Contribution ID: **318** Type: **Oral Presentation**

Compensating and keeping up with atmospheric chaos by tailoring beams of light

Tuesday 8 July 2025 16:50 (20 minutes)

The ability to tailor light in all of its degrees of freedom has seen significant improvements in the fields of optical imaging and communications. It has allowed for the straightforward implementation of spatial modes of light which can be used to form higher dimensional encoding alphabets to increase the bandwidths of free space and optical fibre channels. The orthogonality and completeness of the mode sets allow them to perfectly describe any 2D complex (amplitude and phase) image. However, the promise of structured light is hindered by the distortions induced by the various complex media through which it often needs to propagate. This has many deleterious effects such as limiting imaging resolution, reducing the range over which we can communicate and increasing modal crosstalk. Many of the proposed solutions to combat the degradation of structured light involve determination of a transmission matrix (TM) which describes the manner in which the channel distorts incident light fields. However, The TM is time consuming and difficult to measure making these techniques challenging to implement. Here, we propose a method for estimating the TM in parallel with sending or receiving data through the channel. This allows for a more realistic implementation of these methods and allows us to update our transmission matrix as the medium evolves in time. We demonstrate this both numerically and experimentally, using atmospheric turbulence as an example. This work has applications in the fields of both quantum and classical imaging and optical communications.

Apply for student award at which level:

PhD

Consent on use of personal information: Abstract Submission

Yes, I ACCEPT

Primary authors: PETERS, Cade (Univeristy of the Witwatersrand); Dr SORELLI, Giacomo (Fraunhofer IOSB); Mr BELLOSI, Raphael (Fraunhofer IOSB); Dr GLADYSZ, Szymon (Fraunhofer IOSB); FORBES, Andrew (University of the Witwatersrand)

Presenter: PETERS, Cade (Univeristy of the Witwatersrand)

Session Classification: Photonics

Track Classification: Track C - Photonics