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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

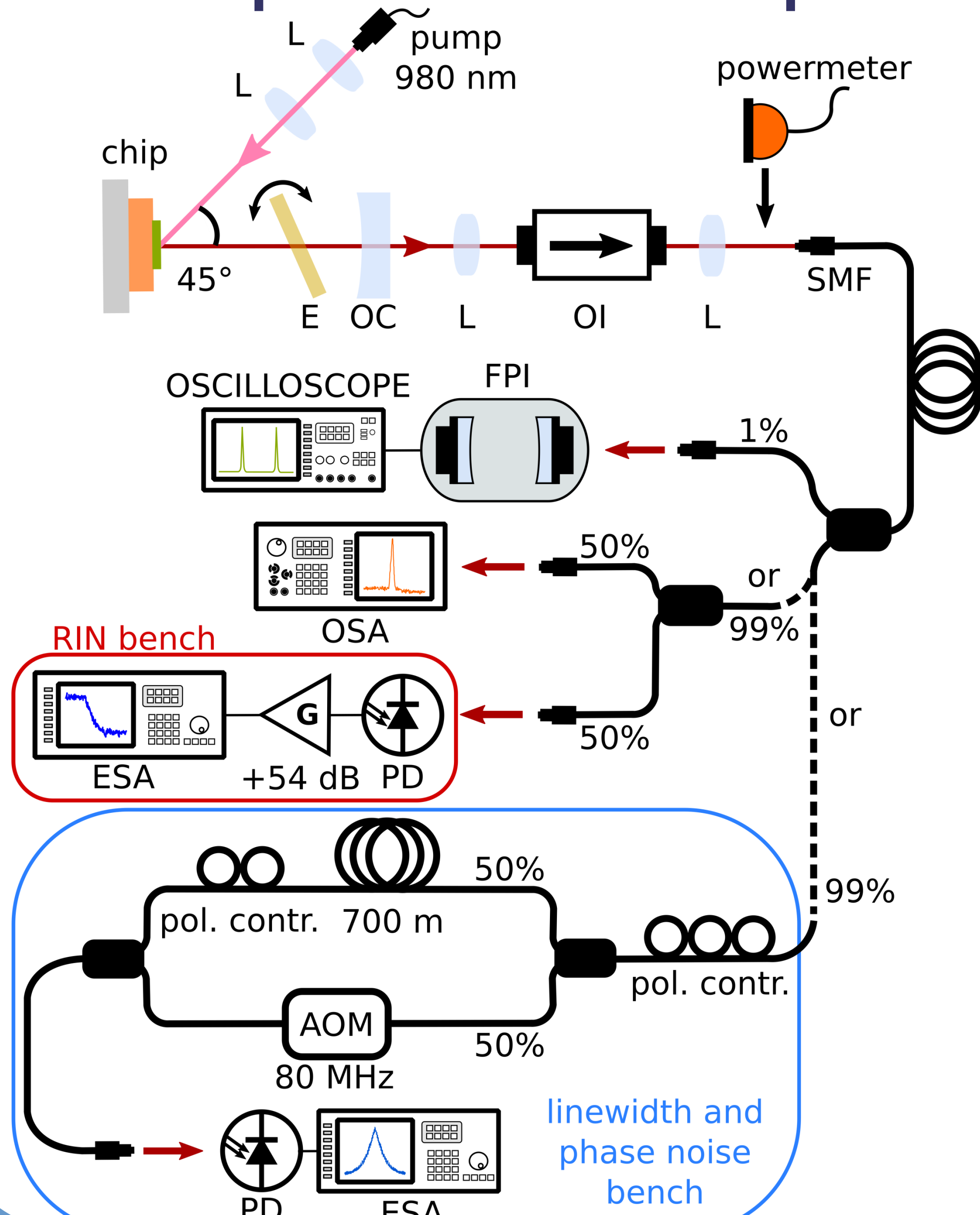
### MICROWAVES:

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

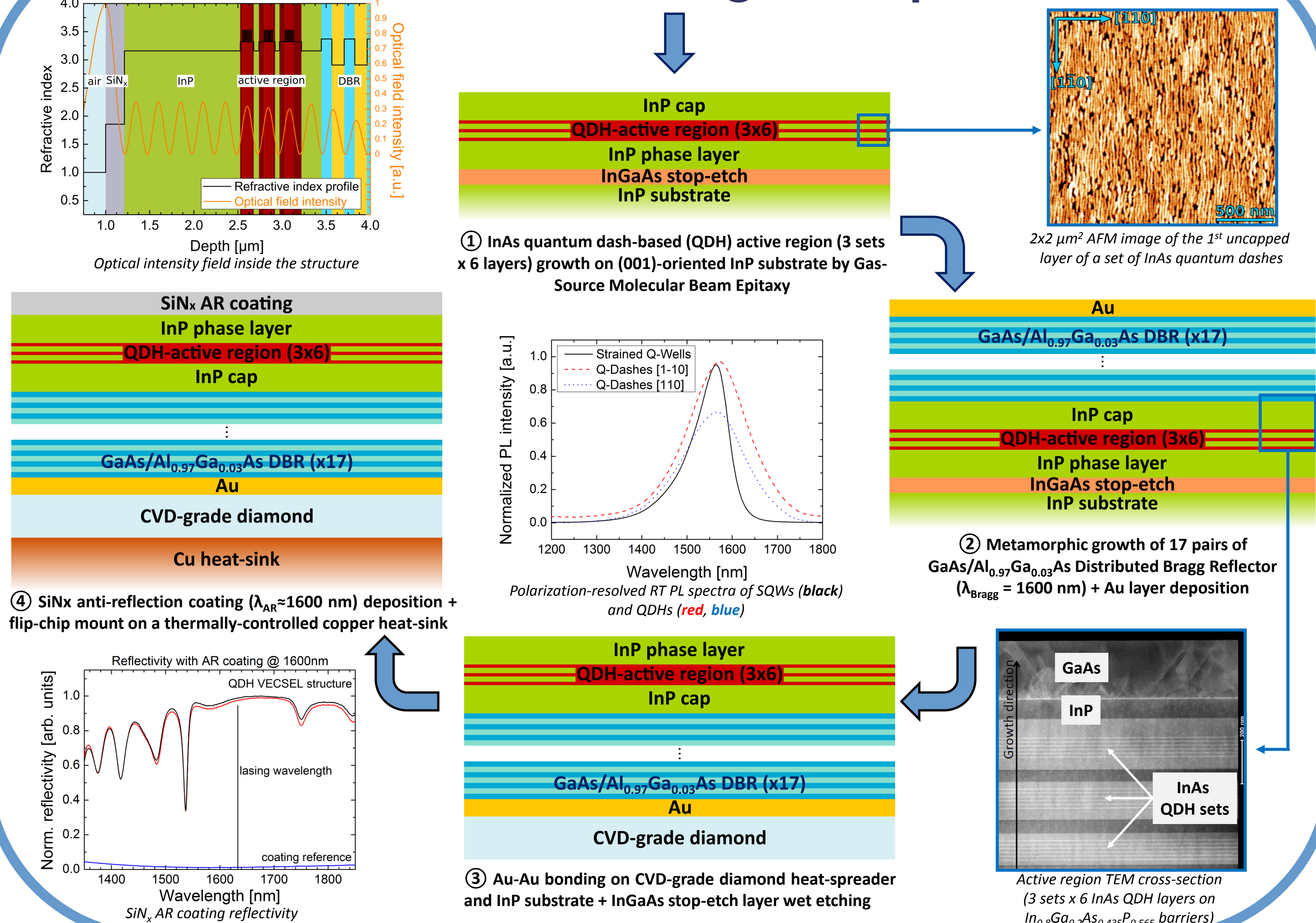
### METROLOGY:

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

## Experimental setup

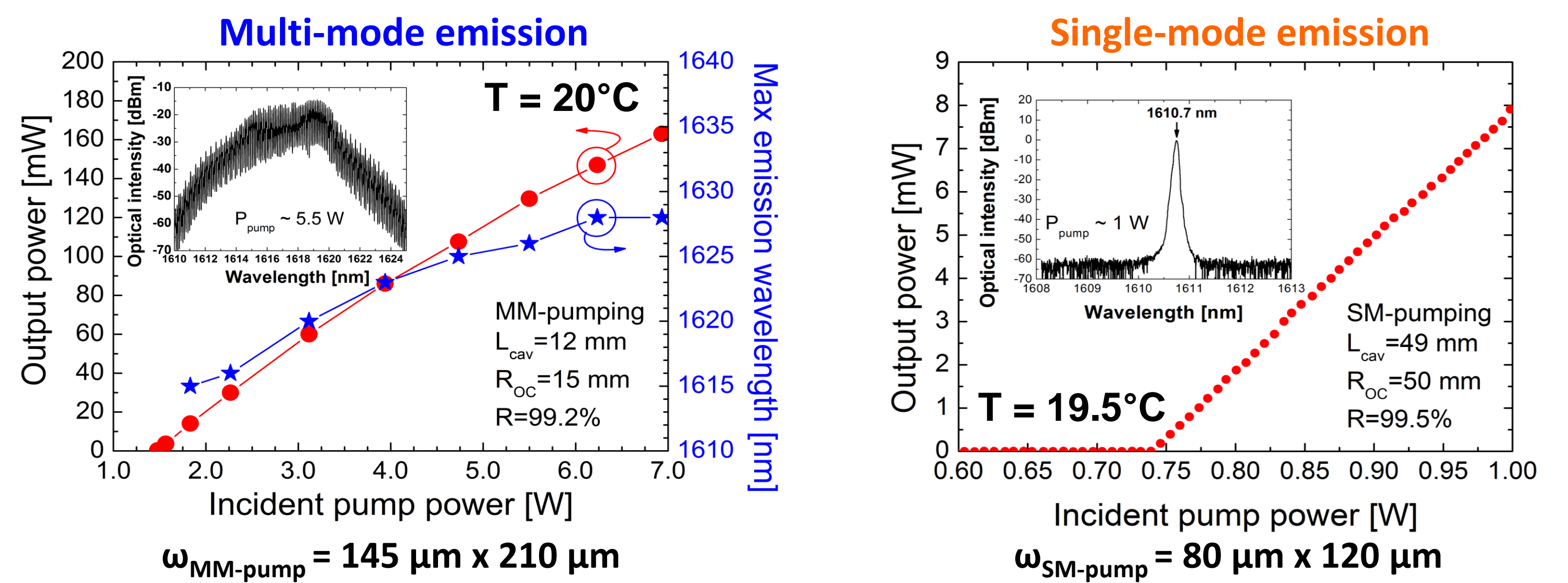


