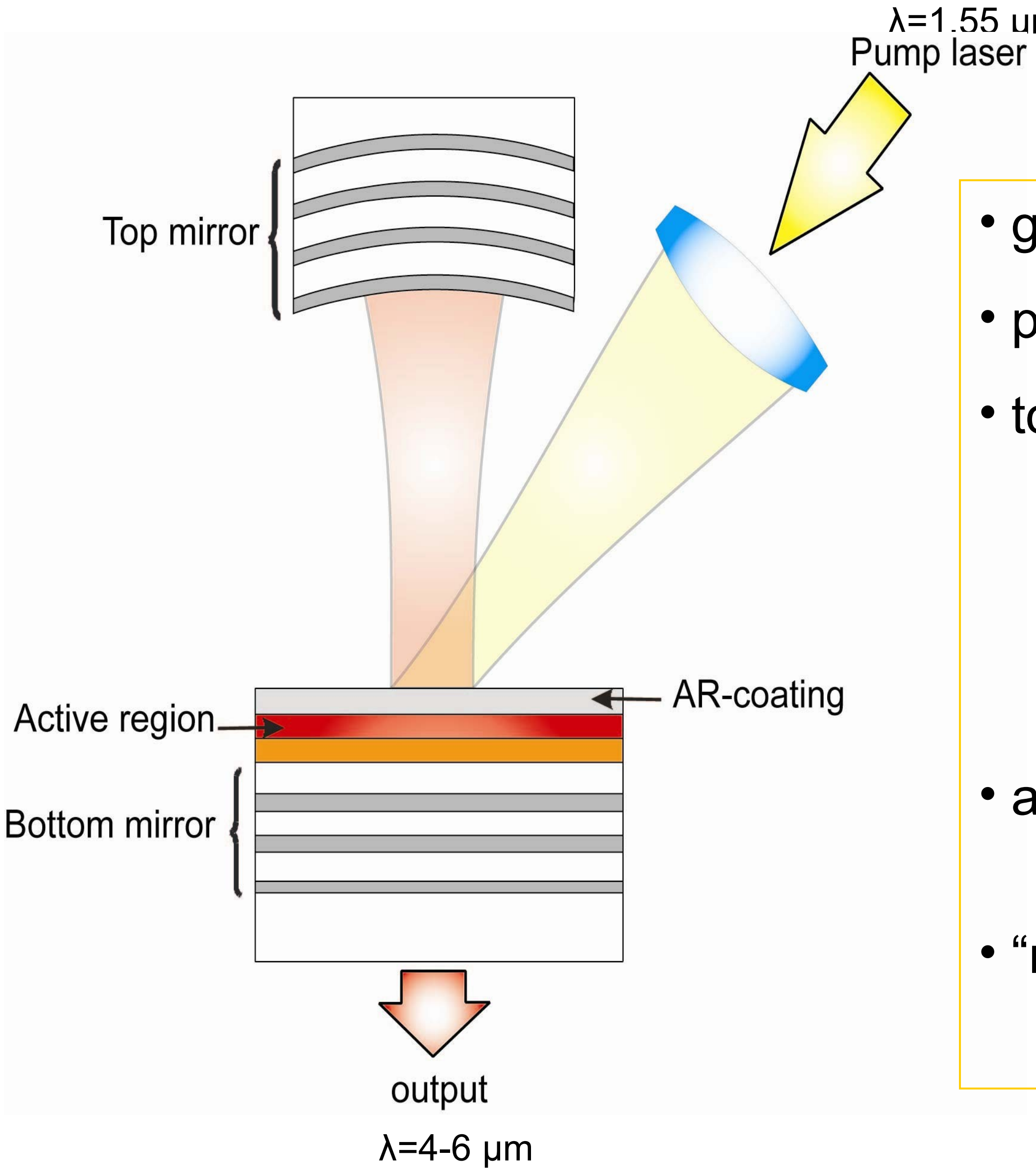
VECSEL: Vertical External Cavity Surface Emitting Laser



