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Stable interferometer for orbital angular momentum sorting

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Our interferometer is based on a previously reported orbital angular momentum (OAM) sorting device. By introducing a specially designed phase- and intensity-inverting prism into each arm of the interferometer, decoupling the vertical and horizontal alignment in each arm, we are able to reduce the degrees of freedom within the interferometer from initially being associated with very optical component to a mere one degree of freedom; the optical path length. The interferometer induces a phase shift, which is proportional to both the OAM of the incoming beam and the relative angle, θ, between the two phase- and intensity-inverting prisms. When the angle between the two phase- and intensity-inverting prisms is 90 degrees, and the path length is appropriately selected, constructive interference will occur in one of the two output ports for even l-valued states and in the opposite port for odd l-valued states. Apart from adjusting the path length of the interferometer, two external degrees of freedom, two mirrors, are used to align the incoming beam into the interferometer.
To test the effectiveness of the interferometer in separating odd and even l-states, the intensity of the interference pattern in one of the output ports was monitored, while the path length of one of the arms of the interferometer oscillated back and forth between constructive and destructive interference. The Michelson contrast was calculated for various incoming l-states. We obtain a maximum Michelson contrast measurement of 92% at an OAM value of l=0 and 85.3% at l=±10.

Level (Hons, MSc,
   PhD, other)?

PhD

Consider for a student
   award (Yes / No)?

Yes

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

No

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