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# Quantum Dash-based Vertical-External-Cavity Surface-Emitting Laser on InP

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## Motivations

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

## Applications

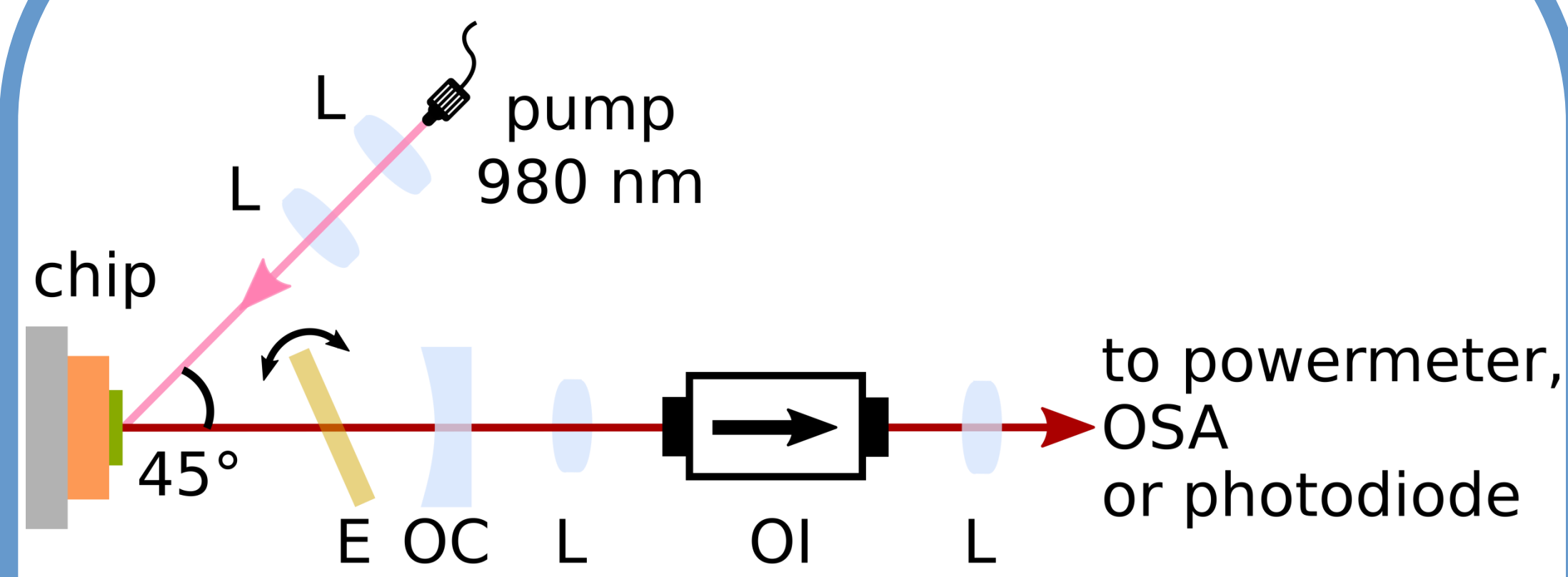
### MICROWAVES:

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

### METROLOGY:

- High resolution spectroscopy
- High pure optical references signals distribution
- Time/frequency metrology

## Experimental setup



### Setup 1 (MM emission):

$R_{OC} = 15 \text{ mm}$   
 $R = 99.2\% @ 1.6 \mu\text{m}$   
 $L_{cav} = 12 \text{ mm}$   
 $\omega_{pump} = 145 \mu\text{m} \times 210 \mu\text{m}$   
Multi-mode pumping  
No etalon

### Setup 2 (SM emission):

$R_{OC} = 50 \text{ mm}$   
 $R = 99.5\% @ 1.6 \mu\text{m}$   
 $L_{cav} = 49 \text{ mm}$   
 $\omega_{pump} = 80 \mu\text{m} \times 120 \mu\text{m}$   
Single-mode pumping  
40  $\mu\text{m}$ -thick etalon ( $R_{eta} = 30\%$ )

