

Phase Noise and Linewidth of Single-Mode VCSELs

Background

The vertical-cavity surface-emitting laser (VCSEL) is the preferred light source for many applications and is today produced in large volumes for optical interconnects in datacenters, gas sensors, and consumer electronics (e.g. smartphones, laser mice, and advanced driver assistance systems in cars). Some of these applications require the VCSEL to be single-mode, with only the fundamental mode being active and therefore producing a single spectral emission line. The width of this line, known as the linewidth, which is related to the phase noise and coherence of the laser, is then of great importance. The linewidth depends on the design of the single-mode VCSEL and the operating conditions.

Objectives

It is the purpose of this project to measure the linewidth for different single-mode VCSELs. The dependence on bias current, output power, and temperature should be quantified. The effects of optical feedback on linewidth could also be studied. For measurements of the linewidth, a measurement system based on the delayed self-heterodyne technique should be constructed. The linewidth should also be measured by mixing using a coherent tunable laser and the results from the two measurements should be compared.

Content

- Writing planning report
- Literature study
- Measurements of basic VCSEL performance parameters
- Construction of setup for linewidth measurements
- Measurements of linewidth under different operating conditions
- Data analysis
- Writing report
- Oral presentation
- Writing and submitting scientific paper (possibly, depending on results)

Advisor and examiner

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