Hugo Larocque
Zhuoya Yuan, Zihan Li, Jiale Sun, Anat Siddharth, Simone Bianconi, Tobias J. Kippenberg
Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland

Sub-kHz linewidth integrated extended-DBR Pockels laser using lithium tantalate

We implement a tunable extended distributed Bragg reflector (e-DBR) Pockels laser within a lithium tantalate photonic integrated circuit. Figure 1 gives the schematics for such a laser. The configuration relies on butt-coupling a III-V reflective semiconductor optical amplifier (RSOA) to a lithium tantalate photonic integrated circuit containing a tunable DBR grating.

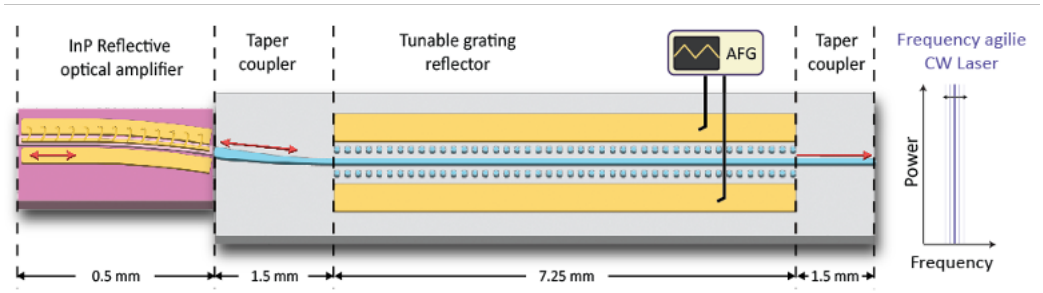

Figure 1 Integrated extended-DBR laser schematics relying on lithium tantalate integrated photonics.

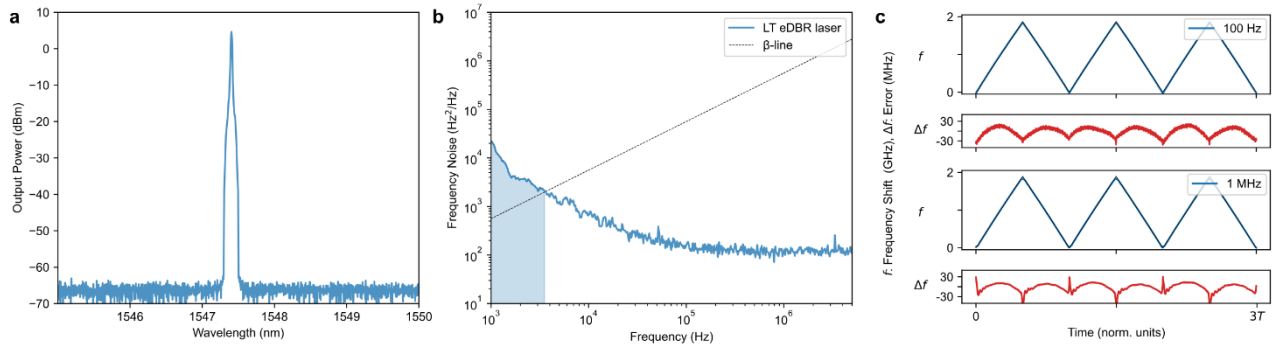

Figure 2 (a) Emission and (b) frequency noise spectra of a sample lithium tantalate extended-DBR laser. (c) Emission frequency tuning of the laser obtained while driving its electrodes with a 5 Vpp triangle wave (blue) and the corresponding deviation from an ideal triangle wave (red) for driving frequencies of 100 Hz and 1 MHz.

Figures 2a,b show sample and frequency noise spectra of such a laser, which can reach output powers of 10 mW and intrinsic linewidths of 117 Hz. Figure 2c provides the emission frequency of the laser while driving its electrodes with 5 Vpp triangle waves, which shows tuning efficiencies of roughly 360 MHz/V. Compared to similar lithium niobate devices [1], this lithium tantalate laser features similar tuning efficiencies and output powers while boasting considerably smaller linewidth.

References

[1] A. Siddarth, S. Bianconi, R.N. Wang, Z. Qiu, A.S. Voloshin, M.J. Bereyhi, J. Riemensberger, and T.J. Kippenberg, Nat. Photon., 19 (2025) 709.