

Quantum Division

Beyond Computation: Quantum Software Meets Quantum-HPC

In the "quantum" division, we will advance cutting-edge research in quantum software, quantum-enabled scientific applications, and the integration of quantum computing with supercomputing (Quantum-HPC). Through a university-wide interdisciplinary research framework, we aim to establish a globally competitive next-generation computing infrastructure. In particular, we seek to establish a new computing paradigm that seamlessly integrates quantum computing and supercomputing, to systematize quantum algorithms and quantum software, and ultimately to realize quantum advantage and accelerate the deployment of quantum technologies in real-world applications.

Through close collaboration with the research institutes and industrial partners located in Tsukuba-city, we will promote fundamental research on quantum technologies and Quantum-HPC, as well as their applications to frontier scientific domains including materials science, chemistry, and information science. Furthermore, we will establish methodologies for effectively utilizing quantum computing to advance scientific discovery and address societal challenges. By doing so, we will build a continuous research and innovation ecosystem that spans fundamental research, technology transfer, and industrial deployment, thereby establishing ourselves as a world-leading international research hub.

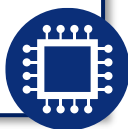
In addition, we will foster the next generation of researchers and engineers who possess interdisciplinary expertise spanning quantum information science, computational science, and supercomputing. By cultivating an active research and technical community capable of integrating these disciplines, we aim to nurture globally competitive talent that will lead future advances in quantum computing and Quantum-HPC.

Overview and Mission of the Area

Quantum-HPC

We will advance computational capabilities by integrating supercomputers and quantum computers, and by developing efficient methods for their combined use.

**Beyond
Computational
Limits**



Quantum-Software

We will advance quantum algorithms for high-performance computation and establish secure cryptographic technologies resilient to future quantum computing threats.

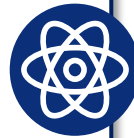
**Quantum Execution &
Critical Information
Infrastructure
Protection**



Quantum Application

We will advance scientific discovery through quantum computing and Quantum-HPC integration, while exploring the potential of quantum information and developing innovative quantum applications for real-world impact. We will push the boundaries of information processing.

**Science and Industrial
Applications: Materials,
Drug Discovery, Finance,
Optimization, and
Demonstration of
Quantum Advantage**



Mission

Enhancing the Quantum-HPC infrastructure

Scientific challenges expected to benefit from quantum computing

Quantum algorithms for noisy and fault-tolerant quantum computers development

Member Faculty

Quantum-HPC R&D

TSUJI Miwako
FUJITA Norihisa
YAMAGUCHI Yoshiki
KOJIMA Takuya
SUGIURA Keisuke

Quantum Software R&D

TAKAHASHI Yasuhiro
KUNIHIO Norobu
MIYAMOTO Masayuki

Quantum Wide Application

SHIGETA Yasuteru
NAKATSUKASA Takashi
TOKURA Yasuhiro
KOIZUMI Hiroyasu
AKIYAMA Shinichiro
SHIKANO Yutaka
IMAI Satoya

From recent research themes



JST Center of Innovation-type Community-led Ecosystem with
Partners (COI-NEXT)
「Center of Innovation for Sustainable Quantum AI」



次世代エッジAI半導体研究開発事業

Next-generation Edge AI Semiconductor
Research and Development Project



ASPIRE 先端国際共同研究推進事業
Adopting Sustainable Partnerships for Innovative Research Ecosystem

Development of design framework of
VLSI circuit with advanced process
node