

errors will have no impact on any mode. Experimentally, we only calibrate the device on one mode, adjusting tuners to minimize crosstalk to all unlaunched modes. This calibration should ensure that all other modes cause similarly low crosstalk.

We first inject circularly polarized OAM0 following the dashed-line path 1 in Fig. 2a and run a gradient descent algorithm to minimize the worst-case crosstalk through optimizing tuning signals. We then removed the OAM0 beam and inject an OAM5 produced by a circularly polarized Gaussian passing through a vortex plate, $m=5$ on the solid-line path 2. A lens of 25mm focus is used to match both OAM0 and OAM5 to the antenna array. During the calibration, the worst-case crosstalk with OAM0 input is improved from an as-fabricated -7.6 dB to a calibrated 12.7 dB (Fig. 2b). The measured worst-case crosstalk for OAM5, with the tuning signals inherited from previous calibration, is -12.9 dB (dashed line Fig. 2b). This is the first step to demonstrating uniform crosstalk performance among all the supported modes of this device. Note that the crosstalk can be further improved by exploiting the intensity tuning circuit [7].

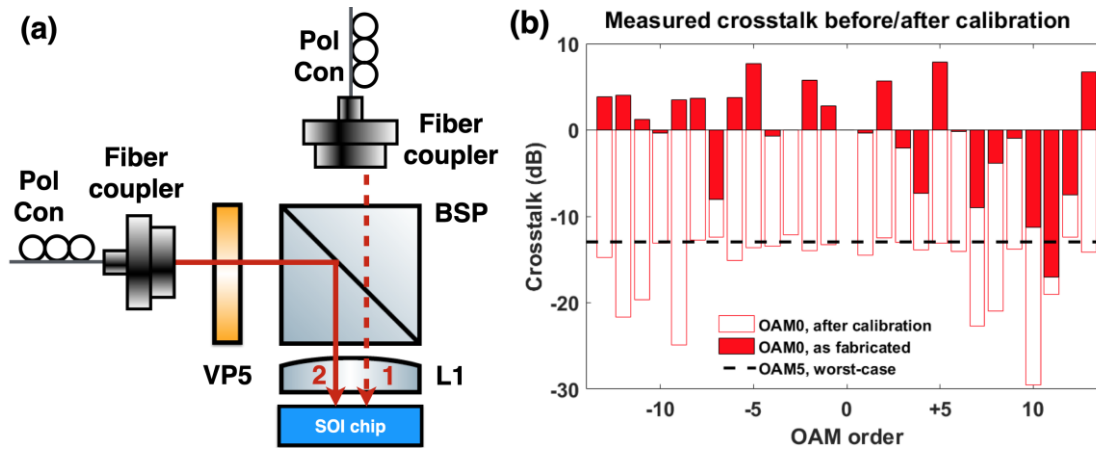


Fig. 2. (a) Setup for phase calibration with Gaussian (dashed path 1) and crosstalk measurement with OAM5 (solid path 2), and (b) Measured crosstalk for Gaussian and OAM5. Pol.con: polarization controller, VP5: vortex plate with $m=5$, BSP: non-polarization beam splitter, L1: 25mm focus lens.

III. CONCLUSION

We characterized an optical phased array on a silicon-on-insulator platform that multiplexes circularly polarized OAM modes. We verified its ability to provide similar performance across two supported modes (-12.7 dB worst-case crosstalk for both modes examined). The characterized device supports a highest-ever-demonstrated 24 modes [7] and can significantly extend the capacity of previous wavelength division multiplexing compatible silicon-based OAM multiplexers. The device provides a scalable, integrated solution for OAM generation and multiplexing in ultra-high capacity SDM systems.

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