Selection of a Vortex beam using a Sagnac Interferometer

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1. Introduction

Optical fields with an embedded phase singularity are referred to as vortex beams as they carry and impart Orbital Angular Momentum (OAM). They have been found to be attractive in various applications such as optical trapping, quantum communications, laser ablation, manipulation of atoms and micro particles and surface structuring. Techniques to select vortex beams vary from spiral phase plates to spatial light modulators to birefringent q-plates to name a few. One interesting approach is the use of interferometric techniques which are known to generate higher order modes from fundamental Gaussian modes. Here we demonstrate experimentally a technique combining a Sagnac Intereferometer and an Astigmatic Mode Converter (AMC) to generate a vortex beam. We exploit both the amplitude and phase difference of two superposing Gaussian beams to obtain a pure Hermite Gaussian mode of first order, then propagate it through an AMC to achieve a vortex mode. As a result, the technique presents a potential for high power applications in laser material processing.

2. Results

The proposed Sagnac Interferometer in combination with the Astigmatic Mode Converter technique is validated. Fig. 1 shows the experimental schematic of a Sagnac Interferometer to select a vortex beam. The resulting vortex beams were interfered with a Gaussian beam, showing a fork grating that indicates the presence of a vortex phase as demonstrated in fig. 2.

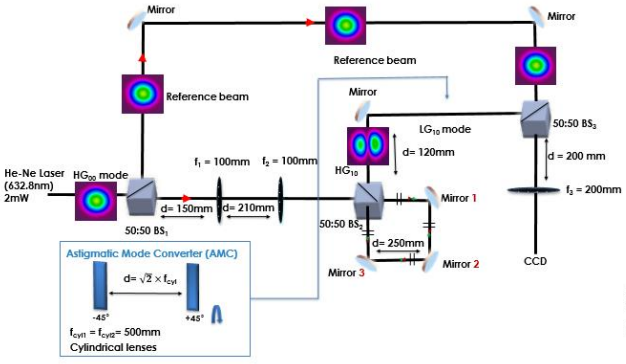

Fig. 1: Experimental schematic of a Sagnac Interferometer + AMC to select a vortex beam

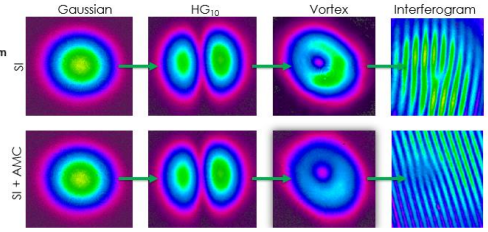

Fig. 2: Experimental outputs and interferograms confirming vortex selection

In conclusion we have shown the selection of vortex beams from a Sagnac interferometer with good quality.

3. References

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