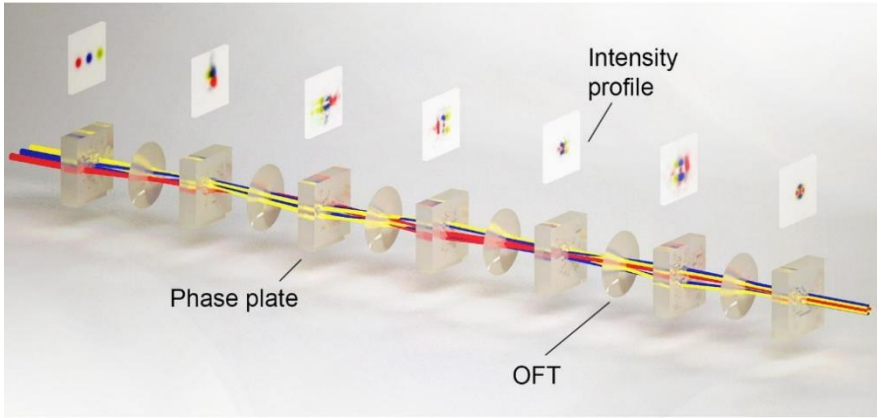
Bachelor / Master Thesis:
Multi-Plane Light Conversion for Mode Multiplexing

Karlsruhe Institute of Technology

The data rates in modern fiber-optic communication systems approach the limits imposed by the maximum transmission capacity of conventional single-mode fibers. Increasing the achievable data rates beyond today's limits requires exploiting yet unused degrees of freedom because of the limited bandwidth of the optical fiber channel. Deploying new fiber types enables propagating multiple signals over the same wavelength and polarization channel using separate spatial transmission paths, so-called fiber modes. The central challenge of this technique is the mapping of the parallel data signals onto the fiber modes and vice versa. This process requires a multiplexer that can be realized (among others) with the help of multi-plane light conversion (MPLC). The basic idea in MPLC is the application of a series of phase masks to the propagating light. This way, unitary transforms between arbitrary modal bases become possible, as shown in the figure below.

Your tasks could comprise:

- Develop a profound understanding of MPLC
- Come up with design guidelines for the phase plates required for specified modal transforms.
- Numerically simulate and optimize different mode multiplexers based on MPLC.



Multiple phase plates realize the transform of three adjacent Gaussian mode profiles into the desired fiber mode.
Source: Labroille et al. Optical Fiber Technology 35. 2017.

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