- good beam quality
- power scalable
- top mirror Radius

  and cavity length

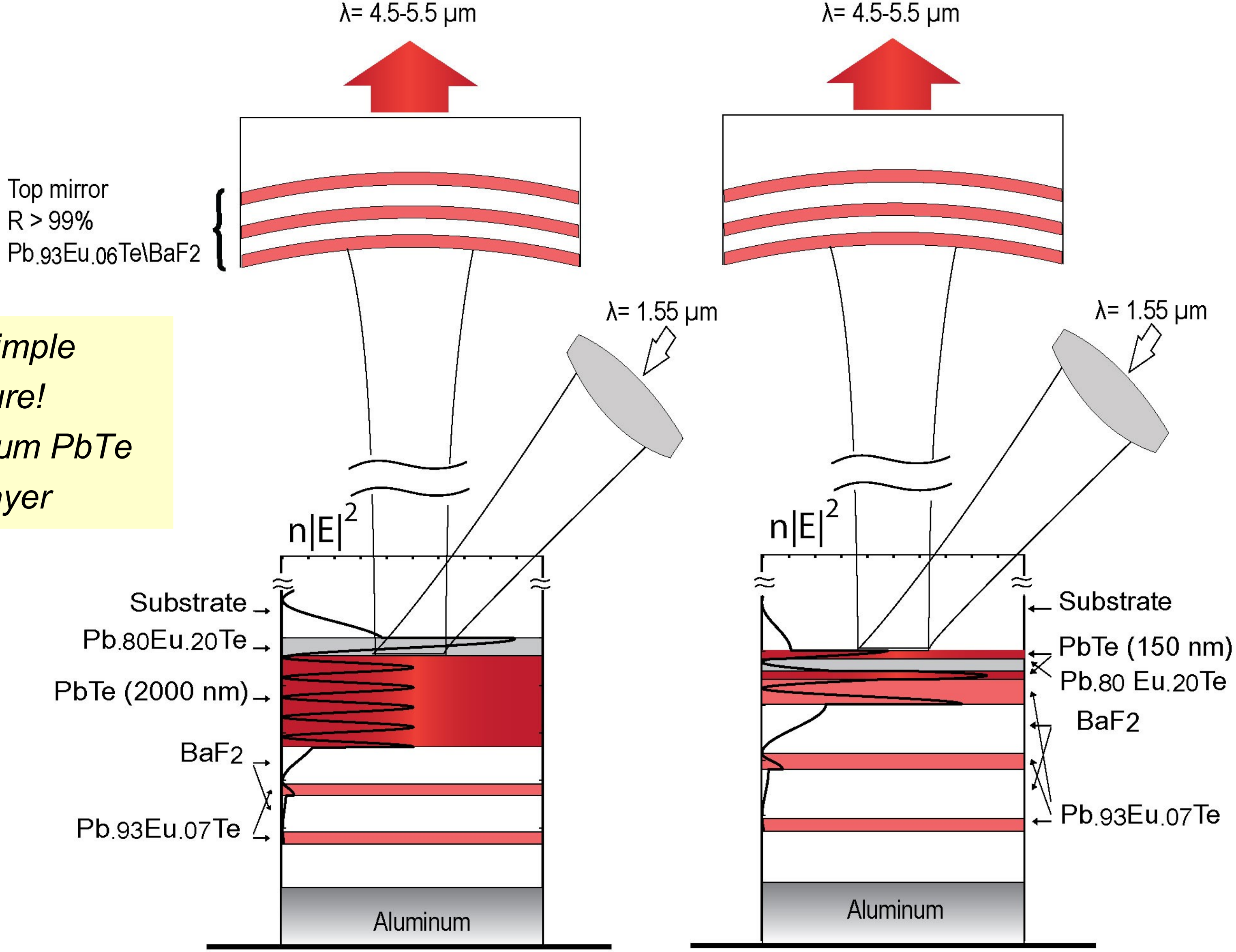
  → beam diameter

- air gap in the cavity

- "resonance" and/or AR-coating

PbTe on BaF_2 VECSEL Design

very simple structure!
just 2 µm PbTe gain layer

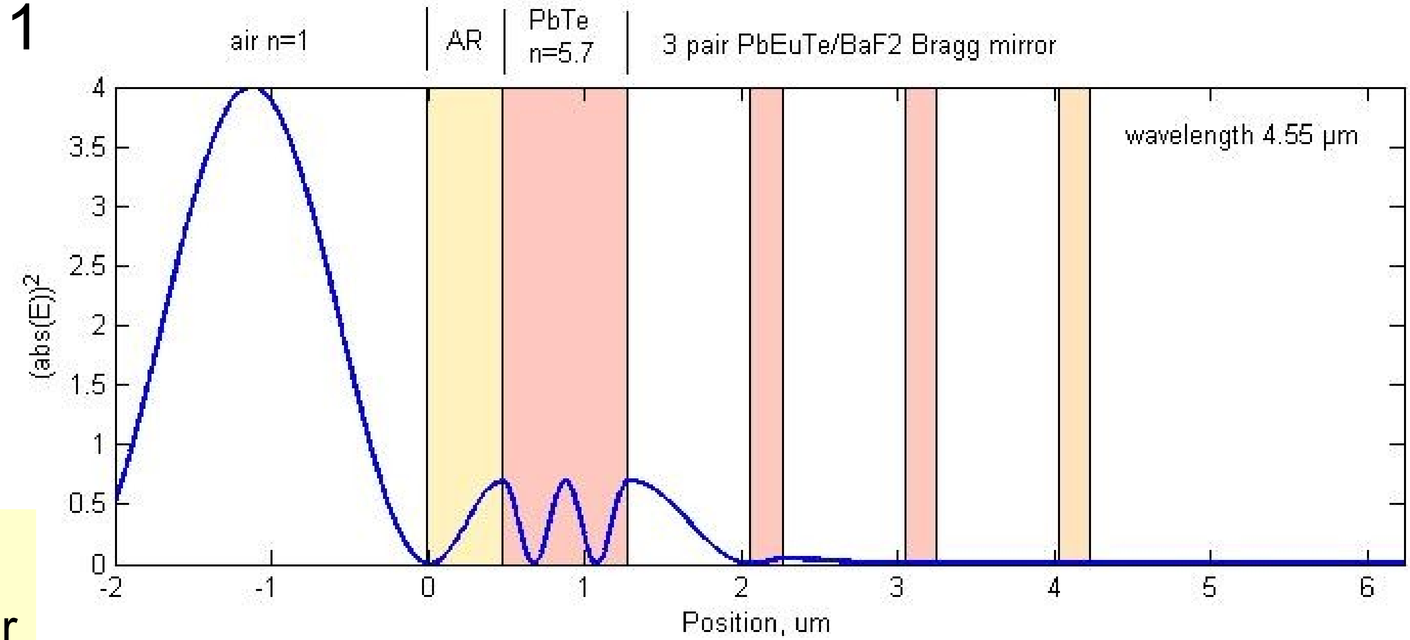


Optics Letters 33, 24, 3010 (2008)

