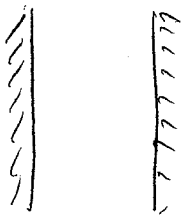
## resonators



fabry-perot

$$\frac{da}{dt} = \left(j\omega_0 - \frac{1}{\tau}\right) a$$

$\omega_0$ = oscillation freq.

$\tau$ = lifetime

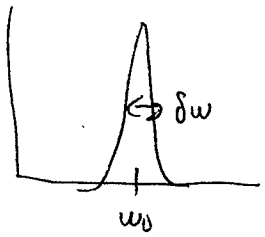
energy $\propto |a|^2$

$$\frac{d|a|^2}{dt} = 2|a|\frac{d|a|}{dt} = \frac{2}{\tau}|a|^2$$ rate of power dissipation

quality factor Q given by $\frac{\text{energy}}{\text{power lost/cycle}}$

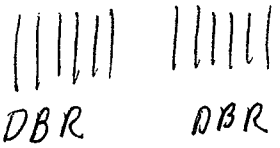
$$Q = \frac{|a|^2 \omega_0}{\frac{2}{\tau}|a|^2} = \omega_0 \tau/2$$

in freq. domain $Q = \omega_0/\delta\omega_{1/2}$

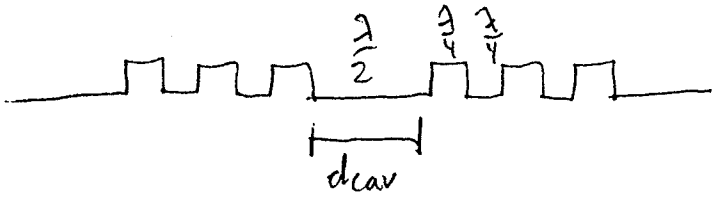


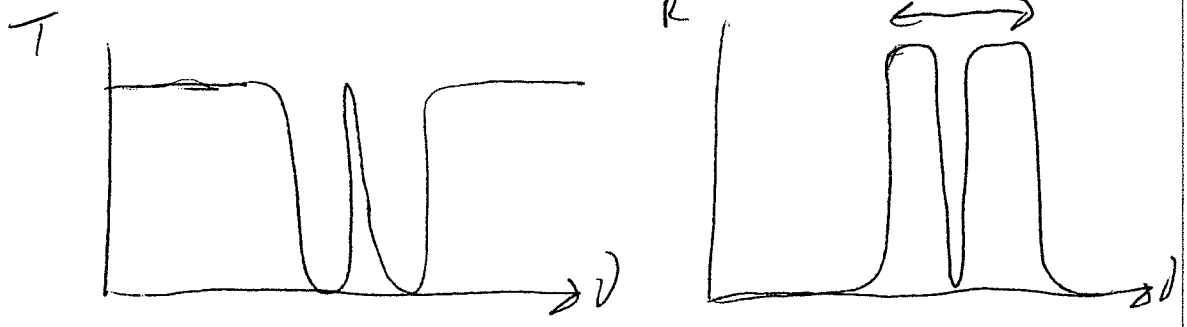

## 1-D cavity resonators

Fabry-Perot.




wave guide grating



$$T(\lambda) = \frac{1}{1 + \frac{4R_{DBR}^2}{(1-R_{DBR}^2)} \sin^2\left|\frac{\pi n_H d_{cav}}{\lambda} - \frac{\pi n_H d_{cav}}{\lambda_0}\right|}$$

$\lambda_0$ = design wavelength  $n_H$ = cavity effective index

$$Q = \frac{4\pi R_{DBR}}{1 - R_{DBR}^2}$$

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homework - 1) direct phase vs. direct ampl. mod. MSJ (Intel 4's)

2) model Intel via beam prop.

4) calc. qual. factor of F.P., simple cavity

3) $\chi$ for function of $\frac{\omega}{\omega_0}$