

The Past and Future of Entangled Multi-Photons

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The generation of entanglement between more than two particles is a major challenge of all physical realizations. Single photons are one of the most promising realizations of quantum bits (qubits), as they are easily manipulated and preserve their coherence for long times. Quantum information can be stored in many different degrees of freedom of the photons. Only recently, eight photons were entangled in a single state through their polarization degree of freedom. The main difficulties in increasing this number are the elaborated setups required and the low rates of state production. I will present a novel and simple scheme that can in principle generate entanglement between any number of photons from a single setup. Because this setup combines photons that are created at different times, there are some surprising consequences that challenge our understanding of non-locality and the measurement of quantum states. A roadmap for even better photon entanglement sources that are suitable for quantum computation will also be presented.

1. “A resource efficient source of multi-photon polarization entanglement”, E. Megidish, T. Shacham, A. Halevy, L. Dovrat and H.S. Eisenberg, Phys. Rev. Lett. **109**, 080504 (2012).
2. “Entanglement Swapping between Photons that have Never Coexisted”, E. Megidish, A. Halevy, T. Shacham, T. Dvir, L. Dovrat, and H. S. Eisenberg, Phys. Rev. Lett. **110**, 210403 (2013).