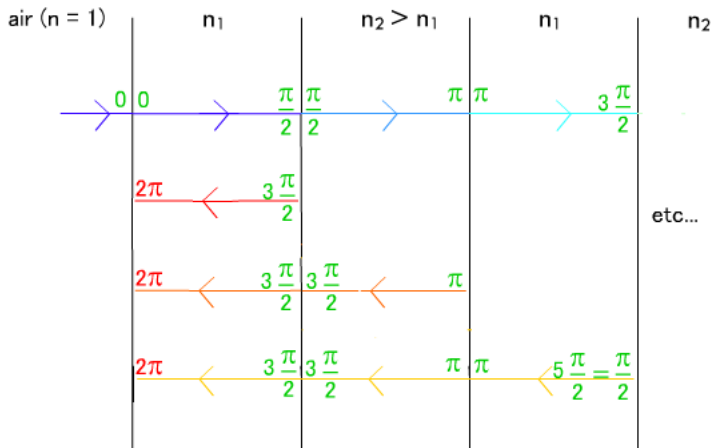


Miroirs et cavités résonnantes pour les phonons

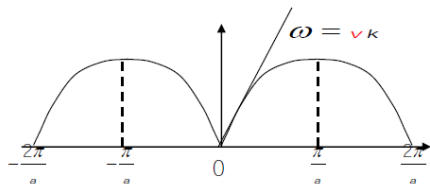
Thomas MERCIER

Miroir de Bragg

Contrairement aux électrons, on ne peut pas confiner un phonon à l'aide d'un puit de potentiel.

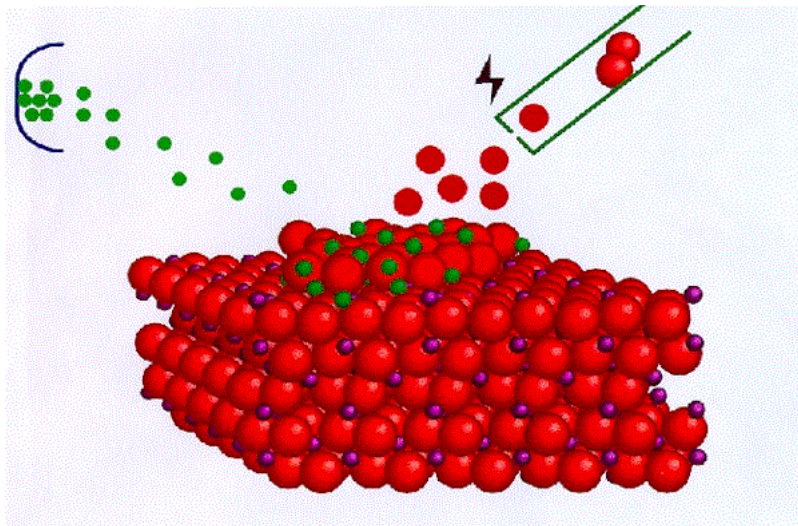


Approximation continue

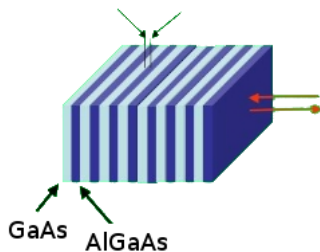


- ▶ $v \sim 5000 \text{ m/s}$
- ▶ $f \sim 1 \text{ THz}$
- ▶ $\lambda \sim 5 \text{ nm} \gg a$
- ▶ $Z = \frac{\rho}{v} = \rho v$