optical design 1

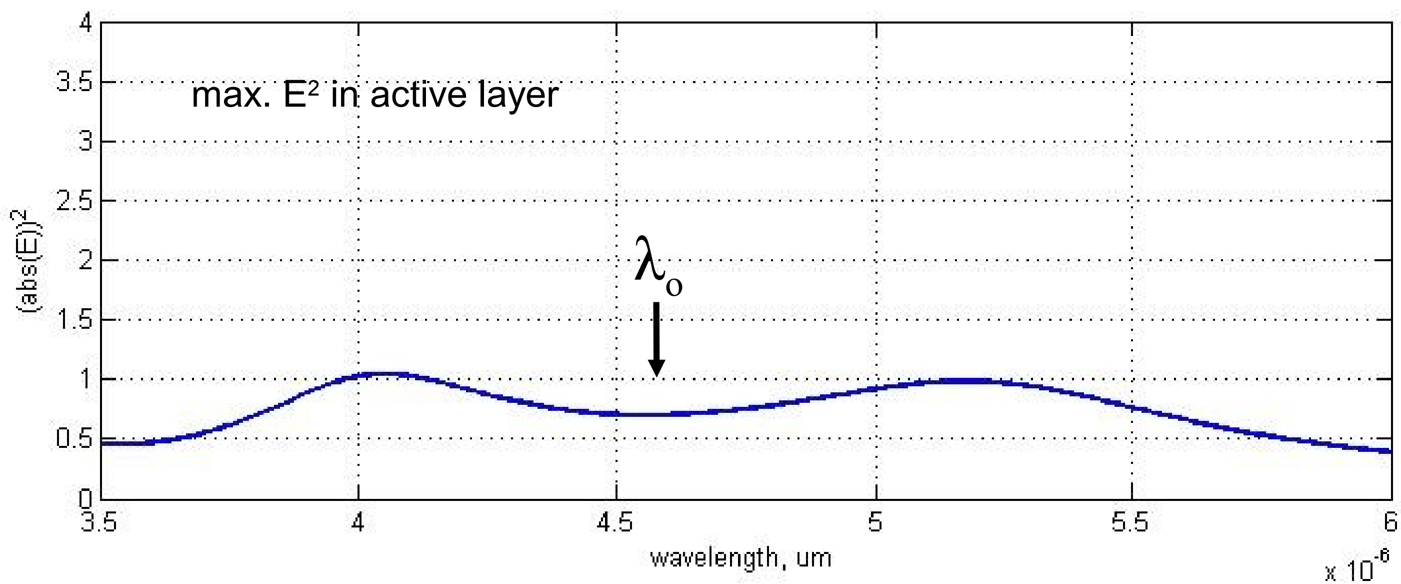
PbTe at 200K,
design wavelength
$\lambda_o = 4.55\ \mu m$

