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Class-A Operation of InAs Quantum Dash-based Vertical-External-Cavity Surface-Emitting Laser

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Motivations

Realization of an optical laser source with high spectral purity, low intensity noise and highly tunability for microwave photonics and coherent communication systems

Applications

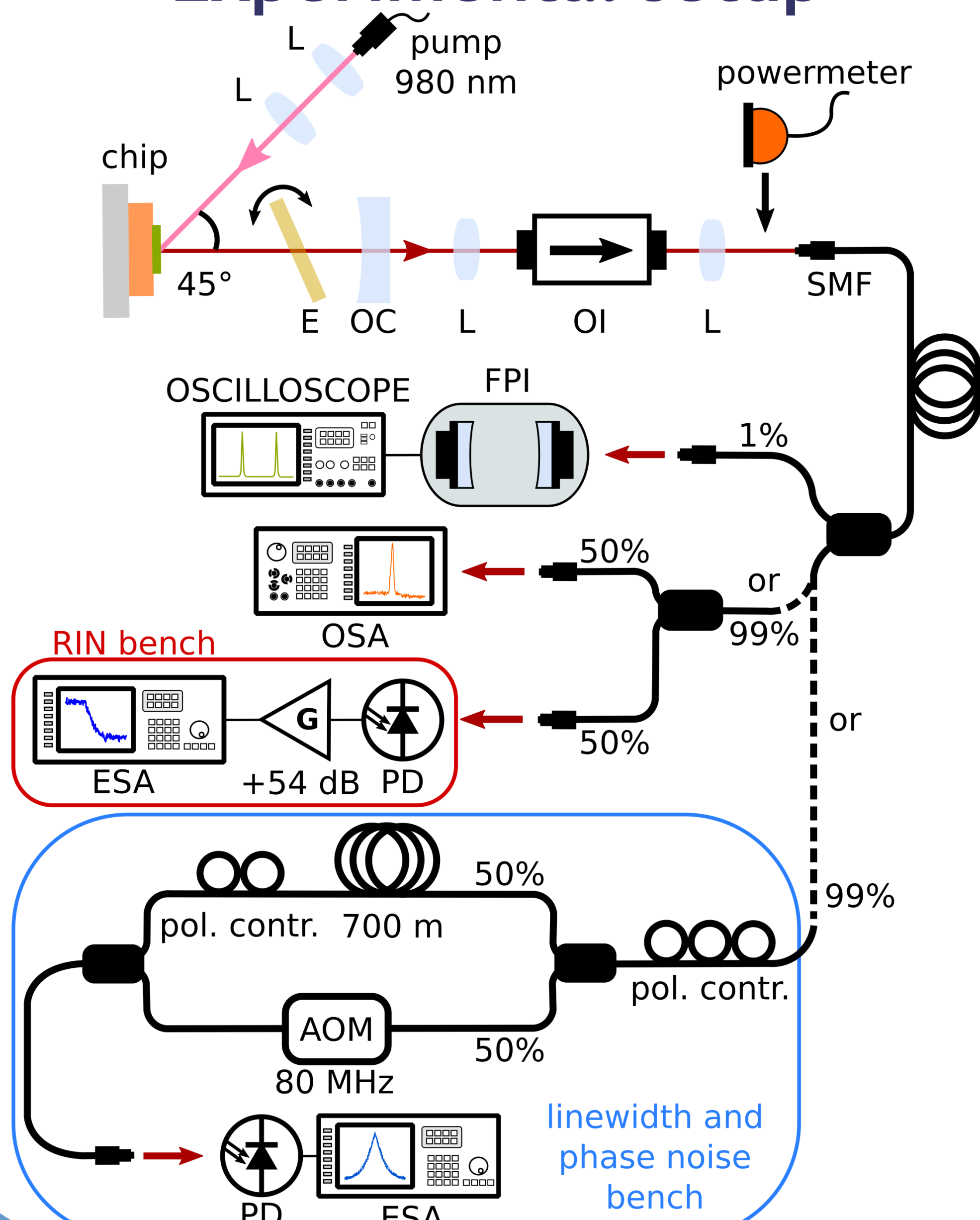
MICROWAVES:

- RADAR/LIDAR systems
- Ultra low-noise sources
- Dual-frequency lasers
- THz generation

