

Paese **USA**

Macrosettore **Physics and astrophysics**

Titolo **Abbattimento degli errori indotti da raggi cosmici nei computer quantistici**

Struttura **INFN**

Dp./Ist. Sede di Roma

Sintesi del progetto

The proposed project aims at developing a technology to protect quantum computers based on superconductors from the catastrophic effects of atmospheric muons. The technology of superconducting circuits offers many advantages in the development of quantum processors: ease in design and fabrication, high fidelity, and fast operation times. Furthermore, as proved by the experience of Google, Rigetti, and other important research centers, this technology allows to inter-couple tens of qubits. IBM recently claimed the deployment of a 127 qubit processor, breaking the symbolic barrier of 100 qubits. Today, one of the main challenges is increasing the coherence time, i.e., the time in which the processor retains its quantum behaviour. This value should be increased from tens of microseconds to few milliseconds or, in more ambitious programs, to a second. Ambient radioactivity can hinder the achievement of a long coherence time: atmospheric muons, but also the radioactivity of the laboratory environment, can release ionizing energy in the qubits, spoiling their performance [1,2,3]. While most of environmental radioactive sources can be easily suppressed using dedicated shields, atmospheric muons are extremely penetrating and can be shielded only by moving the whole facility in a deep underground laboratory [4]. This proposal aims at abating the detrimental effects of atmospheric muons. We will develop a new class of quantum processors equipped with a muon active veto. Such device will allow to identify the interaction of an atmospheric muon in the processor and veto all the operations performed during such interaction. By demonstrating a detection efficiency close to 100% and, at the same time, a negligible dead-time, we will prove that the future of quantum processors can be envisaged in above-ground facilities.