## Conclusion

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

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

$P_{out} = 10.4 \text{ mW} @ P_{inc} = 1.1 \text{ W}, T=19.5^\circ\text{C}$  (SM emission)

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

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

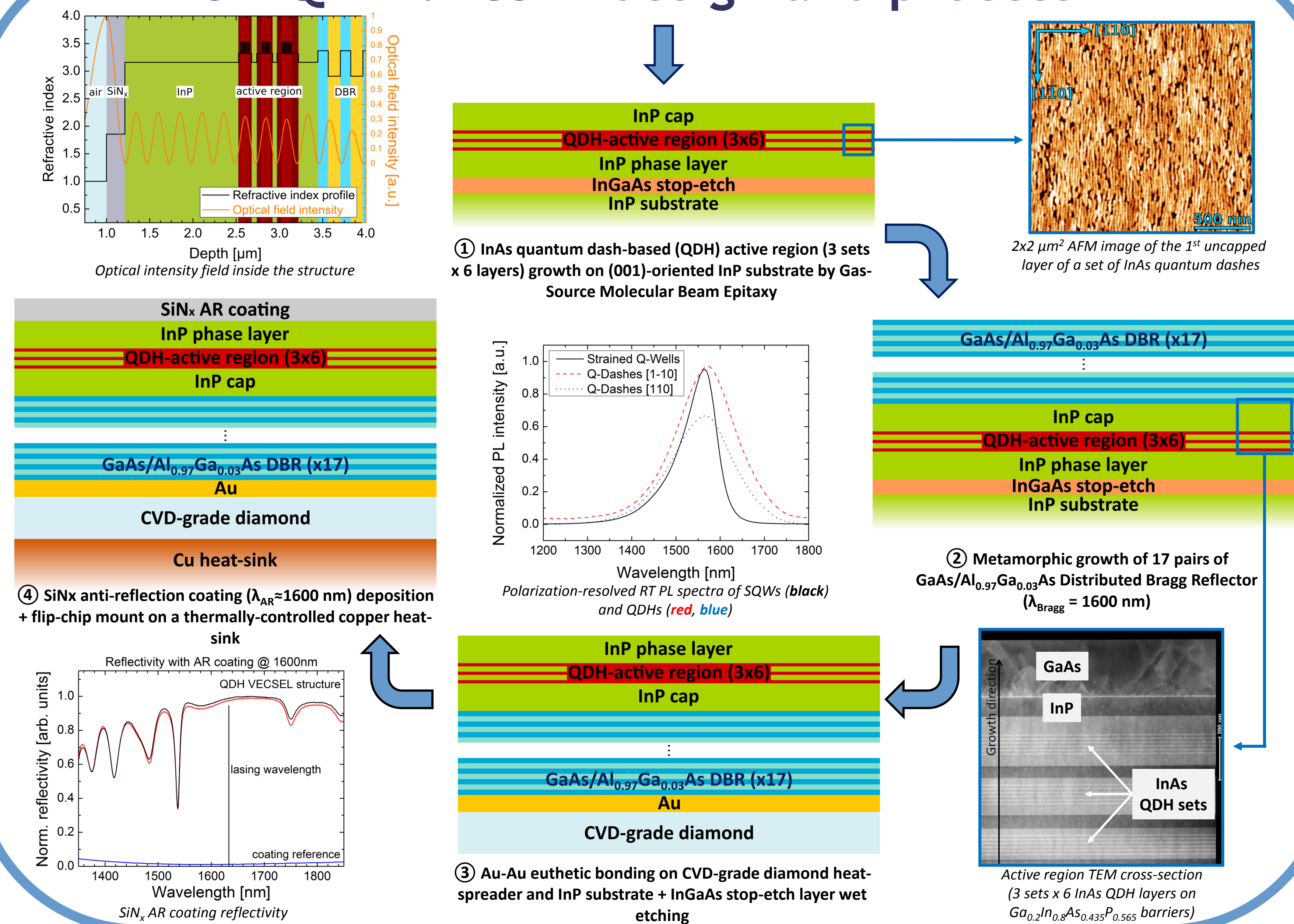
## Future perspectives

- Low-noise laser characterization
- Dual-frequency operation
- Laser stabilisation on ULE cavity (metrology)
- Electrical pumping