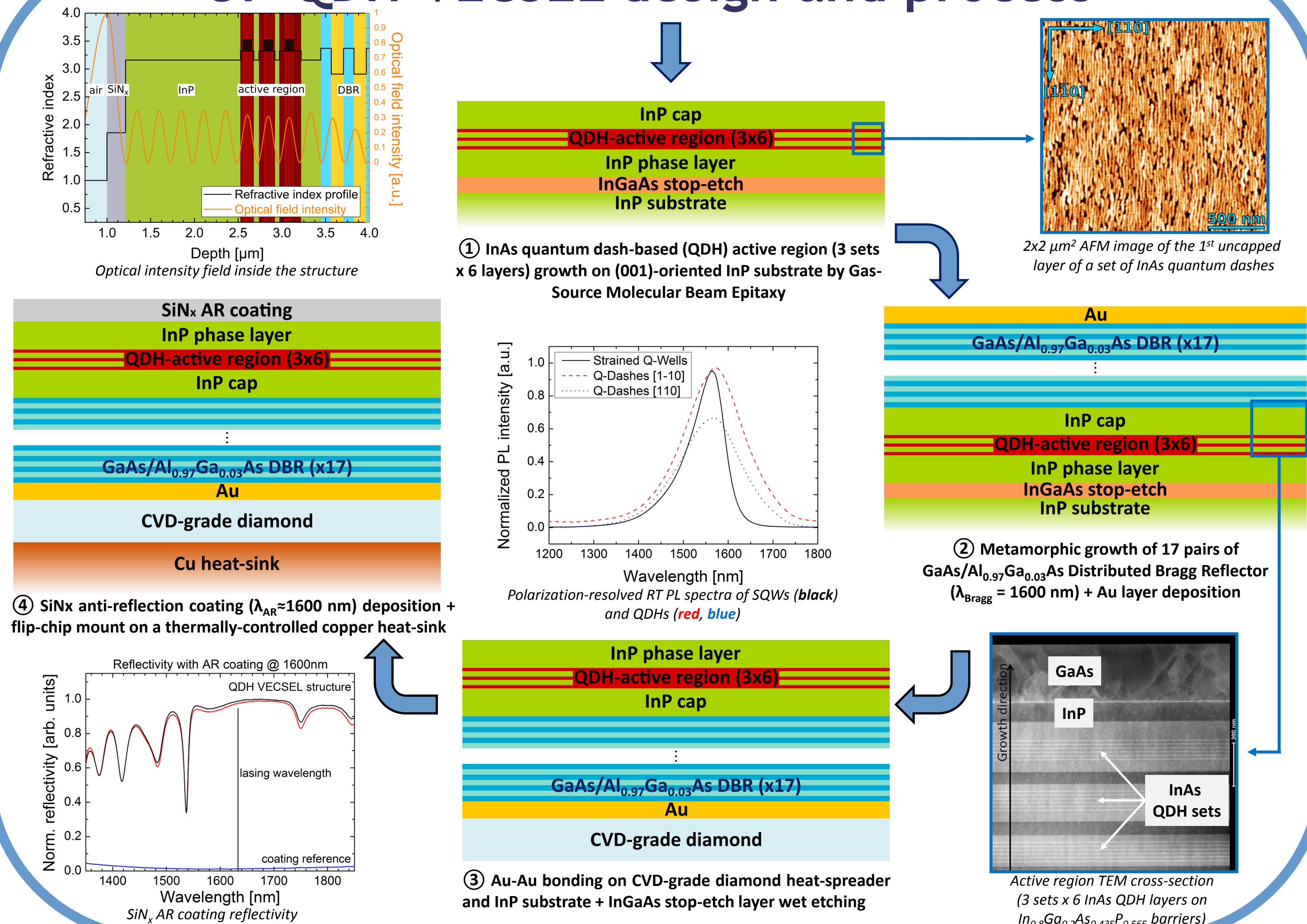
METROLOGY:

- High resolution spectroscopy
- High pure optical reference signal distribution
- Time/frequency metrology

