Photonic Joule effect in a superconducting circuit

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Résumé

Superconducting circuits allow for the experimental realization of quasi-thermodynamical baths coupled to few non-linear quantum degrees of freedom. Usually one looks at the impact of the bath on the small system, all while neglecting the back-action of the system on the bath. In this work we demonstrate that a driven impurity, a small Josephson junction, can induce non-trivial dynamics of the bath, implemented as a chain of 5000 Josephson junctions operating in the harmonic regime. Namely inelastic Cooper pair tunneling in the small junction can populate the bath with a high number of excitations. We show that this is reminiscent of the Joule effect that occurs in usual electrical circuits where a current flowing through a resistor produces heat.

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