resonance + AR:
λ_o thick active layer



broad spectral range

low max. E^2
←→
higher threshold



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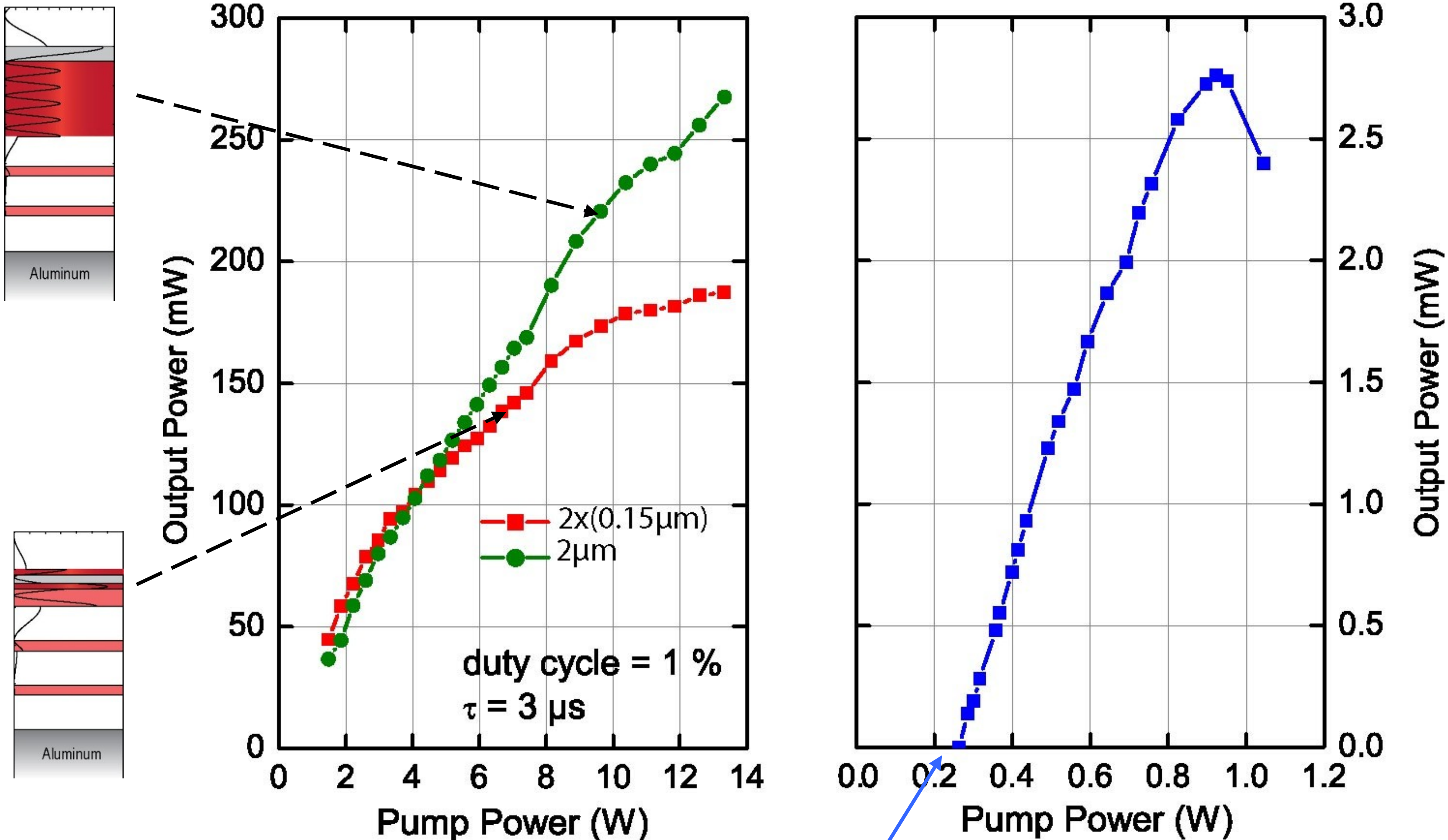
Theory: Garnache et al. J Opt Soc Am B 17 1589 (2000)

PbTe VECSEL on BaF_2 power in / out



threshold 0.3 W

pulsed 100K

cw 100K

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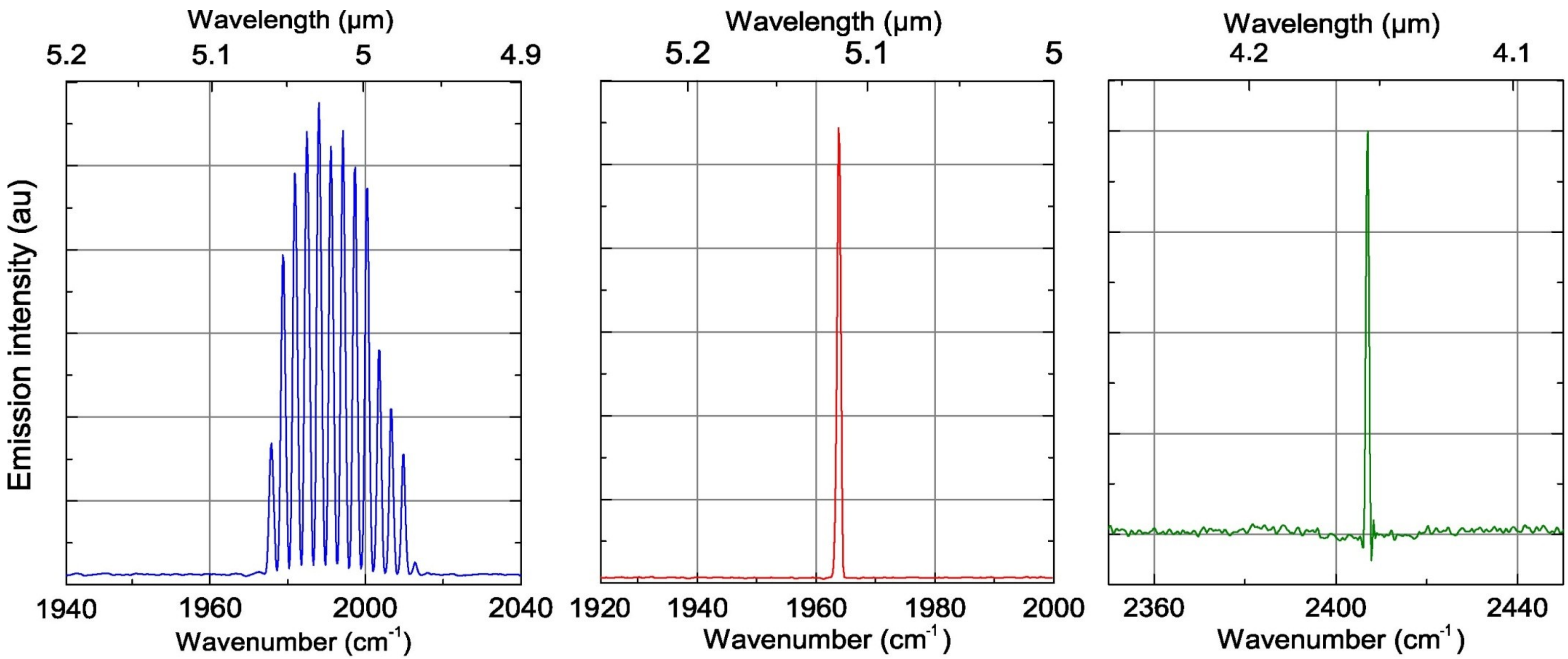
PbTe VECSEL on BaF_2



