College of Optical Sciences
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Many-particle Effects in the Nonlinear Polarization Rotation in Semiconductor Quantum Well Bragg Structures

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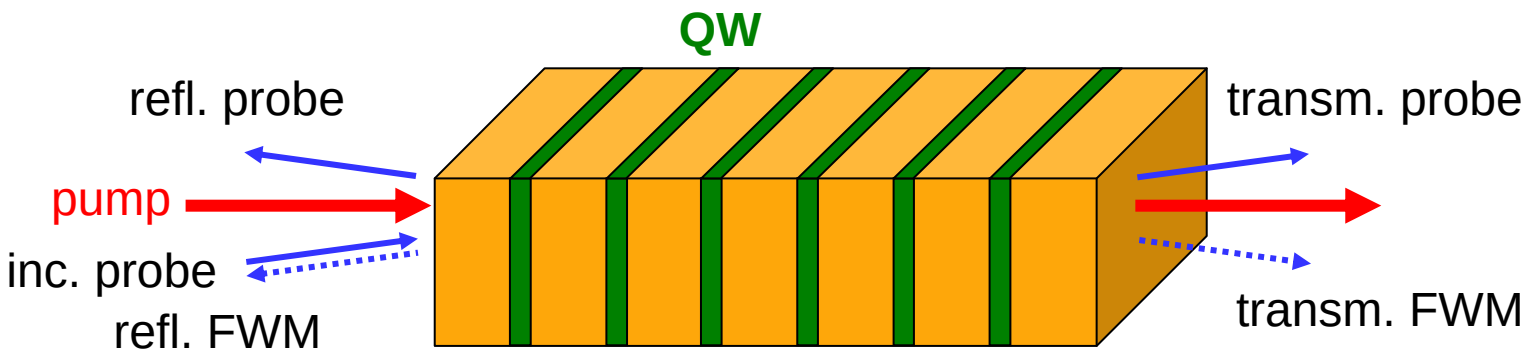
Bragg-spaced multiple quantum wells



One-dimensional resonant photonic bandgap structure

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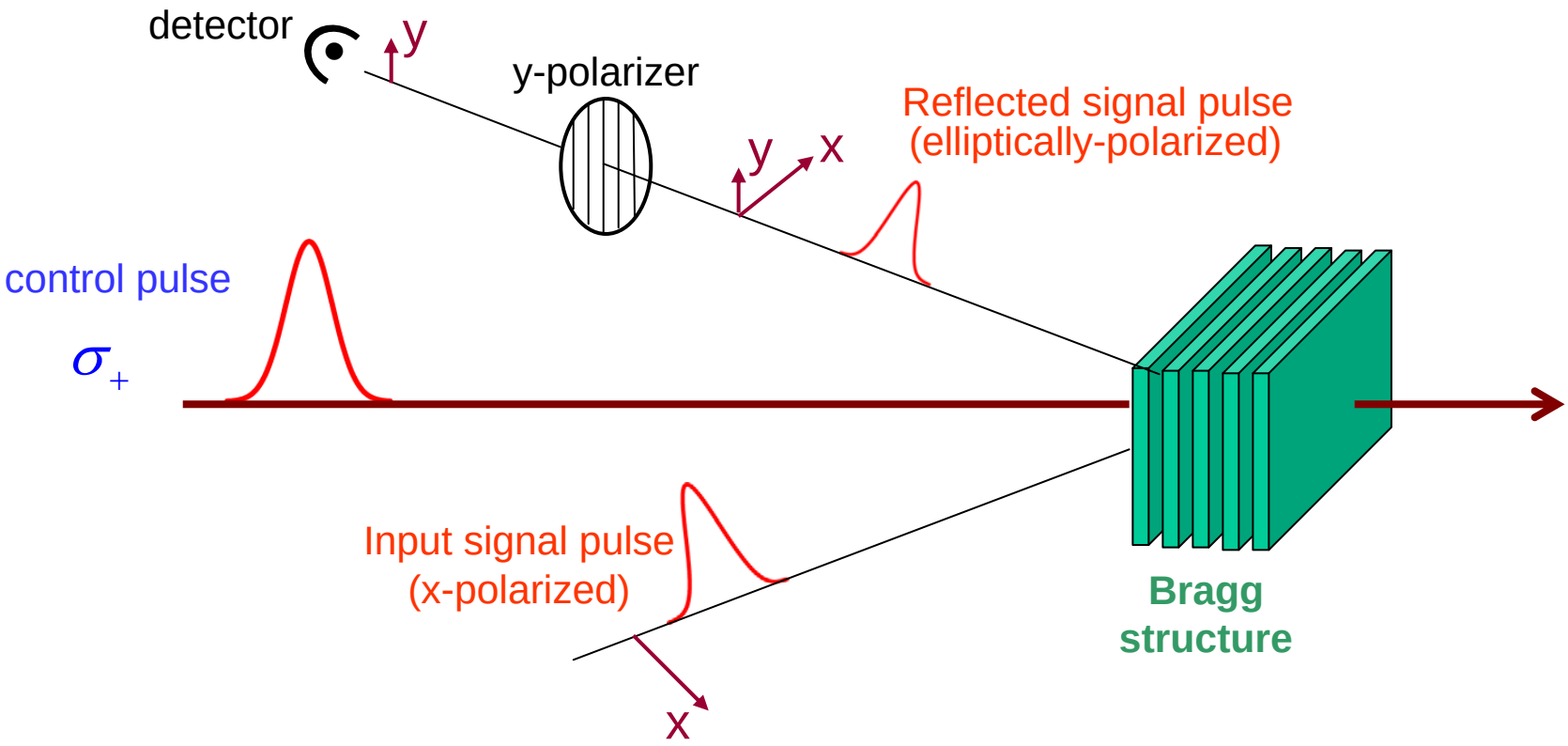
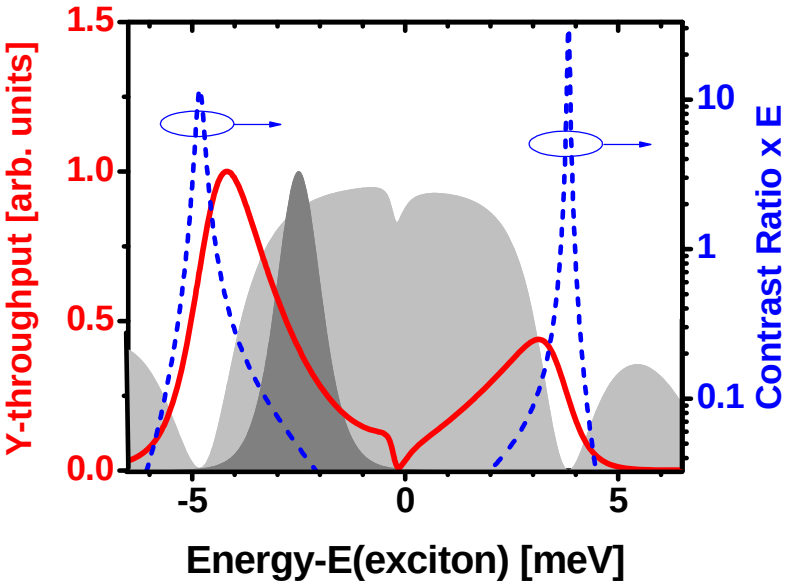
cf. Ivchenko *et al.*, Superlattices and Microstructures 16, 17 (1994), Stroucken *et al.*, PRB 53, 2026 (1996); Prineas *et al.*, PRB 61, 13863 (2000)

