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Non-classical states of light from an optical cavity BASTIAN HACKER, SEVERIN DAISS, STEPHAN WELTE, LUKAS HARTUNG, LIN LI, GERHARD REMPE, Max-Planck-Institute of Quantum Optics — Creation of tailored non-classical states of light is a key problem in quantum optics. Our experiment uses a trapped atom in a high-finesse optical cavity to engineer the state of an optical light pulse. To this end, the light pulse is reflected off the one-sided cavity and gets entangled with the state of the atom. A subsequent measurement of the atomic state in a chosen basis projects the light pulse into one of two orthogonal subspaces. In case of coherent input light, the output is a coherent-state superposition, generally known as cat state. We produce such states with various degrees of freedom, controlled by the atom, and observe genuine quantum features such as a negative Wigner function and squeezing. Furthermore, the setup can be used as a filter for the distillation of pure single photons. We demonstrate the production of photons with arbitrary temporal shapes and a $g^{(2)}(0)$ correlation function down to 0.05. The protocol is applicable to any physical platform with an emitter coupled to the electromagnetic field, such as NV centers, quantum dots or superconducting microwave qubits.

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