Experimental setup

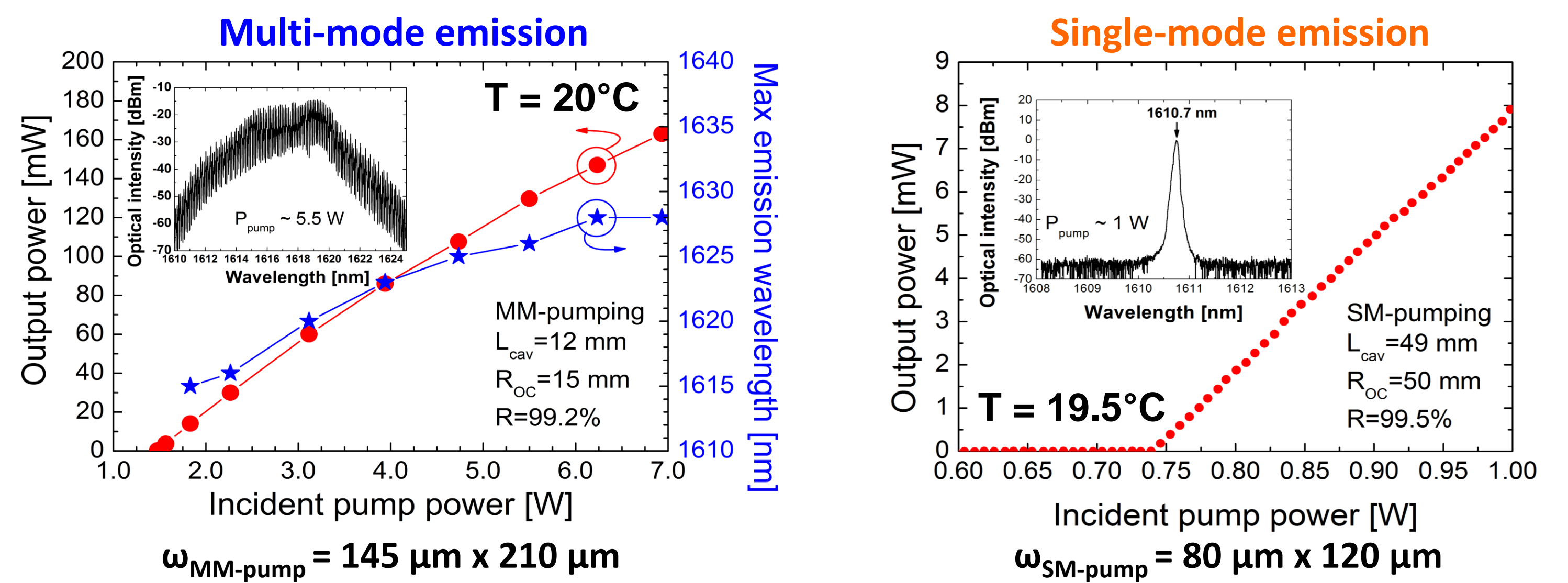


OP-QDH-VECSEL design and process

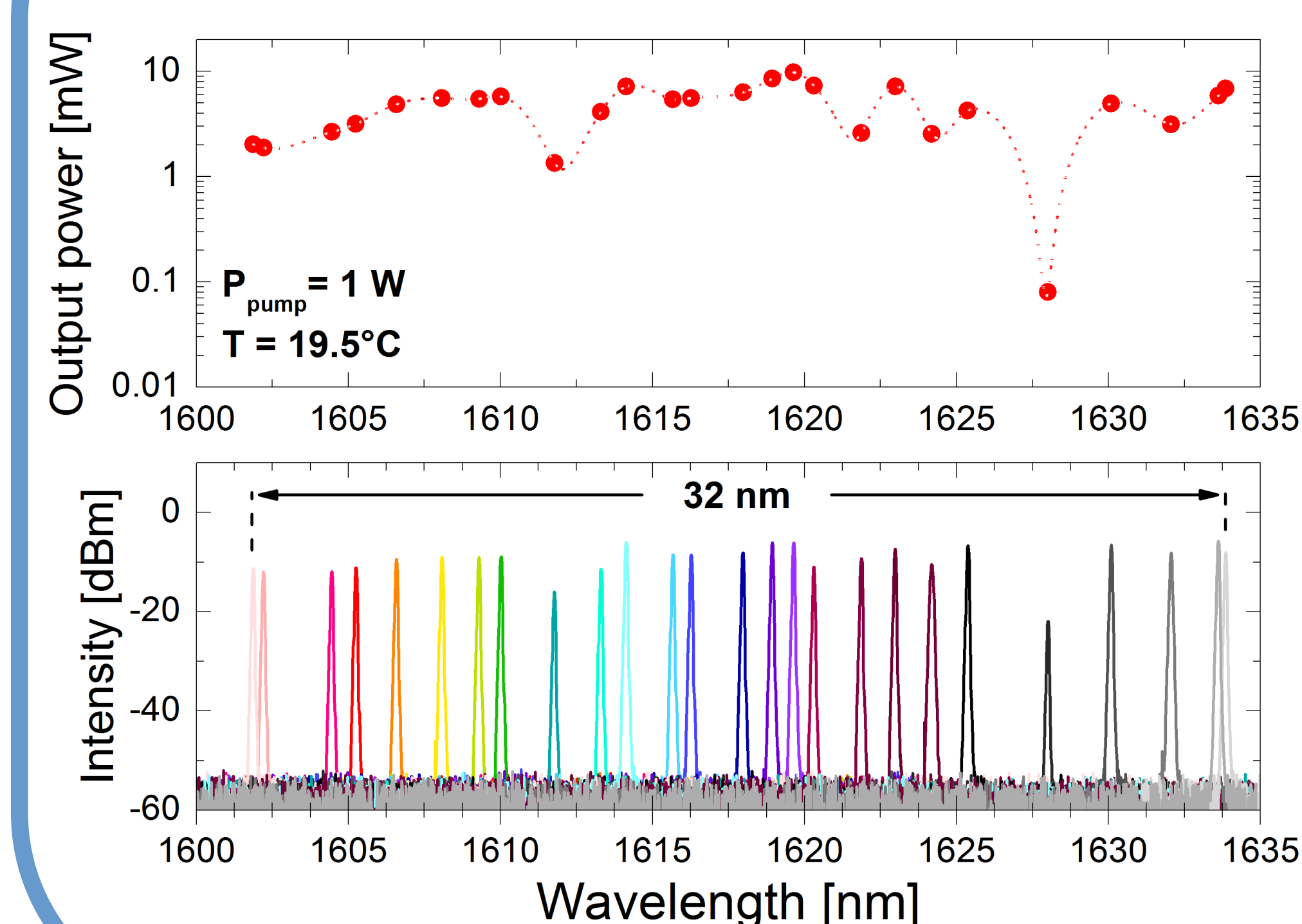


