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Deterministic Shaping and Reshaping of Single-Photon Temporal Wave Functions STEFAN LANGENFELD, OLIVIER MORIN, MATTHIAS KOERBER, GERHARD REMPE, Max Planck Institute of Quantum Optics — Single photons are the most used carrier to communicate within a quantum network. All degrees of freedom of these photons need to be well controlled to use them in quantum applications. The characterization of the temporal mode function is typically reduced to its Hong-Ou-Mandel interference and its temporal intensity profile as measured via single photon counters. However, the connection of different systems in a quantum network requires the ability to control the phase profile of the temporal mode. Here, we investigate thoroughly the possibilities offered by a cavity quantum electrodynamics (QED) system, namely a single Rb87 atom in a high finesse optical resonator. Starting from previous theoretical work [1], we developed a comprehensive and exhaustive model of our system [2]. Thanks to this, we experimentally demonstrate a very high control of the temporal mode of a single photon in amplitude and phase. This opens up various possibilities as for instance modifying the temporal shape by 3 orders of magnitude in time and bandwidth. It also shows that our platform can be compatible with many others and can even be used as a photon mode converter. [1] A. Gorshkov et al., Phys. Rev. A 76, 033804 (2007). [2] O. Morin et al., Phys. Rev. Lett. 123, 133602 (2019).

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