## Funding

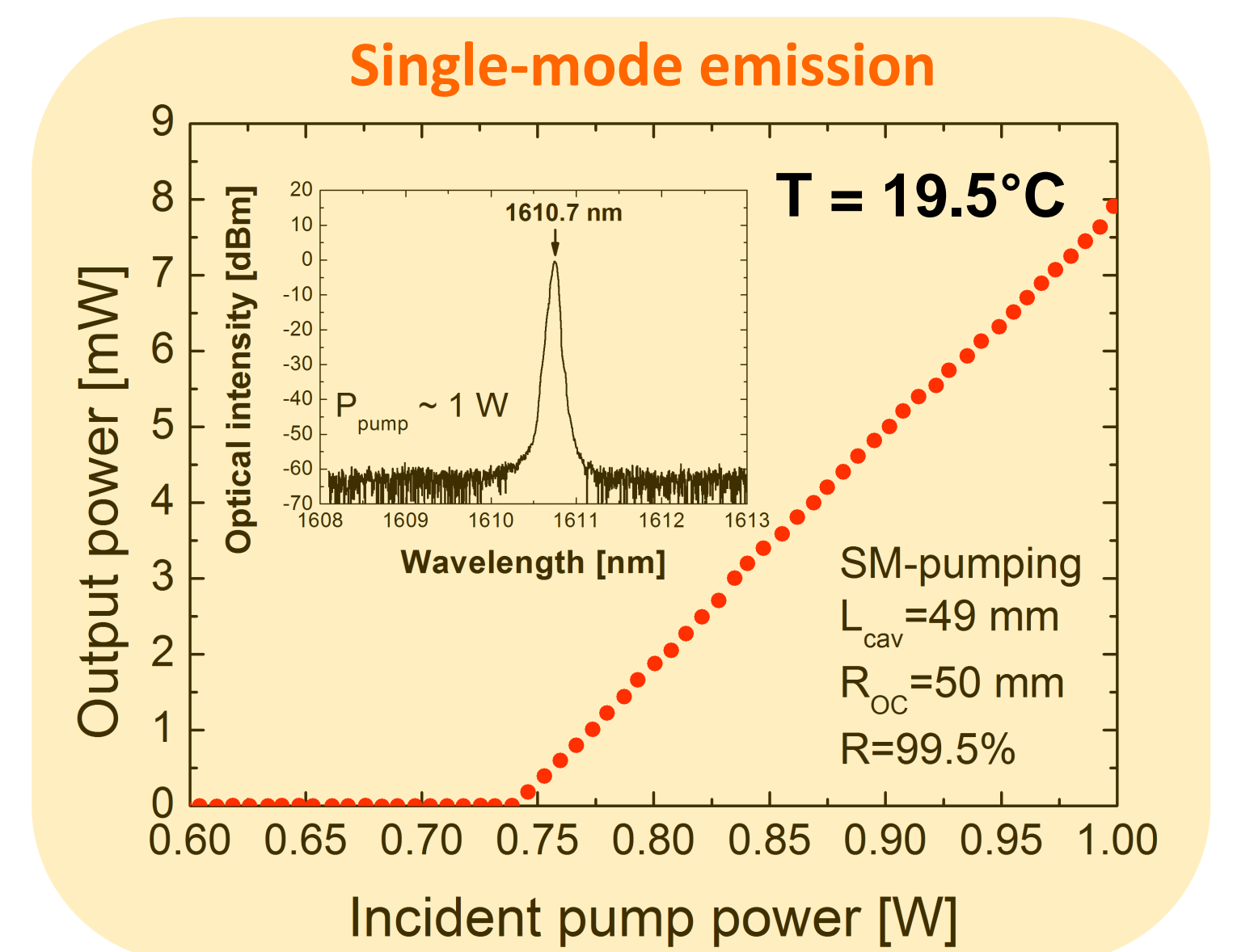
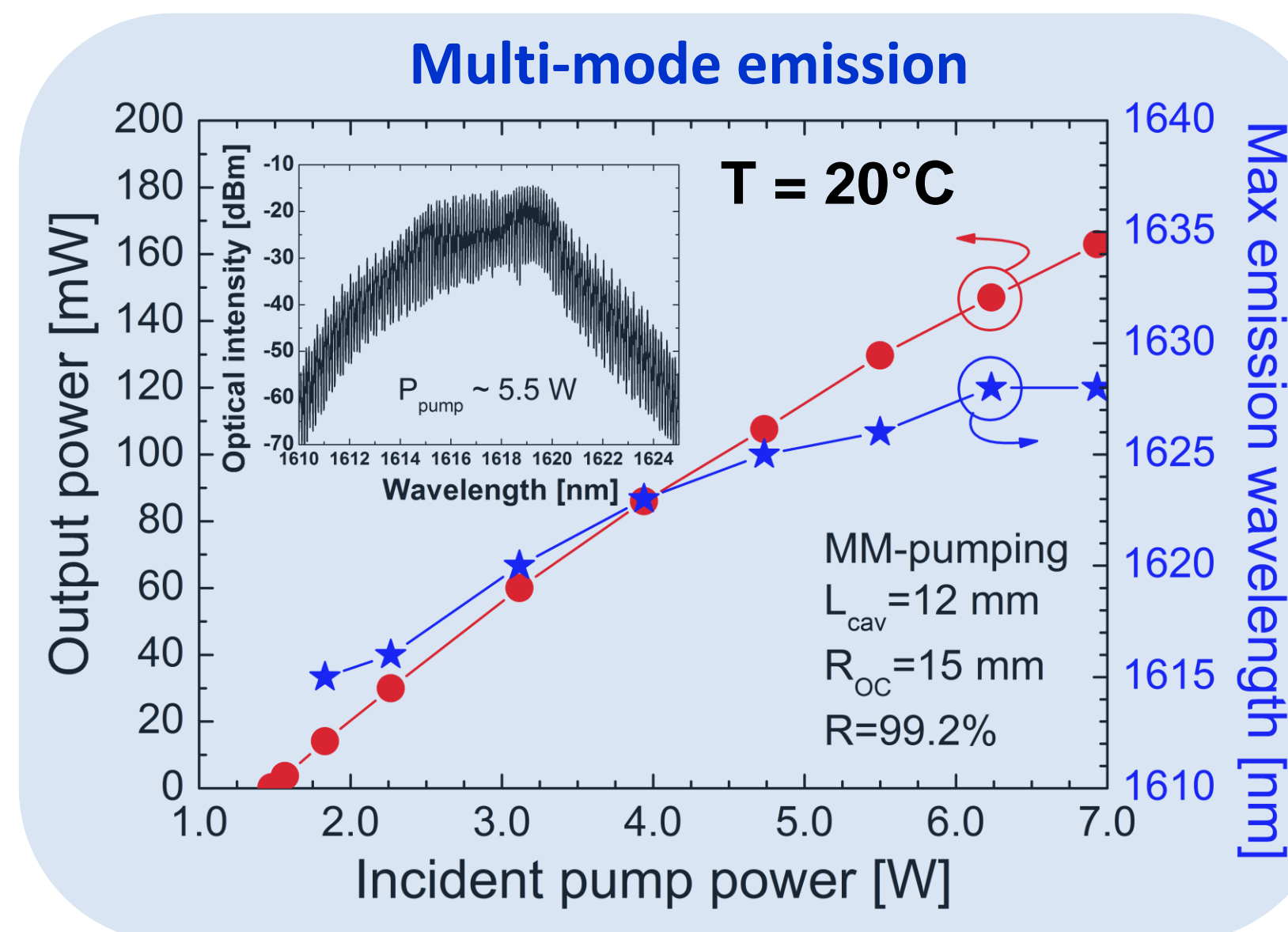
ANR and DGA within the ANR-ASTRID HYPOCAMP project (grant ANR-14-ASTR-0007-01) and a DGA-MRIS/Région Bretagne scholarship (grant ARED-VELOCE 8917).