100 K pulsed
high output power

100 K cw

165 K pulsed
lasing up to 175 K

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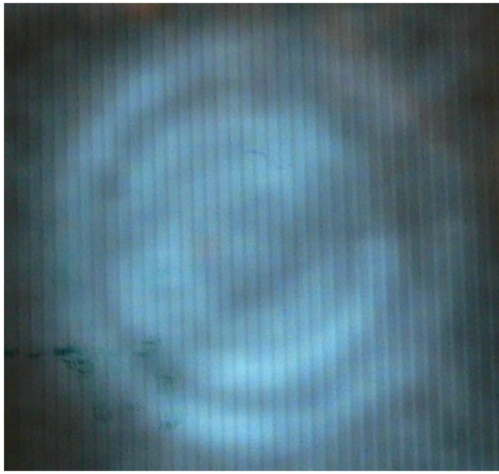
Beam Quality

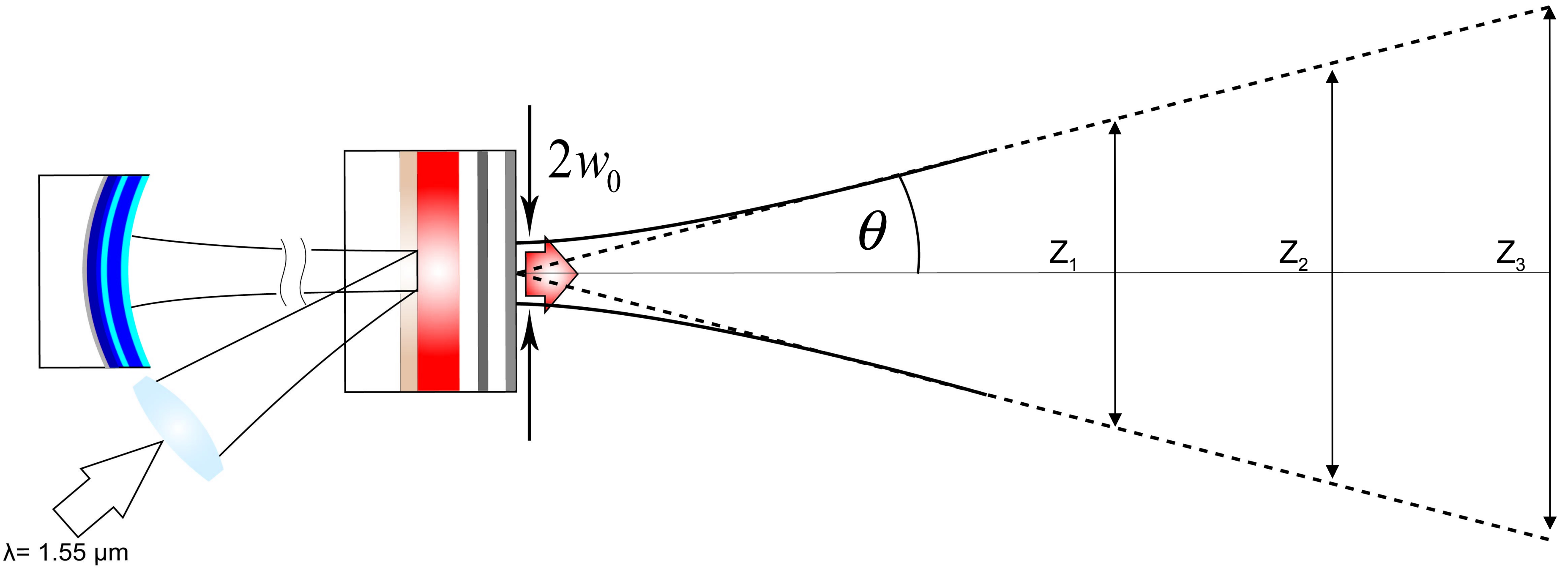


Divergence Limit