Laser characterization

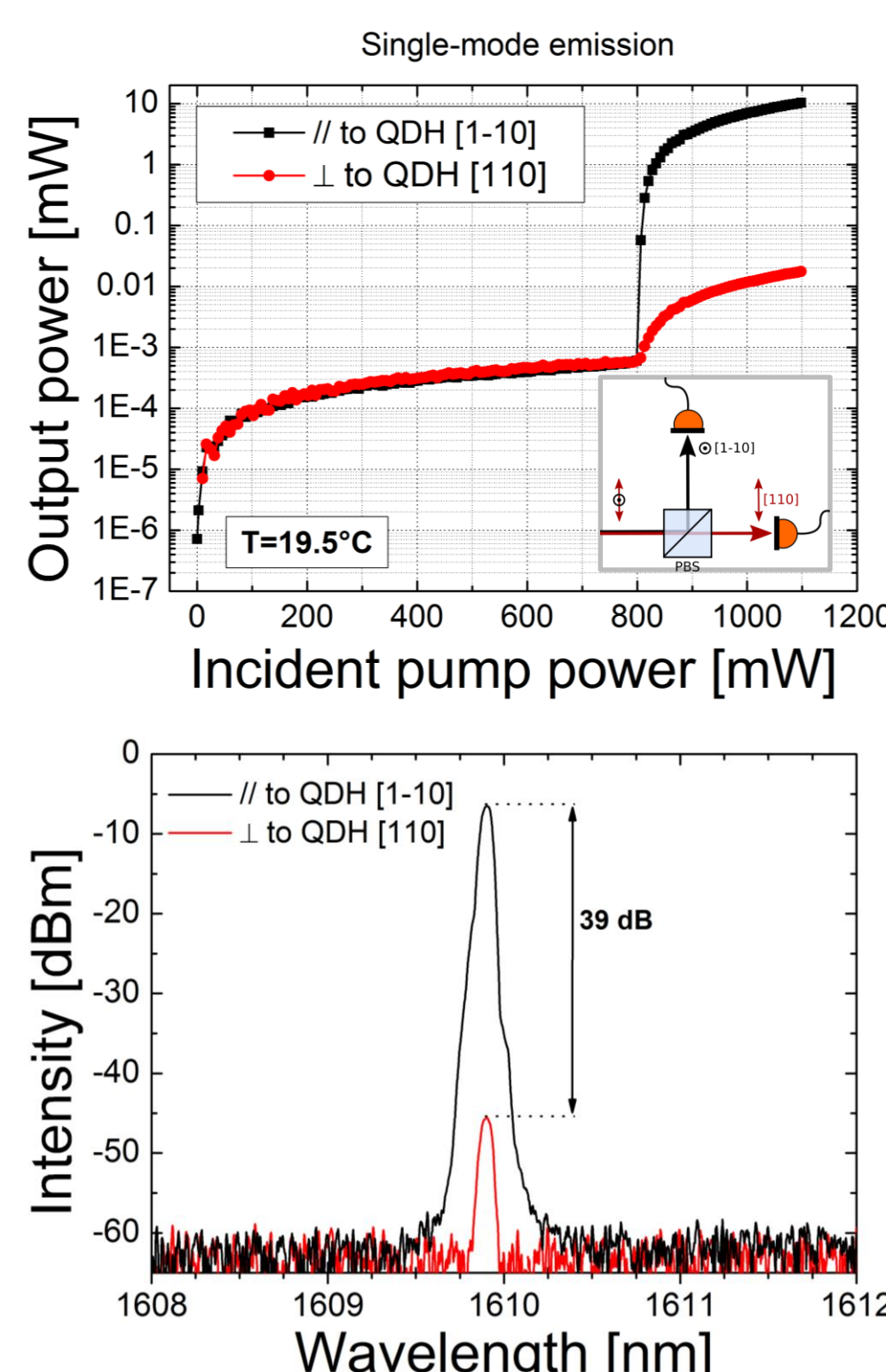
Output characteristics and emission spectra



