Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Omni-directional active pillar arrays for emission extraction and on-chip generation of optical vortices at 1.55μm
NATE LAWRENCE, Department Electrical Engineering, Boston University, JACOB TREVINO, Division of Material Science, Boston University, LUCA DAL NEGRO, Department Electrical Engineering, Boston University — We engineer deterministic aperiodic structures (DAS) for omni-directional light extraction, emission profile shaping and direct orbital angular momentum generation from Si-based light emitting devices operating at telecom wavelengths. Omni-directional diffraction is achieved through the use of structures with circularly symmetric Fourier space and is well suited for extracting light from devices, such as LEDs or lasers. To exploit the unique light scattering properties of these structures we have fabricated active pillar arrays of Erbium (Er) doped Silicon-Rich Nitride (SRN) using electron beam lithography (EBL) and reactive ion etching (RIE) while varying geometry to optimize extraction enhancement around 1.55μm. We find that aperiodic spiral arrays with continuous circular Fourier space give over 10 times extraction enhancement and outperform Archimedean lattices, which are the standard structures commonly utilized for omni-directional extraction. Additionally we directly image the real and reciprocal space of the emitted radiation at 1.55μm and demonstrate direct generation of optical vortices with well-defined values of orbital momentum. These results offer the opportunity to engineer novel optical devices that leverage the control of structured light on optical chips, such as novel laser sources, broadband optical couplers and concentrators.

Nate Lawrence
Department Electrical Engineering, Boston University

Date submitted: 22 Nov 2011 Electronic form version 1.4