## OP-QDH-VECSEL design and process



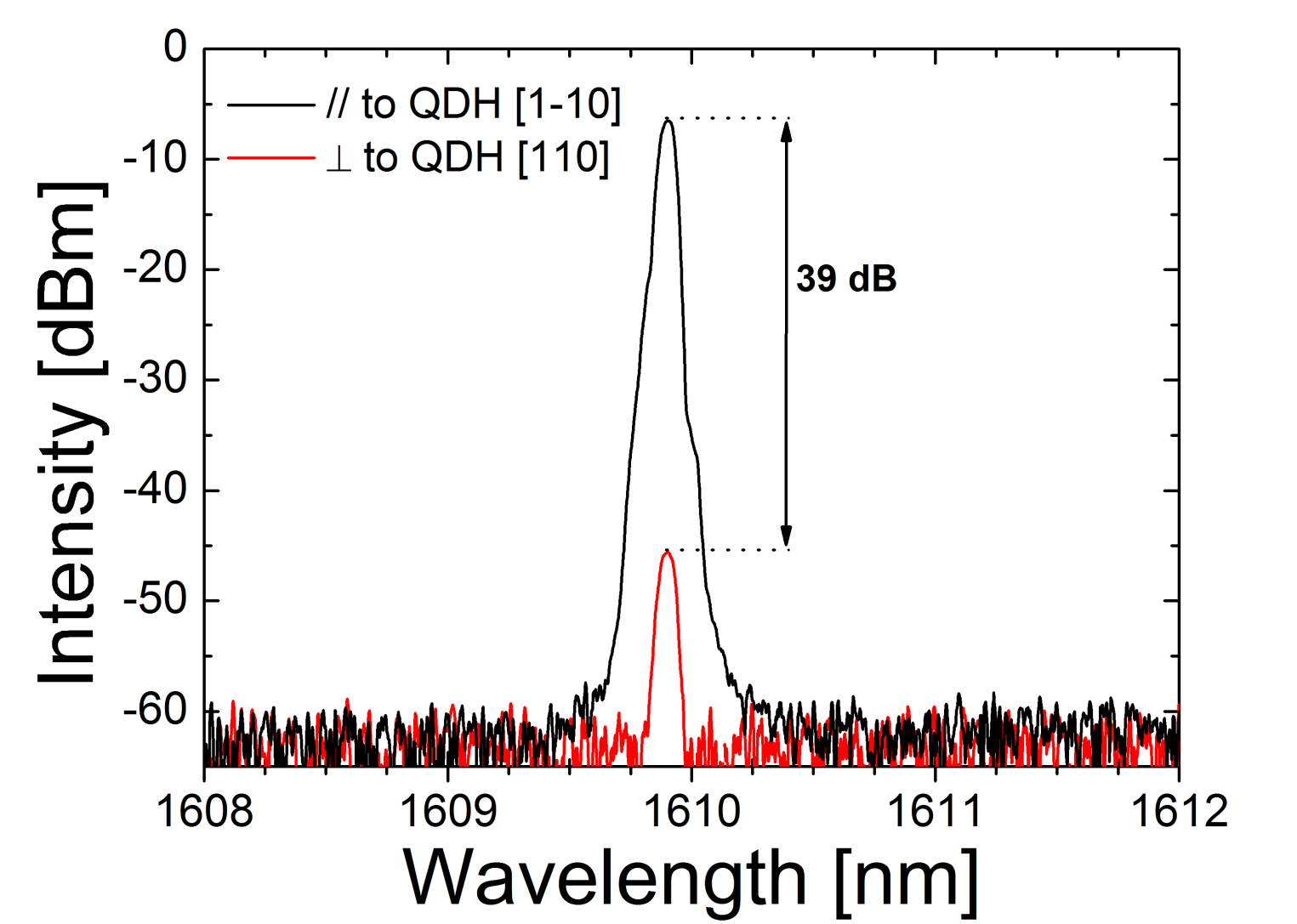
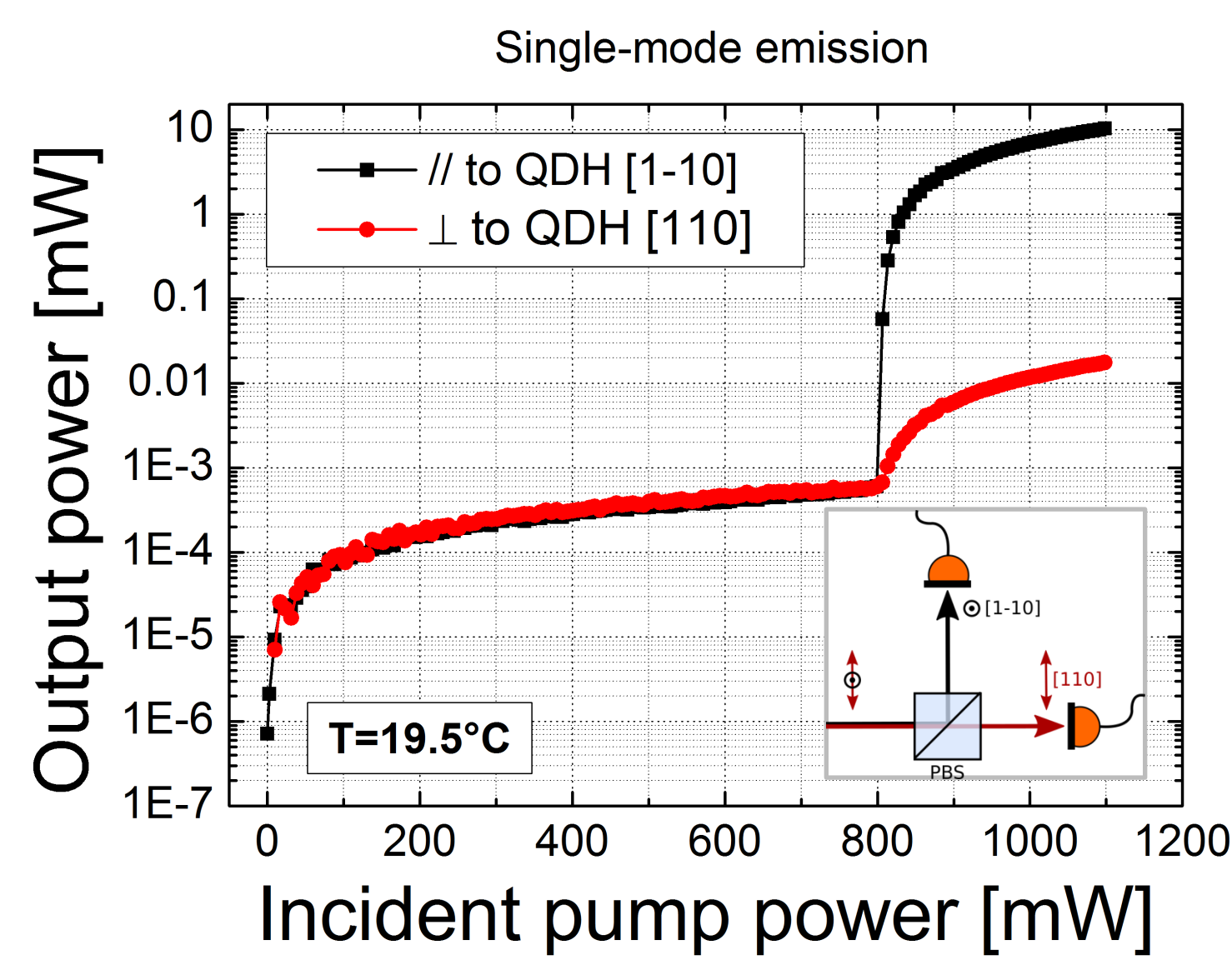
## Laser characterization

### Output characteristics and emission spectra



Single-mode emission tunable in the 1609-1622 nm range

### Polarization-resolved laser emission



### Laser linewidth estimation (delayed self-heterodyne measurement)