## OP-QDH-VECSEL design and process

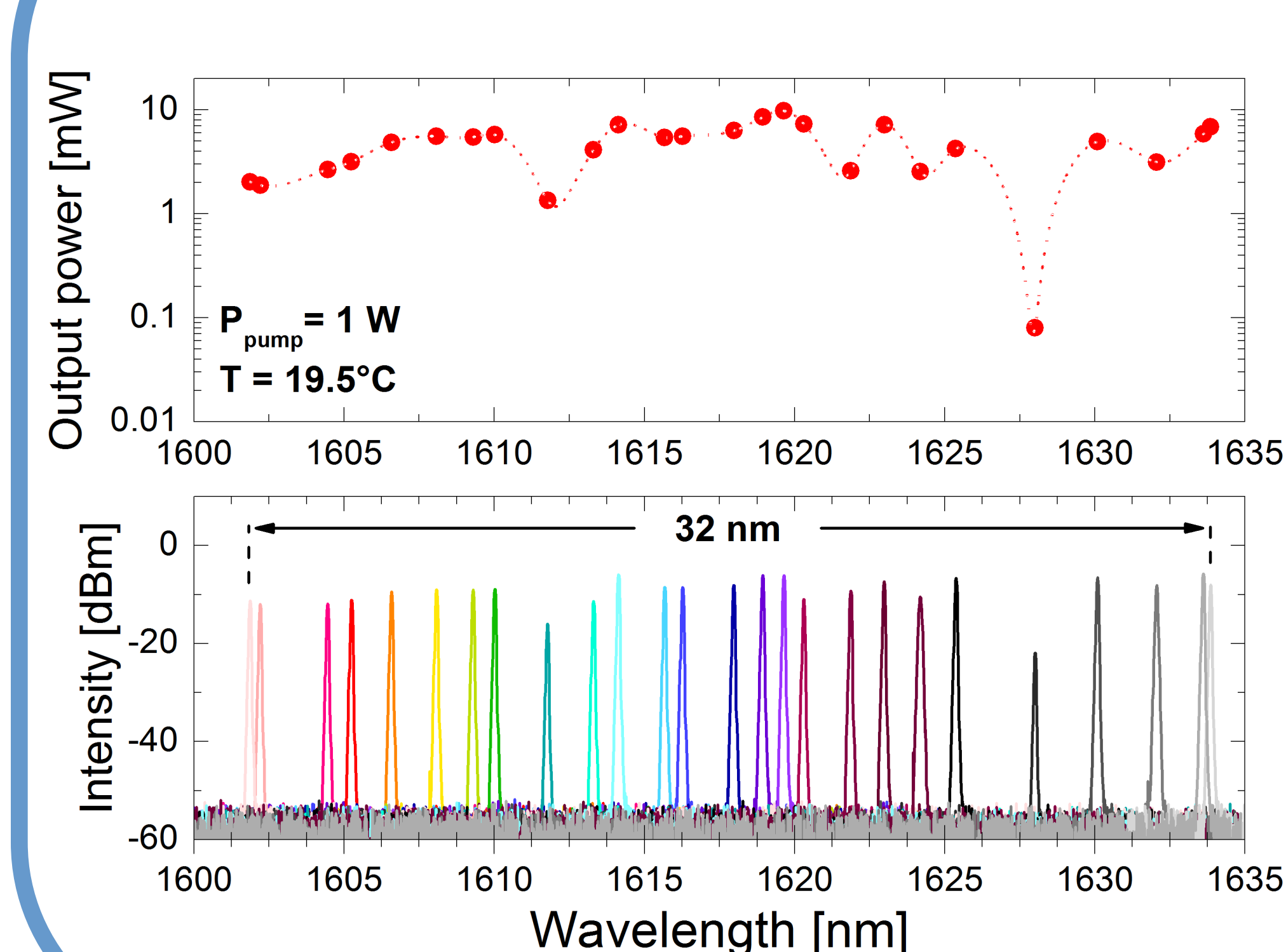