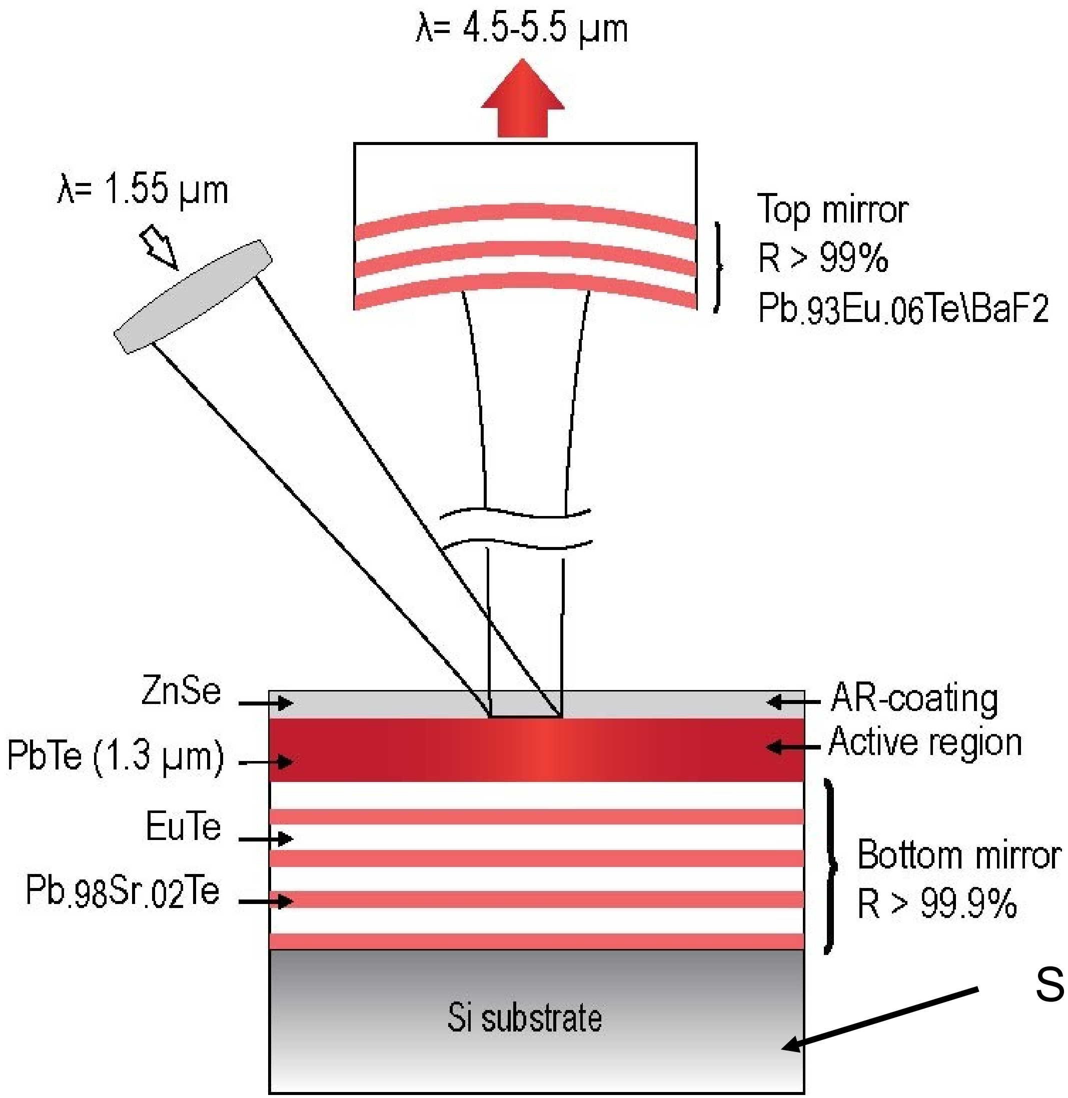
$$\theta = M^2 \frac{\lambda}{\pi w_0}$$

$$M^2 = 1.3$$

$$\theta_{\perp,P} = 1.02$$



PbTe VECSEL on **Si-substrate**



Si-sub outside cavity !

Electronic Letters 44, 25, 1467 (2008)

