL team and see first-hand this monumental supercomputer.

With a peak performance of 200,000 trillion calculations per second—or 200 petaflops, Summit will be eight times more powerful than America's current top-ranked system, Titan, which is also housed at ORNL. For certain scientific applications, Summit will also be capable of more than three billion-billion mixed precision calculations per second. Summit will provide unprecedented computing power for research in energy, advanced materials, and artificial intelligence (AI), among other domains. Summit will enable scientific discoveries that were previously impractical or impossible.

"Today's launch of the Summit supercomputer demonstrates the strength of American leadership in scientific innovation and technology development. It's going to have a profound impact in energy research, scientific discovery, economic competitiveness, and national security," said Secretary Perry. "I am truly excited by the potential of Summit, as it moves the nation one step closer to the goal of delivering an exascale supercomputing system by 2021. Summit will empower scientists to address a wide range of new challenges, accelerate discovery, spur innovation, and above all, benefit the American people."

Summit's computing capacity is so powerful that it has the ability to compute 30 years' worth of data saved on a desktop computer in just one hour. These capabilities mark a huge increase in computing efficiency that will revolutionize the future of American science. ORNL researchers have also figured out how to harness the power and intelligence of Summit's state-of-art architecture to successfully run the

world's first exascale scientific calculation, or exaops, as DOE's fleet of proposed exascale computing systems come online in the next five years.

"From its genesis 75 years ago, ORNL has a history and culture of solving large and difficult problems with national scope and impact," said ORNL Director Thomas Zacharia. "ORNL scientists were among the scientific teams that achieved the first gigaflops calculations in 1988, the first teraflops calculations in 1998, the first petaflops calculations in 2008, and now the first exaops calculations in 2018. The pioneering research of ORNL scientists and engineers has played a pivotal role in our nation's history and continues to shape our future. We look forward to welcoming the scientific user community to Summit as we pursue another 75 years of leadership in science."

In addition to scientific modeling and simulation, Summit offers unparalleled opportunities for the integration of AI and scientific discovery, enabling researchers to apply techniques like machine learning and deep learning to problems in human health, high-energy physics, materials discovery and other areas. These opportunities that Summit will bring align with the White House Artificial Intelligence for America initiative announced last month.

Summit will be open to select projects this year while ORNL and IBM work through the acceptance process for the machine. In 2019, the bulk of access to the IBM system will go to research teams selected through DOE's Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program.

原始連結：

https://www.energy.gov/articles/oak-ridge-national-laboratory-launches-america-s-new-top-supercomputer-science