Compressing, Stretching, and Manipulating Photons Themselves: Observations of Upconversion of Entangled Photon Pairs

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RESUMEN

Quantum entanglement has been widely studied in recent years, often using the entangled photon pairs produced by spontaneous parametric downconversion of a pump beam in a nonlinear crystal. However, there has been far less work done on upconverting or recombining the photon pairs in a second nonlinear crystal, and using the probability of recombination as a means of studying the consequences of manipulating one or both photon pair members. Here we describe experimental work [1,2] in which the photons of an entangled pair are delayed by a few femtoseconds with respect to each other, and one or both pair members are chirped using positive or negative group delay dispersion. Under our experimental conditions, the upconversion rate shows clear effects of desynchronizing pair members by only a few femtoseconds, and also shows the consequences of photon chirp induced by less than a millimeter of optical glass. Further, our results can be taken as an ultraprecise means of timing single photons, providing a direct means of demonstrating that individual photons travel at the group velocity in dispersive media.

Palabras clave: Quantum Entanglement, Upconversion, Photon Pairs

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