OAK RIDGE National Laboratory

AGENDA

MANAGED BY UT-BATTELLE LLC FOR THE US DEPARTMENT OF ENERGY

2025 Quantum Computing User Forum

Day 1: Monday, July 21st

8:30am – Workshop

Presenter: IonQ

Title: Exploring the IonQ Quantum Cloud and Systems: From Hello World to Hybrid Applications

In this hands-on workshop, we'll cover the basics of IonQ's hardware and software, demonstrate different ways to use our systems, and share how our team is leveraging these capabilities to develop new quantum applications. During the first section, we'll review IonQ's trapped-ion hardware and how you can submit circuits to our QPUs and simulators via our quantum cloud platform and supported SDKs. Next, we'll cover some features, techniques, and workflows supported by our platform, including error mitigation with debiasing, submission using our native gates, and leveraging our hosted hybrid service for more complex quantum–classical workflows. Finally, we'll demonstrate how all of these capabilities come together and highlight some of IonQ's recent progress in quantum algorithms and applications. Participants will have the opportunity to follow along and submit jobs to IonQ's hardware and simulators throughout the workshop.

12:00pm – Working Lunch

Presenter: Claire Marvinney and Josh Cunningham (ORNL)

Title: The Quantum Computing User Program

1:00pm – Keynote

Presenter: Martin Roetteler (IonQ)

Title: Toward quantum commercial advantage with enterprise-grade quantum computers

2:00pm –

Presenter: In-Saeng Suh (ORNL)

Title: Distributed QAOA on the superconducting and trapped-ion quantum computers

2:30pm–

Presenter: Alejandro Montanez-Barrera (Forschungszentrum Julich)

Title: Evaluating the performance of quantum process units at large width and depth

3:00pm - BREAK

3:30pm –

Presenter: Suman Debnath, Phani Marthi (Oak Ridge National Laboratory)

Title: Applications of Quantum Computing in Power Grid/Energy System - Some Examples

4:00pm –

Presenter: Chao Lu (Oak Ridge National Laboratory)

Title: Optimizing Quantum Linear Solvers: Benchmarking the HHL Algorithm with an Enhanced QPE Framework

4:30pm –

Presenter: Martin Suchara (Microsoft)

Title: TBD

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Day 2: Tuesday, July 22nd

8:30am – Workshop
Presenter: Quantinuum
Title: Quantinuum Workshop

Join us for an in-depth workshop designed to introduce the capabilities and latest advancements of Quantinuum Systems, including Helios, which is slated for launch later this year. The workshop will cover the core features and functionalities of Helios; introduce our newly released programming language, Guppy; provide an overview of Nexus and its integration with Helios to enhance system performance; and discuss the capabilities of Selene emulators. We will discuss how to maximize the use of these tools and explore various use cases, providing an in-depth look at quantum error correction workflows and the dynamic behaviors and applications of quantum systems. The workshop will conclude with Q&A, providing an opportunity to clarify concepts and discuss further applications. This session is ideal for researchers, developers, and enthusiasts looking to deepen their knowledge and leverage the power of quantum computing in their work.

12:00pm – Working Lunch
Presenter: Catherine Lefebvre (Open Quantum Institute (OQI)
Title: Quantum Computing for the Benefit of Humanity

1:00pm – Keynote
Presenter: Justin Bohnet (Quantinuum)
Title: Helios: A new dimenstion for Quantinuum systems

2:00pm –
Presenter: Xiaozhou Feng (The University of Texas at Austin)
Title: Postselection-free experimental observation of the measurement-induced phase transition in circuits with universal gates

2:30pm–
Presenter: Adrian Harkness (Lehigh University)
Title: Improved Implementation of Quantum Linear Systems Algorithms on a Trapped-Ion Quantum Processor

3:00pm - BREAK

3:30pm –
Presenter: Gregory Quiroz (Johns Hopkins University Applied Physics Laboratory)
Title: Sparse Non-Markovian Noise Modeling of Transmon-Based Multi-Qubit Operations

4:00pm –
Presenter: Arnab Banerjee (Purdue University)
Title: Magnetism and dynamics using quantum hardware

4:30pm –
Presenter: Ermal Rrapaj (NERSC, Lawrence Berkeley Laboratory)
Title: Collective Neutrino Oscillations in Three Flavors on Qubit and Qutrit Processors

