Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Path Entangled Photons from Parametric Down-Conversion HAGAI EISENBERG, JUAN HODELIN, GEORGE KHOURY, DIRK BOUWMEESTER, Department of Physics, University of California at Santa-Barbara, Santa-Barbara, California 93106, USA — Path entangled photon states can be used to overcome classical limits on the accuracy of interferometric measurements such as the diffraction limit. These states are superpositions of finding n photons in one out of two (or more) paths. Using stimulated parametric down-conversion (PDC), we propose a method for generating heralded multiphoton path entanglement, without applying post-selection. PDC is relatively easy to produce compared to pure Fock states as demanded by other proposals. By a special coincidence detection at one down-converted arm, the photons of the second arm non-locally bunch into the desired state. Entanglement in photon number is created between two polarization modes rather than two paths. A polarization beam-splitter and a $\lambda/2$ waveplate can translate between the two representations. The experimental generation of a two-photon path entangled state was detected by observing interference at half the photon wavelength. The scheme is generally extendable to higher photon numbers.

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Date submitted: 01 Dec 2004 Electronic form version 1.4