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Quantum electrodynamics near a photonic band-gap YANBING LIU, ANDREW HOUCK, Princeton University — Quantum electrodynamics predicts the localization of light around an atom in photonic band-gap (PBG) medium or photonic crystal. Here we report the first experimental realization of the strong coupling between a single artificial atom and an one dimensional PBG medium using superconducting circuits. In the photonic transport measurement, we observe an anomalous Lamb shift and a large band-edge avoided crossing when the artificial atom frequency is tuned across the band-edge. The persistent peak within the band-gap indicates the single photon bound state. Furthermore, we study the resonance fluorescence of this bound state, again demonstrating the breakdown of the Born-Markov approximation near the band-edge. This novel architecture can be directly generalized to study many-body quantum electrodynamics and to construct more complicated spin chain models.

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