5:00pm – Group Photo

5:15-7:00pm – Poster Session

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Day 3: Wednesday, July 23rd

8:30am – Workshop
Presenter: IBM
Title: IBM Quantum Workshop

IBM has been at the forefront of advancing the state-of-the-art in quantum computing — from 100+ qubit devices and cutting-edge error mitigation strategies to novel low-density and resource-efficient error correction schemes, algorithms, and application development. This includes pioneering work in quantum-centric supercomputing and the exploration of practical use cases across disciplines. We actively facilitate working groups focused on high-impact domains where quantum advantage is most promising, such as materials science, high energy physics, and optimization. To support this ecosystem, IBM has invested heavily in enabling both internal and external researchers through our Quantum Algorithm Engineering (QAE) team — a group of domain experts dedicated to the scalability of emerging quantum applications and algorithms. Their work spans experiment and workflow optimization, demonstration of novel techniques on hardware, and the development of benchmarking methods that allow rigorous comparisons between quantum and classical approaches to assess true quantum advantage. This workshop will highlight IBM's latest developments, services, and capabilities — with an emphasis on how the quantum community can collectively achieve quantum advantage within the next two years. Topics will include recent hardware advancements, experimental optimization techniques for IBM devices, and how quantum-classical HPC integration can unlock computational capabilities previously out of reach. By showcasing results from internal efforts, joint research collaborations, and technical working groups, we aim to demonstrate how IBM continues to lead the way in quantum computing.

12:00pm – Working Lunch
Presenter: Veronica Vergara (ORNL)
Title: Oak Ridge Leadership Computing Facility

1:00pm – Keynote
Presenter: Sarah Sheldon (IBM)
Title: From algorithms to applications: The path to Quantum Advantage

2:00pm –
Presenter: Muqing Zheng (Pacific Northwest National Laboratory)
Title: Bypassing Optimization: Generator-Coordinate-Inspired Methods for Quantum Chemistry

2:30pm –
Presenter: Yuqi Zhang (Kent State University)
Title: Protein Structure Prediction in Drug Discovery on Utility-Level Quantum Processors

3:00pm - BREAK

3:30pm –
Presenter: Esam El-Araby (The University of Kansas (KU))
Title: Utilizing Quantum Computing for Solving Multidimensional Partial Differential Equations

4:00pm –
Presenter: Hisham Amer (Virginia Tech)
Title: Utility scale implementation and benchmarking of Dynamically Corrected Gates at the coherence limit of IBM devices

4:30pm –
Presenter: Ji Liu (Argonne National Laboratory)
Title: Pauli Check Extrapolation for Quantum Error Mitigation

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Day 4: Thursday, July 24th

8:30am – Workshop
Presenter: IQM
Title: Getting started with hybrid quantum-classical algorithms

As quantum computing advances, its role is increasingly conceived as a powerful complement to traditional high-performance computing (HPC). Hybrid quantum-classical workflows have demonstrated early promise in domains such as quantum chemistry, materials science, and optimization. However, realizing the full potential of hybrid quantum-classical systems requires collaboration across disciplines. This workshop provides participants with an opportunity for a hands-on exploration of hybrid quantum algorithms. Iterative and sequential hybrid workflows will be explored, with example problems spanning application domains from chemistry simulations to optimization problems.

12:00pm – Working Lunch
Presenter: Andreas Sawadsky (Quantum Brilliance)
Title: Virtual QPUs: Bridging the Gap Between Simulation and Hardware Performance

1:00pm – Keynote
Presenter: Eric Mansfield (IQM
Title: Supercharging HPC with IQM: A vision for hybrid computing

2:00pm –
Presenter: Chenxu Liu (PNNL)
Title: STQS: A Unified System Architecture for Spatial Temporal Quantum Sensing

2:30pm –
Presenter: Kalyana Chakravarthi Gottiparthi (Oak Ridge National Laboratory)
Title: Quantum Linear Solvers for Computational Fluid Dynamics

3:00pm - BREAK

3:30pm –
Presenter: Jan Balewski (NERSC/LBNL)
Title: EHands: Quantum Protocol for Polynomial Computation on Real-Valued Encoded States

4:00pm –
Presenter: Seongmin Kim (ORNL)
Title: Many-qubit is All We Need for Optimization Challenges

4:30pm –
Presenter: Andreas Sawadsky (Quantum Brilliance)
Title: Unlocking Quantum Potential: From Mobile Accelerators to Scalable Parallel Clusters

The QCUF concludes on Thursday, July 24th. Please consider registering for the OQSSw event to be hosted on Friday, July 25th.