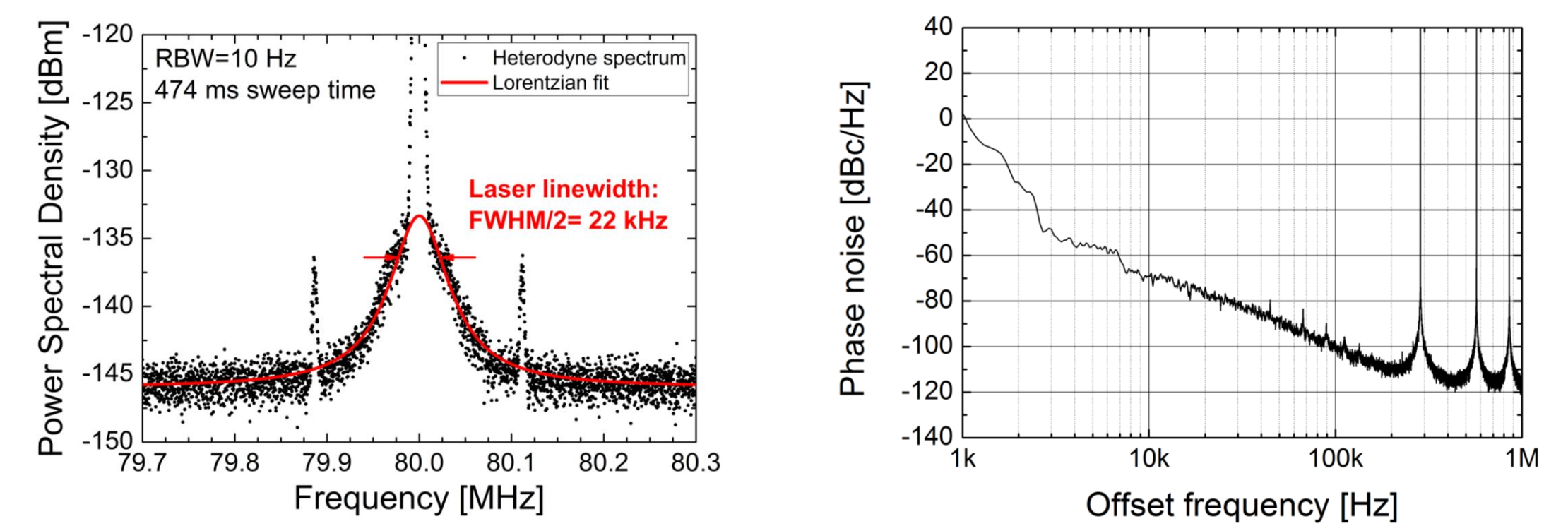
Single-frequency wavelength tuning



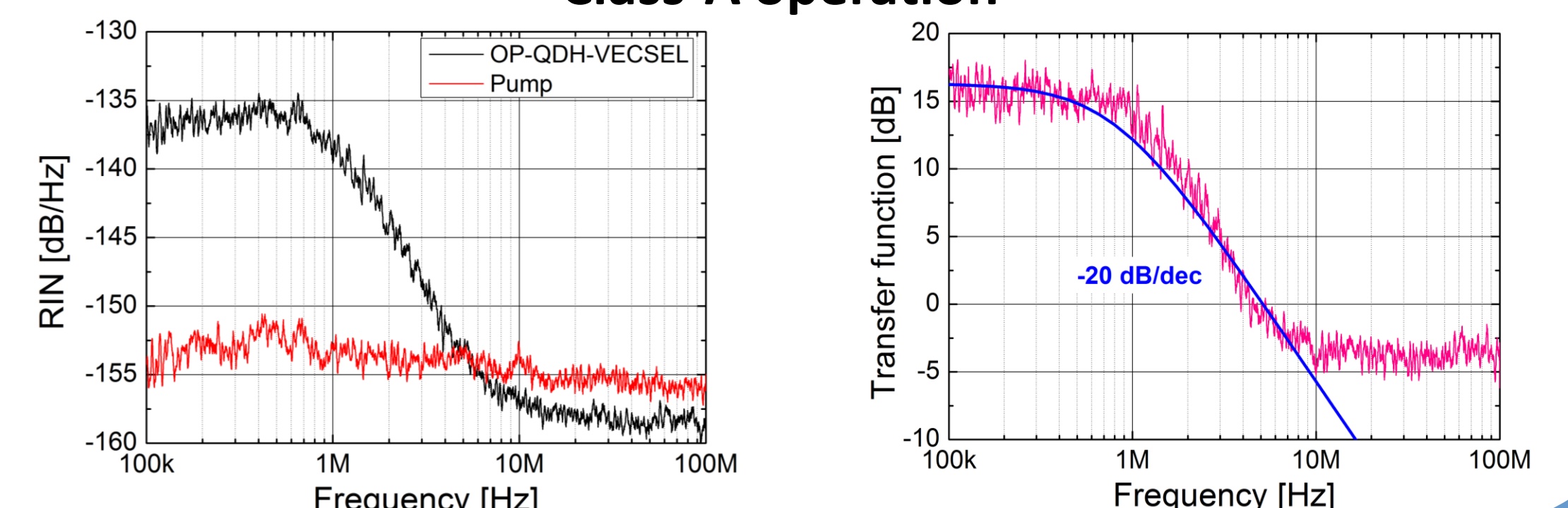
Polarization-resolved SM-emission



Laser linewidth and phase noise



Class-A operation



Conclusion

Demonstration of a Class-A Optically-Pumped InAs Quantum Dash-based Vertical-External-Cavity Surface-Emitting Laser on InP.

MM-emission: $P_{out} = 163 \text{ mW}$ @ $P_{inc} = 7 \text{ W}$, $T=20^\circ\text{C}$

SM-emission: $P_{out} = 10.4 \text{ mW}$ @ $P_{inc} = 1.1 \text{ W}$, $T=19.5^\circ\text{C}$, 32 nm tuning

Polarization stably aligned along dash [1-10] direction, OPSR = 39 dB

Laser linewidth estimation: 22 kHz (49 mm-long cavity)

Phase noise: -110 dBc/Hz @ $f > 200 \text{ kHz}$ (free-running)

Class-A operation: $f_c = 800 \text{ kHz}$, RIN = -158 dB/Hz ($I_{phd} = 2 \text{ mA}$)

Future perspectives

- Dual-frequency operation
- Laser stabilisation on ULE cavity (metrology)
- Electrical pumping

Funding

ANR and DGA within the **ANR-ASTRID HYPOCAMP project** (grant ANR-14-ASTR-0007-01) and a DGA-MRIS/Région Bretagne scholarship (grant ARED-VELOCE 8917).

References

S. Pes et al., "Class-A Operation of an Optically-Pumped 1.6 μm -emitting Quantum Dash-based Vertical-External-Cavity Surface-Emitting Laser on InP", Opt. Express **25**(10), 11760-11766 (2017)