Bachelor / Master Thesis:

Hybrid integrated narrow-linewidth light sources for distributed acoustic fiber sensing (DAS)

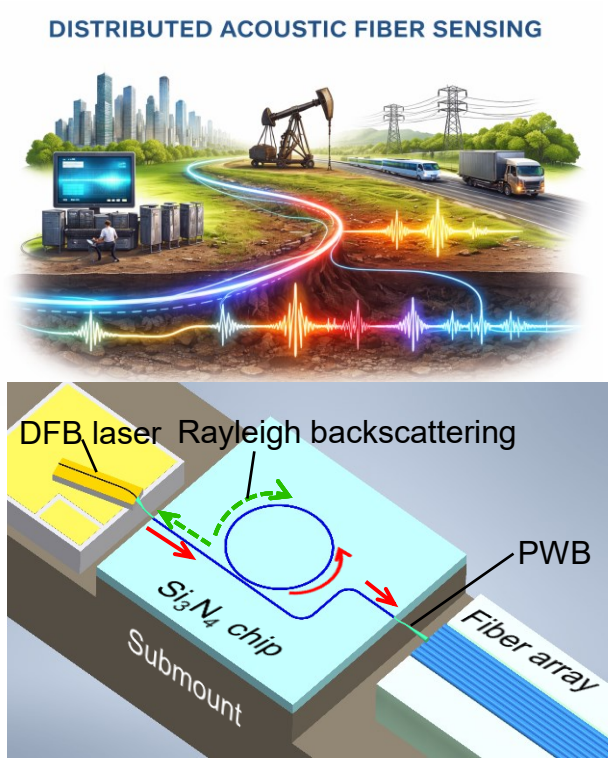
Introduction

Distributed acoustic sensing (DAS) [1] can continuously monitor vibrations and acoustic signals along long lengths of optical fiber. This technology can be used in a wide range of applications, such as railway and traffic monitoring, structural health monitoring, and subsea cable monitoring. On a technical level, DAS systems are based on the coherent detection of Rayleigh backscatter signals in optical fibers, which crucially rely on lasers with high coherence (narrow-linewidth) and stable wavelength. Current DAS systems typically use bulky external cavity lasers or fiber lasers, which limit the compactness and cost of the systems.

In this thesis work, you will develop photonic integrated lasers with low phase noise [2] as the light sources for DAS systems, which can reduce the footprint and cost of the overall DAS systems. You will implement a novel DAS system concept, a multi-channel distributed acoustic fiber sensing architecture, which could potentially increase the sensing capacity, mitigate signal fading, and improve the sensing sensitivity.

Your tasks

- Develop integrated narrow-linewidth laser sources
- Implement digital signal processing for DAS system
- Implement the DAS system and evaluate the system performance



Concept of a hybrid integrated laser source

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[1] Z. He, et al., “Optical Fiber Distributed Acoustic Sensors: A Review,” Journal of Lightwave Technology, 39, 3671-3686, 2021.
[2] H. Peng, et al., “Low-phase-noise frequency-agile hybrid integrated laser offering highly linear tuning for fmcw lidar,” CLEO, 2024.