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CMOS-Compatible Optical Phased Arrays Powered by Monolithically-Integrated Erbium Lasers
J. Notaros, N. Li, C. V. Poulton, Z. Su, M. J. Byrd, E. S. Magden, E. Timurdogan, C. Baiocco, N. M. Fahrenkopf, and M. R. Watts
Sponsorship: DARPA E-PHI program (HR0011-12-2-0007) and NSF Graduate Research Fellowship (1122374)

Integrated optical phased arrays (OPAs), fabricated in advanced silicon photonics (SiP) platforms, enable dynamic high-speed control of free-space light. As such, OPAs have many promising wide-reaching applications, including light detection and ranging (LIDAR), holographic displays, and free-space communications. However, due to the absence of a direct-band-gap material in standard SiP platforms, many of these demonstrations have been limited to systems with fiber-coupled off-chip lasers, which restrict the practicality of the system due to packaging and cost concerns.

In this work, an erbium-doped laser and an electrically-steerable OPA are monolithically integrated in a CMOS-compatible 300-mm-wafer SiP platform. This system represents the first demonstration of an active CMOS-compatible SOI photonics system powered by a rare-earth-doped monolithically-integrated laser and paves the way for future monolithic SiP systems, such as data communication links and optical synthesizers.

(a) Simplified schematic (not to scale) and (b) photograph of the integrated optical phased array system powered by a monolithically-integrated erbium laser.