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Optical Quantum State Synthesis PAUL KWIAT, KEVIN MCCUSKER, RADHIKA RANGARAJAN, University of Illinois Urbana-Champaign — Sources of well specified photon number are a critical resource for optical quantum information processing (QIP), e.g., quantum cryptography, computing, and metrology. Spontaneous downconversion has been the main method to produce such states, but there is an immediate limitation because the pairs are produced at random. Here we describe a time-multiplexing technique by which one can essentially remove much of the randomness from the process, effectively creating a pseudo-deterministic source of single photons. An extension of the technique allows one to create Fock states with higher photon numbers; due to the semi-deterministic nature of the process, this method is exponentially more efficient than experiments to date. By modifying the scheme, one can also produce more exotic multi-photon states, such as "N00N" states, which until now have only been created probabilistically. For all of these multi-photon state creation techniques, the photons from a given downconversion pair actually need to be unentangled in their spectral and spatial modes. We will describe our progress at producing such states, as well as the results of the time-multiplexed scheme for producing single photons on demand.

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