Épitaxie



Solution périodique



$$t = \frac{2Z_1}{Z_1 + Z_2} \text{ et } r = \frac{Z_1 - Z_2}{Z_1 + Z_2}$$

$$u = u_0 e^{i(\omega t - qdn)} \text{ avec } d \text{ période du réseau}$$

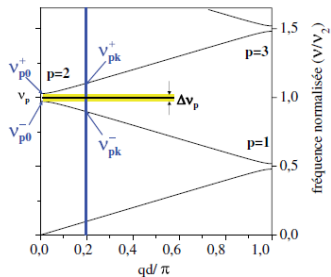
Équation de dispersion

$$\cos(qd) = \cos(\omega T) - \frac{\varepsilon^2}{2} \sin(\omega T_1) \sin(\omega T_2)$$

$$\varepsilon = \frac{|Z_1 - Z_2|}{\sqrt{Z_1 Z_2}}$$

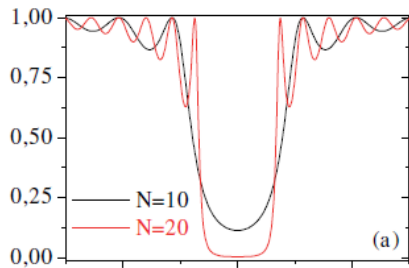
$|\cos(qd)| \leq 1$ donc certaines pulsations sont interdites.

Bande interdite

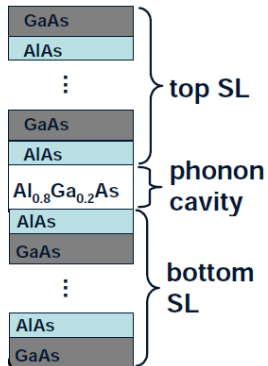


$$\Delta\omega \approx \frac{2\varepsilon}{\tau} \sin\left(p\pi \frac{\tau_1}{\tau}\right)$$

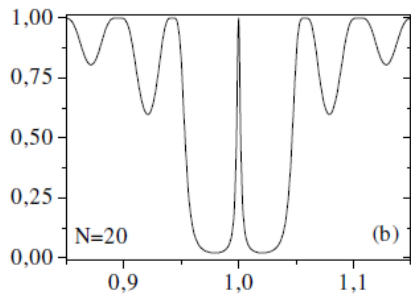
Cas non infini : spectre en transmission



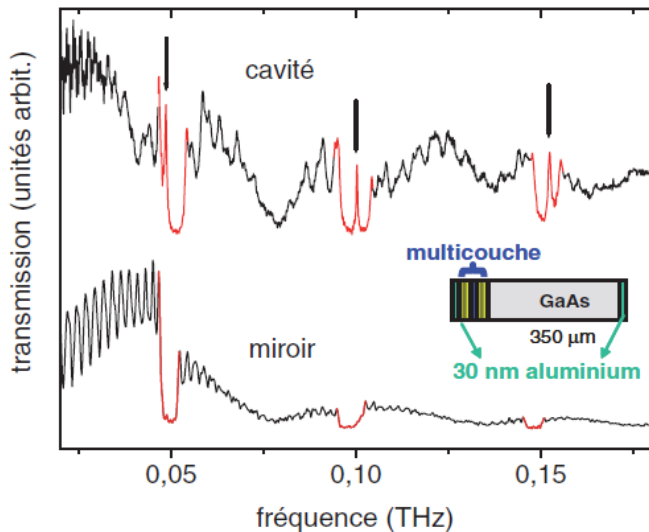
Cavité résonnante



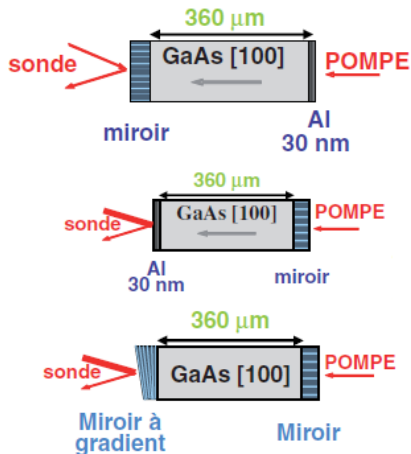
Cavité résonnante : spectre



Confirmation expérimentale



Dispositifs pompe-sonde



- ▶ Interactions lumière-matière
- ▶ Diffusion Brillouin (spectroscopie Raman)