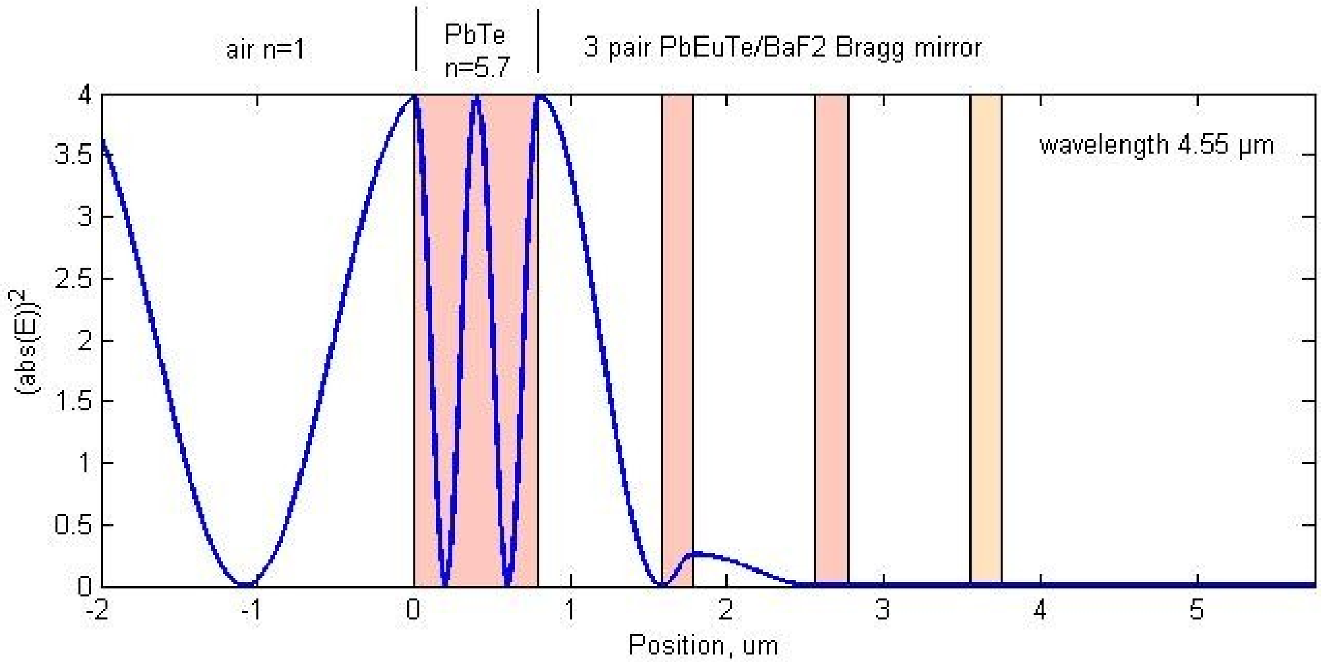
optical design 2

PbTe at 200K,
design wavelength
λ_o = 4.55 μm

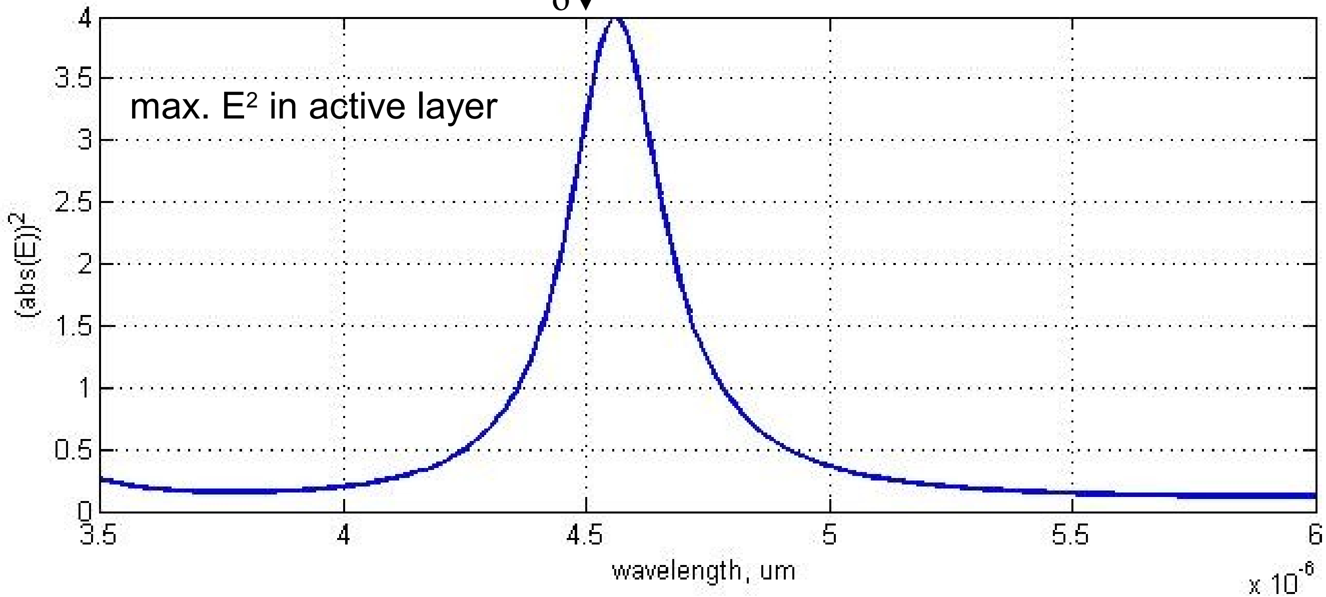
resonance, no AR:
λ_o thick active layer

