Simultaneous wavelength and orbital angular momentum demultiplexing using tunable MEMS-based Fabry-Perot filter - DTU Orbit (06/12/2018)

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In this paper, we experimentally demonstrate simultaneous wavelength and orbital angular momentum (OAM) multiplexing/demultiplexing of 10 Gbit/s data streams using a new on-chip micro-component-tunable MEMS-based Fabry-Perot filter integrated with a spiral phase plate. In the experiment, two wavelengths, each of them carrying two channels with zero and nonzero OAMs, form four independent information channels. In case of spacing between wavelength channels of 0.8 nm and intensity modulation, power penalties relative to the transmission of one channel do not exceed 1.45, 0.79 and 0.46 dB at the hard decision forward-error correction (HD-FEC) bit-error-rate (BER) limit $3.8 \times 10^{-3}$ when multiplexing a Gaussian beam and OAM beams of azimuthal orders 1, 2 and 3 respectively. In case of phase modulation, power penalties do not exceed 1.77, 0.54 and 0.79 dB respectively. At the 0.4 nm wavelength grid, maximum power penalties at the HD-FEC BER threshold relative to the 0.8 nm wavelength spacing read 0.83, 0.84 and 1.15 dB when multiplexing a Gaussian beam and OAM beams of 1st, 2nd and 3rd orders respectively. The novelty and impact of the proposed filter design is in providing practical, integrable, cheap, and reliable transformation of OAM states simultaneously with the selection of a particular wavelength in wavelength division multiplexing (WDM). The proposed on-chip device can be useful in future high-capacity optical communications with spatial-and wavelength-division multiplexing, especially for short-range communication links and optical interconnects.