Switch Geometry



All pulses in quasi-normal incidence

Theory (1)



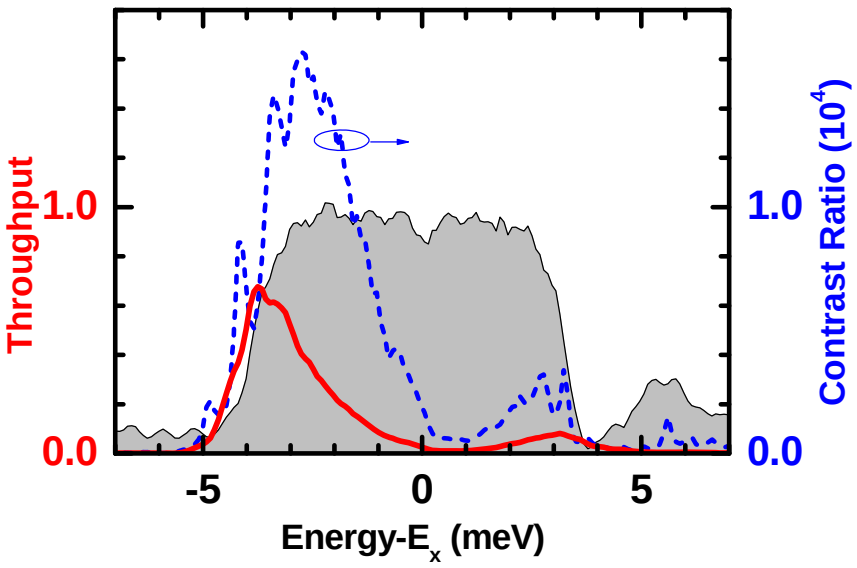
Pump-induced difference in the "+" and "-" signal reflectivities leads to a non-zero y-signal component

E = system leakage fraction (typically ~ 10^{-4})

- Contrast ratio at lower egde ~ 10^4 or 40 dB
- Max. throughput is 12% of input x-signal intensity
- Switching time control-pulse width limited

(1) Nguyen, Kwong, Yang, Binder, Smirl, Appl. Phys. Lett. 90, 181116 (2007)

Experiment (1)



Large throughput and contrast ratio at lower band gap

System leakage may contain frequency dependent rotation from Bragg structure anisotropy

- Contrast ratio > 40 dB
- Max. throughput is 60% of input signal intensity
- Switching time ~ 1 ps (control-pulse width limited)
- Switching energy ~ 14 μJ/cm ^{2}
- T=10K

(1) Jonston et al., Appl. Phys. Lett. 87, 101113 (2005)