Simultaneous Turbulence Compensation of Multiple Orbital Angular Momentum 100–Gbit/s Data Channels

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Problem: Bandwidth demand > Spectral resource

-60 Tbit/s capacity is needed by 2015.

Existing Solutions to Boost Data Capacity

- Spectral resource is limited, even for optics.

Orbital Angular Momentum (OAM)

- Non-OAM beam
- Phase front
- Intensity profile
- OAM beams (l=±1)
- "Donut" Intensity

How to generate OAM

- OAM multiplexing/demultiplexing
- Superimposed OAMs
- Data 1
- Data 2
- Data 3
- Data 4

OAM Beam Propagating Through Turbulence and Adaptive Optics Compensation

- Atmospheric Turbulence
- Transmit OAM
- Freid’s parameter
- Rotating Phase Plate
- Rotating Phase Plates with phase distribution obeying Kolmogorov Spectrum Statistics is used to emulate atmospheric turbulence

The Proposed Turbulence Compensation for OAM Modes

- Beam splitter
- Turbulence Emulator
- Free Space Propagation
- Wavefront Corrector
- Feedback controller
- Corrected OAM beams
- Corrected Gaussian beam

Experimental Results — Adaptive Optics Compensation

- Far-field intensity Before/After Turbulence Compensation
- RMS 0.813
- PV 2.562
- SR: 0.231

- RMS 0.092
- PV 0.649
- SR: 0.924

- By using the correction pattern obtained from the Gaussian probe beam in the closed-loop adaptive optics, the distorted OAM beams up to \( l = 9 \) are efficiently compensated.
- The crosstalk is mitigated efficiently by 10. 4dB, reduced from -9.51 dB to -19.95 dB.

Y. Ren et al, CLEO2013, paper CM2G.4 (Invited Paper)