Master Thesis:
Applications of Hybrid External-Cavity Lasers

Karlsruhe Institute of Technology

Tunable lasers are key building blocks of integrated optics. Because of their ability to provide single longitudinal mode operation over a wide tunability range with exceptionally small linewidth, there is much interest in integrated external cavity lasers (ECLs)[1][2] for, e.g., optical communication and sensing applications. We recently demonstrated a new class of hybrid ECLs exploiting 3D-printed photonic wirebonds (PWB) for connecting InP RSOA to SiP external-cavity circuits[3].

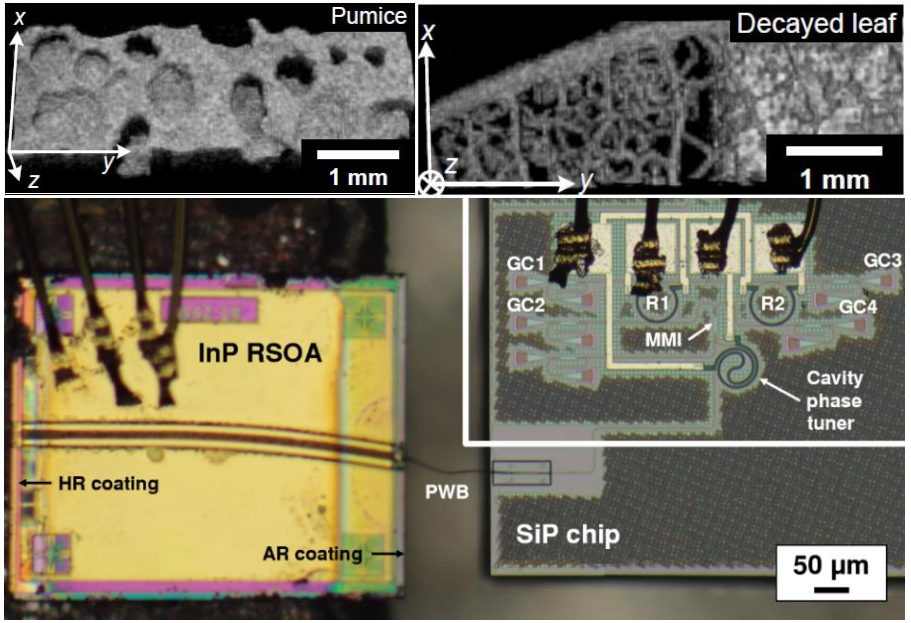
The goal of this thesis is to investigate concepts for the automated tuning of such an integrated ECL over its available tuning range. On this basis, you can build upon our existing demonstrations[4] to improve the performance of the device as a light source for applications such as swept source optical coherence tomography (SS-OCT).

[1] Guan *et al.*, "Widely-tunable, Narrow-linewidth III-V/Silicon Hybrid External-cavity Laser for Coherent Communication," *Optics Express* **26**(7), pp. 7920–7933, (2018).

[2] Fan *et al.*, "290 Hz Intrinsic Linewidth from an Integrated Optical Chip-based Widely Tunable InP-SiN Hybrid Laser," *CLEO*, paper JTh5C.9, (2017).

[3] Xu, Maier *et al.*, "Hybrid external-cavity lasers (ECL) using photonic wire bonds as coupling elements," *Scientific Reports* **11**(1), 16426 (2021).

[4] Maier, Bremauer *et al.*, "Swept-Source Optical Coherence Tomography (SS-OCT) Using a Hybrid Silicon Photonic External-Cavity Laser (ECL)," *CLEO*, paper AM5I.4, (2022).



Your tasks may include:

- Development of concepts for automated tuning
- Investigate feasibility for applications, e.g. SS-OCT
- Fabrication of new ECL modules including PWB
  - Precharacterization of ECL components
  - Fabrication of PWB using two-photon polymerization
  - Characterization of the laser performance

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