Contribution ID: **38** Type: **Poster contribution**

Integrated conversion and photodetection of virtual photons in an ultrastrongly coupled superconducting quantum circuit

Tuesday, 7 May 2024 17:30 (1h 30m)

The ground-state of an artificial atom coupled to quantized modes in the Ultra-Strong Coupling regime is entangled and contains an arbitrary number of virtual photons.
The problem of their detection, raised since the very birth of the field, still awaits experimental demonstration despite the theoretical efforts in the last decade.
In a recent work [1] it has been shown that experimental limitations can be overcome by leveraging an unconventional design of the artificial atom with advanced coherent control techniques.
In this work we study a simple scheme of control-integrated continuous measurement which makes remarkably favourable the tradeoff between measurement efficiency and backaction showing that the unambiguous detection of virtual photons can be achieved within state-of-the art quantum technologies [2].
Work supported by the PNRR MUR project PE0000023-NQSTI

[1] L. Giannelli et al. "Detecting virtual photons in ultrastrongly coupled superconducting quantum circuits". In: Phys. Rev. Res. 6 (1 Jan. 2024), p. 013008. doi: 10.1103/PhysRevResearch.6.013008. url: https://link.aps.org/doi/10.1103/PhysRevResearch.6.013008.
[2] Luigi Giannelli et al. "Integrated conversion and photodetection of virtual photons in an ultrastrongly coupled superconducting quantum circuit". en. In: The European Physical Journal Special Topics (Sept. 2023). issn: 1951-6355, 1951-6401. doi: 10.1140/epjs/s11734-023-009890. url: https://link.springer.com/10.1140/epjs/s11734-023-00989-0 (visited on 11/17/2023).

Abstract category

Quantum Simulations

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Session Classification: Poster session