Departamento de Física de la Materia Condensada
Universidad Zaragoza

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Barcelona Supercomputing Center - Centro Nacional de Supercomputación

Noisy Intermediate-Scale Quantum Computation

A universal fault-tolerant quantum computer that can solve efficiently problems such as integer factorization and unstructured database search requires millions of qubits with low error rates and long coherence times. While the experimental advancement towards realizing such devices will potentially take decades of research, noisy intermediate-scale quantum (NISQ) computers already exist. These computers are composed of hundreds of noisy qubits, i.e. qubits that are not error-corrected, and therefore perform imperfect operations in a limited coherence time. In the search for quantum advantage with these devices, algorithms have been proposed for applications in various disciplines spanning physics, machine learning, quantum chemistry and combinatorial optimization. The goal of such algorithms is to leverage the limited available resources to perform classically challenging tasks. In this talk, I will provide an overview of NISQ computational paradigms and algorithms, discussing the key structure of these algorithms, their limitations and potential advantages.

Alba Cervera-Lierta is a Senior Researcher at the Barcelona Supercomputing Center. She earned her PhD in 2019 at the University of Barcelona, where she studied her physics degree and a Msc in particle physics. After her PhD, she moved to the University of Toronto as a postdoctoral fellow at the Alán Aspuru-Guizik group. She works on near-term quantum algorithms and their applications, high-dimensional quantum computation, and artificial intelligence strategies in quantum physics. Since October of 2021, she is the coordinator of the Quantum Spain project, an initiative to boost the quantum computing ecosystems and that will install a quantum computer at the BSC-CNS, integrated into the Spanish Supercomputing Network.

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