Quantum Physics

# Supersensitive measurement of angular displacements using entangled photons

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We show that the use of entangled photons having non-zero orbital angular momentum (OAM) increases the resolution and sensitivity of angular-displacement measurements performed using an interferometer. By employing a 4$\times$4 matrix formulation to study the propagation of entangled OAM modes, we analyze measurement schemes for two and four entangled photons and obtain explicit expressions for the resolution and sensitivity in these schemes. We find that the resolution of angular-displacement measurements scales as $Nl$ while the angular sensitivity increases as $1/(2Nl)$, where $N$ is the number of entangled photons and $l$ the magnitude of the orbital-angular-momentum mode index. These results are an improvement over what could be obtained with $N$ non-entangled photons carrying an orbital angular momentum of $l\hbar$ per photon

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