narrow spectral range

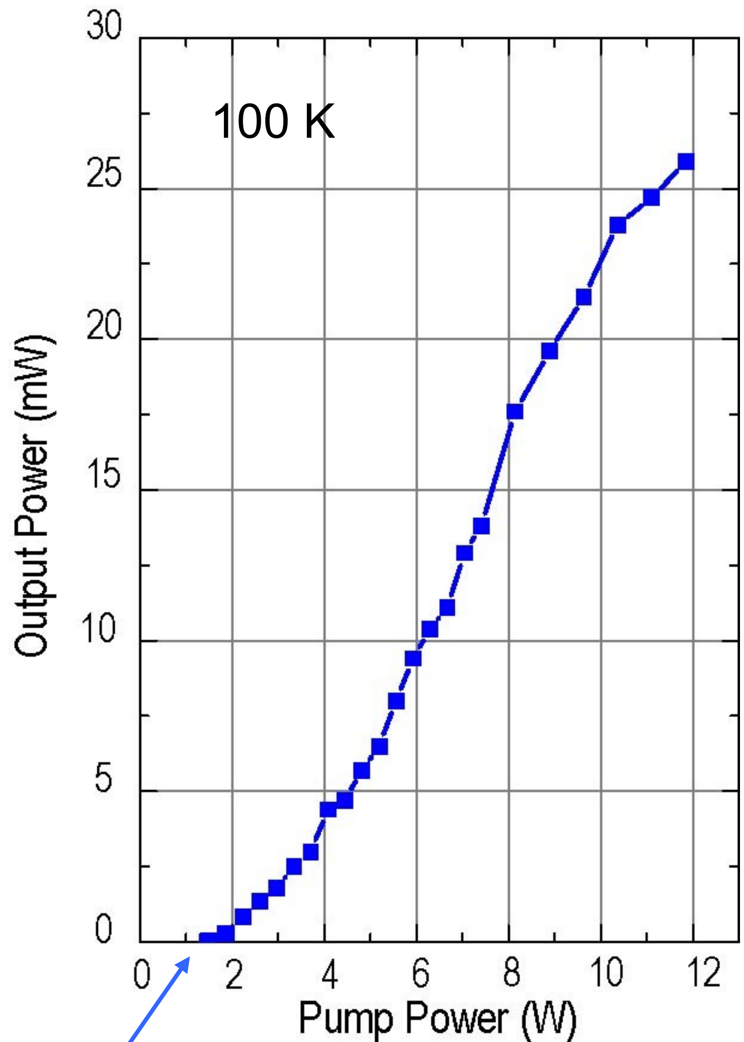
highest max. E^2
↔
lowest threshold



λ_o



PbTe VECSEL on Si-substrate



λ_{out} ~5 μm
as before

lasing up to 130 K

threshold 1.7 W

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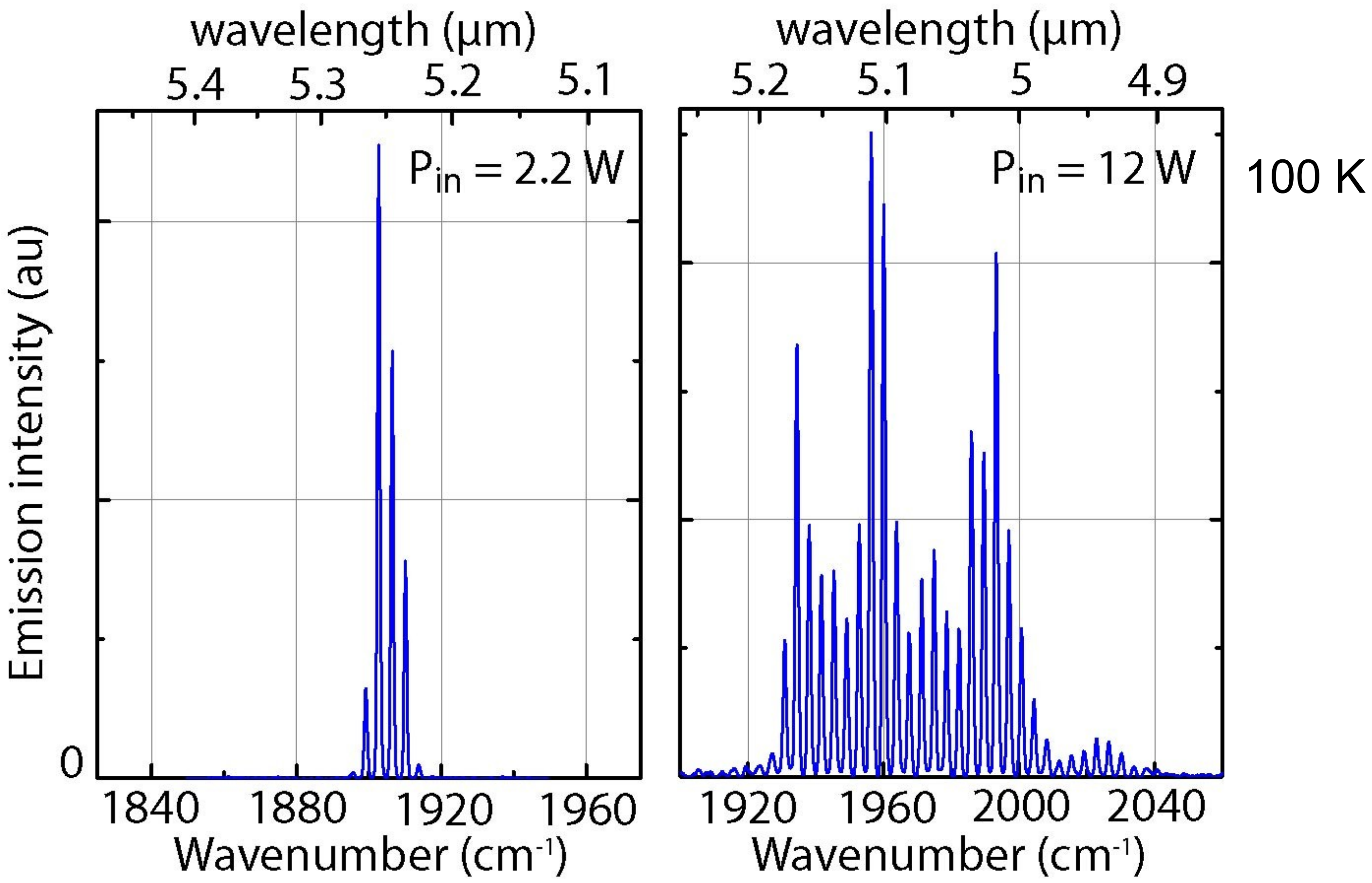
PbTe VECSEL on Si-substrate



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