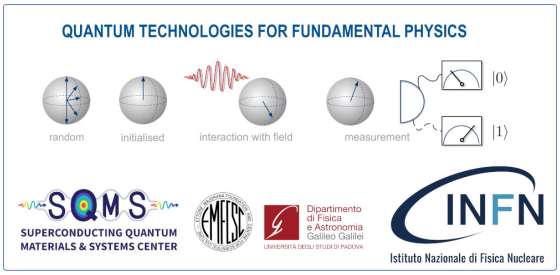

ID contributo: **25** Tipo: **non specificato**

Loophole-free Bell Inequality Violation with Superconducting Circuits*

Superposition, entanglement, and non-locality constitute fundamental features of quantum physics. Remarkably, the fact that quantum physics does not follow the principle of locality can be experimentally demonstrated in Bell tests performed on pairs of spatially separated, entangled quantum systems. While Bell tests were explored over the past 50 years, only relatively recently experiments free of so-called loopholes succeeded. Here, we demonstrate a loophole-free violation of Bell's inequality with superconducting circuits [1]. To evaluate a CHSH-type Bell inequality, we deterministically entangle a pair of qubits and perform fast, and high-fidelity measurements along randomly chosen bases on the qubits connected through a cryogenic link spanning 30 meters. Evaluating more than one million experimental trials, we find an average S-value of 2.0747 ± 0.0033, violating Bell's inequality by more than 22 standard deviations. Our work demonstrates that non-locality is a viable new resource in quantum information technology realized with superconducting circuits with applications in quantum communication, quantum computing and fundamental physics.

[1] S. Storz, J. Schär, A. Kulikov, P. Magnard, P. Kurpiers, J. Lütolf, T. Walter, A. Copetudo, K. Reuer, A. Akin, J-C. Besse, M. Gabureac, G. J. Norris, A. Rosario, F. Martin, J. Martinez, W. Amaya, M. W. Mitchell, C. Abellán, J-D. Bancal, N. Sangouard, B. Royer, A. Blais, and A. Wallraff, Nature 617, 265-270 (2023)

- Work done in collaboration with Simon Storz, Josua Schaer, Anatoly Kulikov, Paul Magnard, Philipp Kurpiers, Janis Luetolf, Theo Walter, Adrian Copetudo, Kevin Reuer, Abdulkadir Akin, Jean-Claude Besse, Mihai Gabureac, Graham J. Norris, Andres Rosario, Ferran Martin, Jose Martinez, Waldimar Amaya, Morgan W. Mitchell, Carlos Abellan, Jean-Daniel Bancal, Nicolas Sangouard, Baptiste Royer, Alexandre Blais, and Andreas Wallraff

Relatore: WALLRAFF, Andreas (ETH Zurich)

Classifica Sessioni: Physics Case for Quantum Technologies