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A New Angle on the Tilted Lens

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Passing a beam through an aberrated optical system can result in unwanted changes to both the phase and amplitude of the beam. These changes can greatly degrade many important properties of the beam such as the resolution, spot size in focusing and the beam quality factor. These aberrations are generally corrected for using pre- or post-corrective optics or other methods. The ideal solution for overcoming these issues would be to find the structures of light that remain unchanged when passing through these aberrated systems, also called the eigenmodes of the system. In this work we show that these modes can be calculated by treating the optical system as an operator and then finding the eigenstates of the operator. We experimentally confirm the effectiveness of the method by making use of the topical example of the tilted lens, which is a highly astigmatic system that has been used to measure the topological charge of OAM modes. We find the eigenmodes of the tilted lens analytically and demonstrate their practical robustness using an experimental setup. This work has many applications in the fields of optics, imaging and optical communications.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

Primary authors: TAVARES BUONO, Wagner (University of the Witwatersrand); PETERS, Cade Ribeiro (University of the Witwatersrand); FORBES, Andrew (U. Witwatersrand)

Presenter: PETERS, Cade Ribeiro (University of the Witwatersrand)

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