

Time-Bin Qubits *via* Transformation of a Single Photon Field into Bunches of Pulses

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We propose a method to transform a single photon field into bunches of pulses with controllable timing and number of pulses in a bunch. The method is based on transmission of a photon through an optically thick single-line absorber vibrated with a frequency appreciably exceeding the width of the absorption line. The narrow spectrum of the incoming photon is “seen” by the vibrated absorber as a comb of equidistant spectral components separated by the vibration frequency. Tuning the absorber in resonance with m -th spectral component transforms the output radiation into bunches of pulses with m pulses in each bunch. We experimentally demonstrate the proposed technique with single 14.4 keV photons. This method opens a new way to the production of time-bin qubits. Proposals for construction of time-bin qubits with dimension higher than two by the pulse-bunching technique are discussed.