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Generation of single photons with highly tunable wave shape from a cold atomic quantum memory GEORG HEINZE, PAU FARRERA, BORIS ALBRECHT, HUGUES DE RIEDMATTEN[1], ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Barcelona, Spain, MELVYN HO, MATIAS CHAVEZ, COLIN TEO, NICOLAS SANGOUARD, Department of Physics, University of Basel, Basel, Switzerland — We report on a single photon source with highly tunable photon shape based on a cold ensemble of Rubidium atoms [1]. We follow the DLCZ scheme [2] to implement an emissive quantum memory, which can be operated as a photon pair source with controllable delay. We find that the temporal wave shape of the emitted read photon can be precisely controlled by changing the shape of the driving read pulse. We generate photons with temporal durations varying over three orders of magnitude up to 10 μs without a significant change of the read-out efficiency. We prove the non-classicality of the emitted photons by measuring their antibunching, showing near single photon behavior at low excitation probabilities. We also show that the photons are emitted in a pure state by measuring unconditional autocorrelation functions. Finally, to demonstrate the usability of the source for realistic applications, we create ultra-long single photons with a rising exponential or doubly peaked time-bin wave shape which are important for several quantum information tasks.
[1] P. Farrera *et al.*, arXiv:1601.07142 (2016).
[2] L. M. Duan *et al.*, Nature **414**, 413 (2001).

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