

Designing the spatial structure of optical vortex photons

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We generate optical photons which possess quantized values of orbital angular momentum by imprinting a helical phase front on a Gaussian mode using a spiral phase plate. The transverse spatial optical mode can be tailored into various geometries via interference in a modified Mach-Zehnder interferometer. This is done by either interfering photons that are co-propagating and counter-rotating in the near field of the phase plate or in the far field of the phase plate. In addition, the spatial geometry of the interference pattern can be modified by interfering spatial modes with slightly different radius of curvatures. We intend to use the field immediately after the phase plate to diffract ultra-cold atoms (~nanokelvin cold) into a superposition of external angular momentum states which may form the basis of a new type of gyroscope for rotation measurements.