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Controlling the spatial correlation of entangled photon states using engineered crystal patterns S.N. ZHU, X.Q. YU, P. XU, Department of Physics, Nanjing University — In this work, we will illustrate a scheme to tailor and manipulate the spatial mode of the quantum entanglement of two photons by carefully engineering a nonlinear crystal. We study the entangled state generated from a crystal of lithium tantalite with parallel stripes at intervals of 200 micrometres. These stripes are periodically poled with the period of $\Lambda = 7.548$ μm. The longitudinal nonlinearity works for quasi-phase-matched spontaneous parametric down conversion (QPM-SPDC), whereas the transverse modulation is used to manipulate the two-photon state's spatial mode. When a 532 nm laser is directed on the crystal, it can split the 532nm photon into two degenerate 1064 nm photons. They must be entangled and the structural information in periodic crystal patterns would be transferred into their spatial mode. We performed a far-field interference experiment with such entangled photon pairs. The coincidence count shows a multi-beam two-photon sub-wavelength interference pattern with the peak interval of 3.72 mm and the visibility of the fringe is 0.82 ± 0.03. The result implies that it is possible to control the spatial properties of the entangled photons simply by changing the periodic patterns of nonlinear crystal.

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