

# Quantum Circuits as Artificial Atoms on a Chip: a pedagogical introduction

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**Abstract:** Recent technological advances have made it possible to implement atomic-physics and quantum-optics experiments on a chip using artificial atoms. These artificial atoms can be made from either semiconductor quantum dots and, more often, from superconducting circuits. Superconducting circuits based on Josephson junctions exhibit macroscopic quantum coherence and can behave like artificial atoms. Novel electronic devices are being explored with these type of superconducting (low-power-consumption) electronics. This talk presents a pedagogical (and, hopefully, entertaining) brief introduction to this rapidly advancing field. The references [1-13] provide a few overviews on various aspects of this subject and related topics.

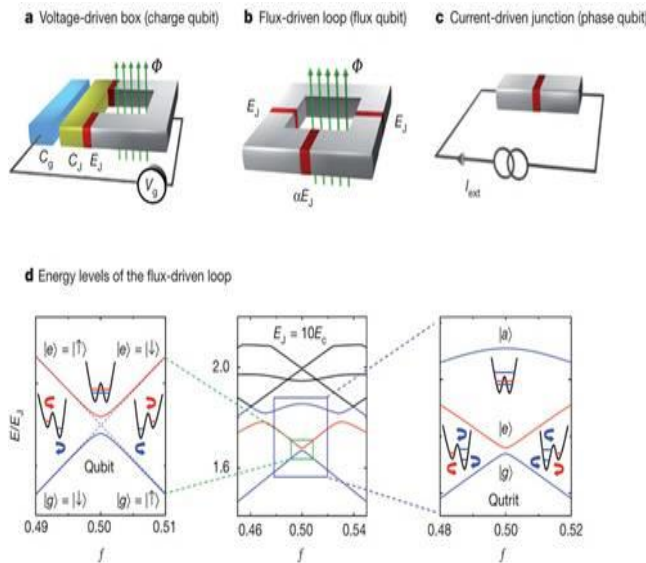


Fig. 1. Superconducting circuits as artificial atoms [1].

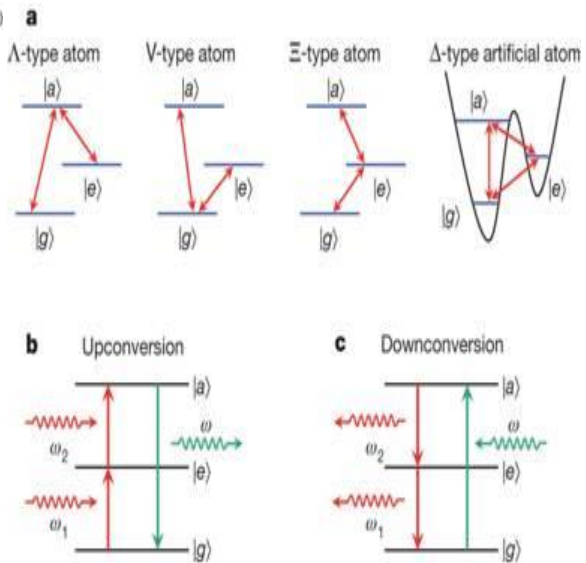


Fig. 2. Three-level atoms and frequency conversions [1].

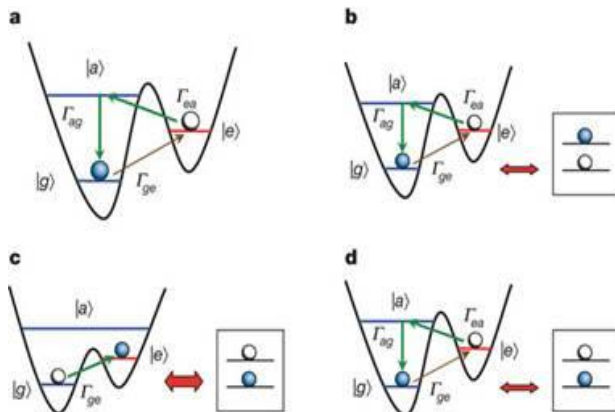


Fig. 3. Cooling a 3-level atom and a nearby 3-level system.

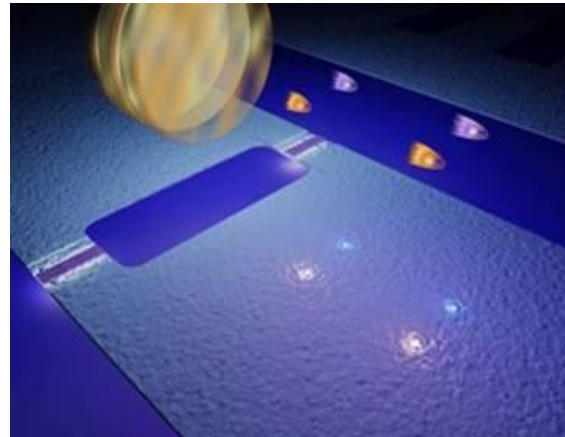


Fig. 4. Dynamical Casimir effect with superconducting circuits

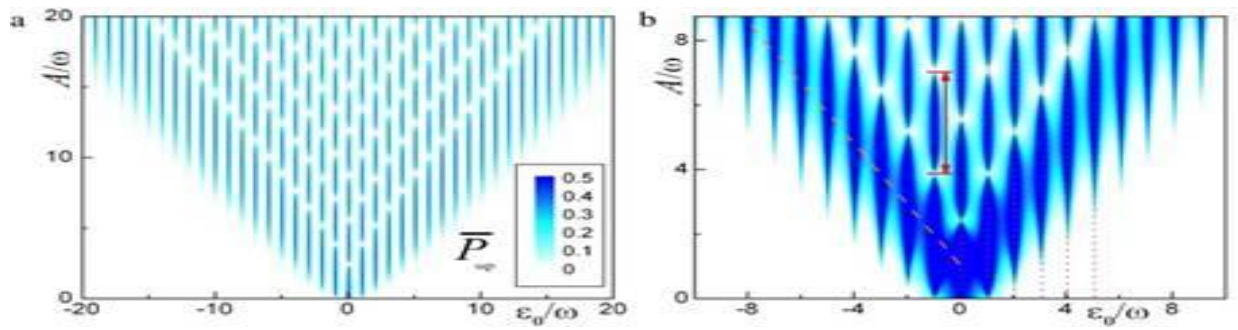


Fig. 5. Interference patterns from LZS interferometry using superconducting circuits. From Ref. [7]

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