## Laser characterization

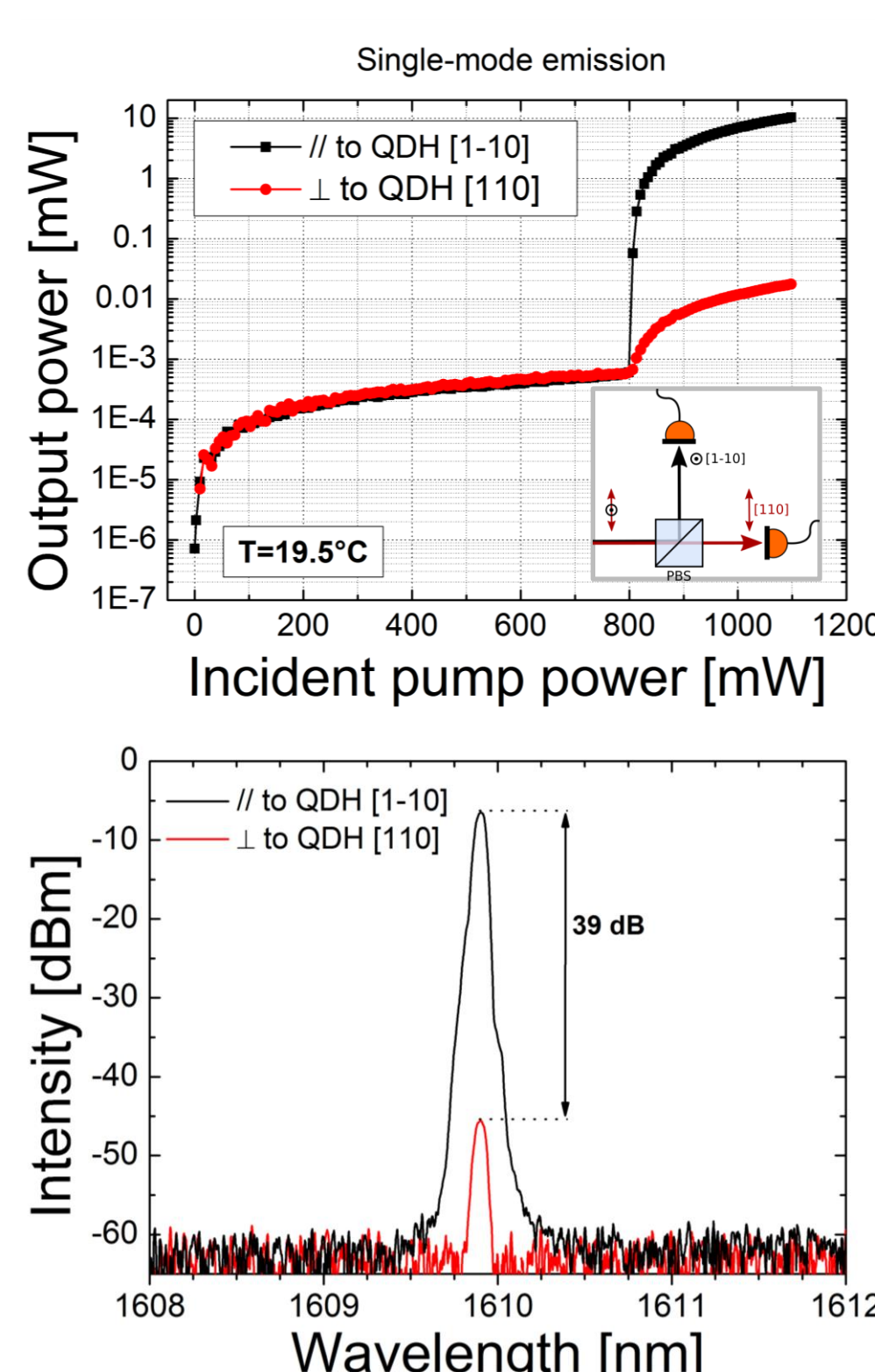
### Output characteristics and emission spectra



