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Quantum dynamics of an electromagnetic mode that cannot contain N photons EMMANUEL FLURIN, LANDRY BRETHEAU, PHILIPPE CAMPAGNE, FRANÇOIS MALLET, BENJAMIN HUARD, Laboratoire Pierre Aigrain, QELEC TEAM — Electromagnetic modes are instrumental for realizing quantum physics experiments and building quantum machines. In this experiment, we demonstrate a new way to manipulate these modes by effectively controlling their phase space. By preventing access to a single energy level, the dynamics of the field is dramatically changed. Here, it was possible to keep the mode from containing a number of photons N, which was arbitrarily chosen between 2 and 5. Under this constraint, and starting in its ground state, a resonantly driven mode is confined to levels 0 to N-1. The level occupation is then found to oscillate in time, similarly to an N-level system. Performing a direct Wigner tomography of the field reveals its non-classical features. In particular, at half period in the evolution, it resembles a "Schrödinger cat state." This fine control of the field in its phase space enables innovative applications in quantum information and metrology.

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