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Coherent manipulation of spin wave vector for polarization of photons in an atomic ensemble

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We experimentally demonstrate the manipulation of two-orthogonal components of a spin wave in an atomic ensemble. Based on Raman two-photon transition and Larmor spin precession induced by magnetic field pulses, the coherent rotations between the two components of the spin wave is controllably achieved. Successively, the two manipulated spin-wave components are mapped into two orthogonal polarized optical emissions, respectively. By measuring Ramsey fringes of the retrieved optical signals, the \pi/2-pulse fidelity of ~96% is obtained. The presented manipulation scheme can be used to build an arbitrary rotation for qubit operations in quantum information processing based on atomic ensembles.

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