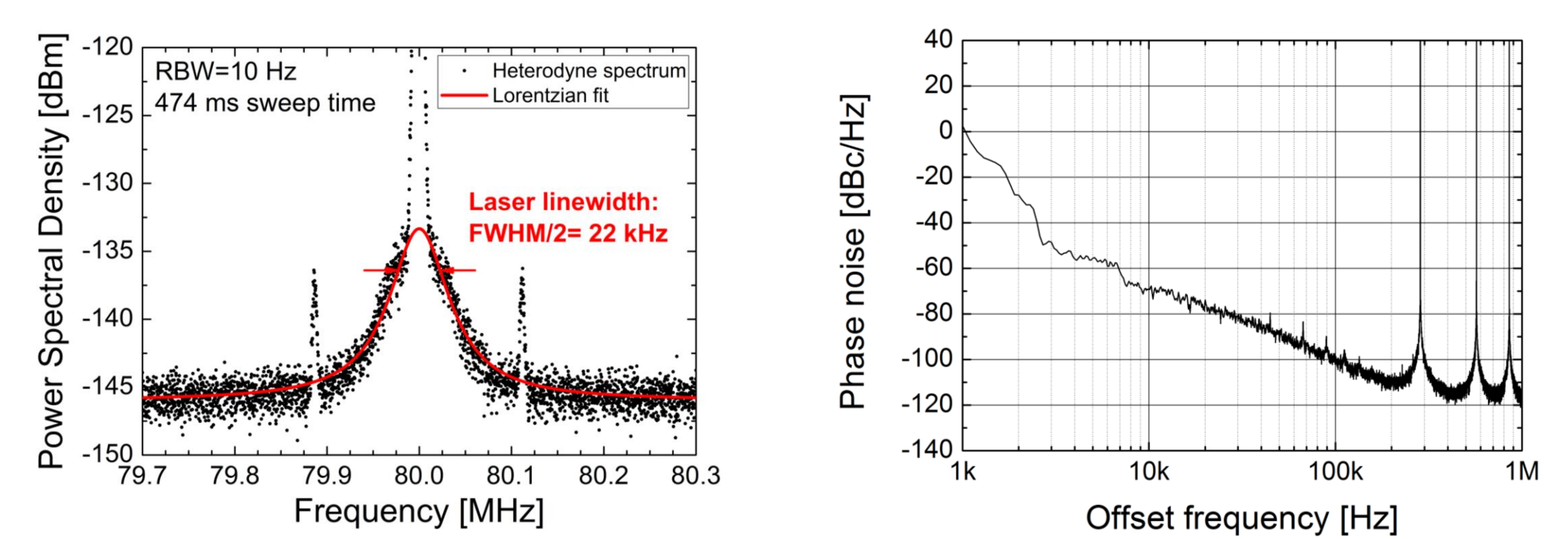
### Single-frequency wavelength tuning



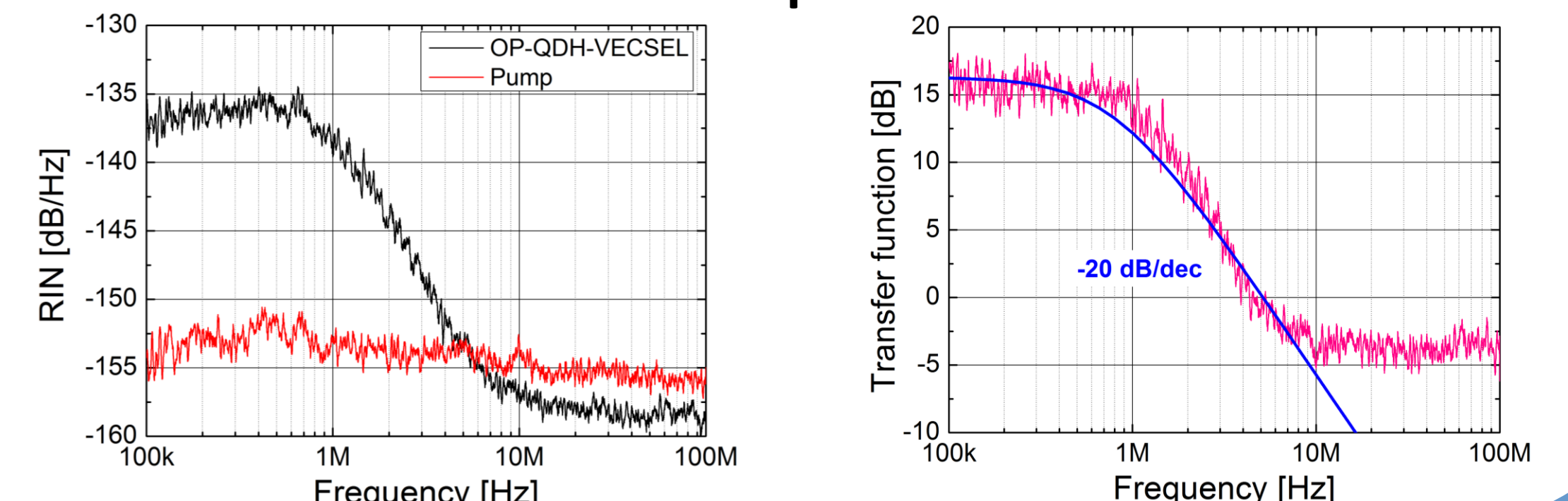
### Polarization-resolved SM-emission



### 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<sub>out</sub> = 163 mW @ P<sub>inc</sub> = 7 W, T=20°C

**SM-emission:** P<sub>out</sub> = 10.4 mW @ P<sub>inc</sub> = 1.1 W, T=19.5°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 kHz (free-running)

Class-A operation: f<sub>c</sub> = 800 kHz, RIN = -158 dB/Hz (I<sub>phd</sub> = 2 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  $\mu\text{m}$ -emitting Quantum Dash-based Vertical-External-Cavity Surface-Emitting Laser on InP", Opt. Express **25**(10), 11760-11766 (2017)