Abstract Submitted
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Vacuum-Induced Berry Phase Measured Via a Phase-Tunable Atom-Field Interaction S. GASPARINETTI, S. BERGER, A. A. ABDUMALIKOV, M. PECHAL, S. FILIPP, A. WALLRAFF, ETH Zurich — Geometric phases incorporate a fundamental aspect of quantum mechanics. They are at the heart of many quantum phenomena in solid-state physics, from the quantum Hall effect to topologically protected phases, and may provide a resource for quantum computation. We present the first experimental observation of the vacuum-induced Berry phase [1], a geometric effect that arises when the phase of a quantized field mode coupled to an atom is adiabatically steered. Our atom-field system is a transmon embedded in a 3D microwave cavity. A phase-coherent microwave tone induces a tunable interaction between the third level of the transmon and a long-lived mode of the cavity [2]. By adiabatically steering the phase of the interaction, we demonstrate that the qubit accumulates a geometric phase even when the cavity mode is empty. We characterize this effect by varying the effective atom-field detuning as well as the photon number in the cavity mode.
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