Wasserwellen ; σ_0 = Oberflächenspannung

Kapillarwellen : $\omega = \sqrt{\frac{\sigma_0}{\rho}\cdot k^3}$; Wassertiefe $h \gg \lambda$

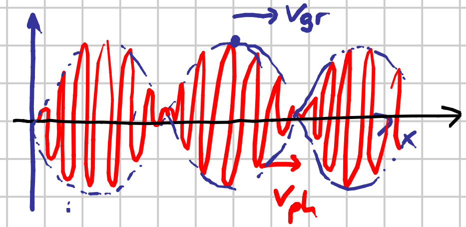
$\omega = \sqrt{\frac{\sigma_0 \cdot h}{\rho}\cdot k^2}$; $h \ll \lambda$

Schwerewellen : $\omega = \sqrt{g \cdot k}$

Schallwellen in Luft

$v_{ph} = \sqrt{\frac{K}{\rho}}$ $\quad K = p$ für $\omega \ll 1\,\text{kHz}$

$K = \kappa \cdot p$ $\quad \omega \gg 1\,\text{kHz}$



$$S(x,t) = 2A\cos\Big(\underbrace{\frac{\Delta k}{2}x - \frac{\Delta\omega}{2}t}_{\varphi_{gr}}\Big)\cdot\cos\big(\underbrace{\bar{k}x - \bar{\omega}t}_{\varphi_{ph}}\big) \Rightarrow \varphi = \text{const}$$

$$\rightarrow v_{ph} = \frac{dx}{dt} = \frac{\bar{\omega}}{\bar{k}}$$

Welle im Medium mit komplexem $\tilde{n}$

$$E(x,t) = E_0 \cdot e^{i(\omega t - k_m x)} = E_0 \cdot e^{-\kappa k_0 x} \cdot e^{i(\omega t - \underbrace{n k_0}_{\frac{2\pi}{\lambda_m}} z)}$$

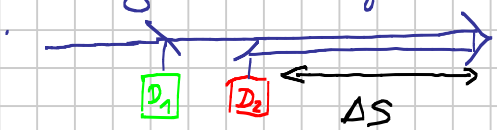
im Medium $\quad \rightarrow k_m = \tilde{n} k_0 = n k_0 - i \kappa k_0$

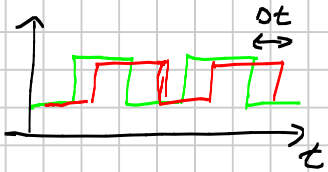
Absorption: $I \sim |E|^2 = e^{-2\cdot\kappa\cdot k_0 x} \overset{!}{=} e^{-\alpha x} \Rightarrow \alpha = 2\kappa \cdot k_0 = \frac{4\pi\kappa}{\lambda_0}$

Lambert-Beer $\qquad$ Absorptionskoeff.

Experimente:

Messung der Phasengeschwindigkeit von Licht:

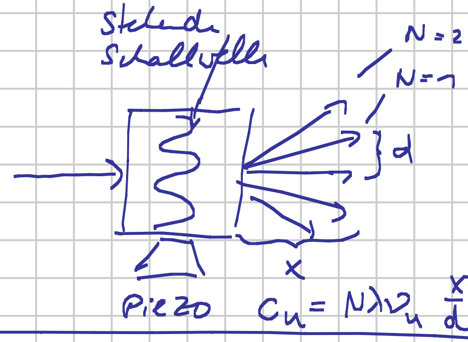




$\Delta v = \frac{\Delta S}{\Delta t}$

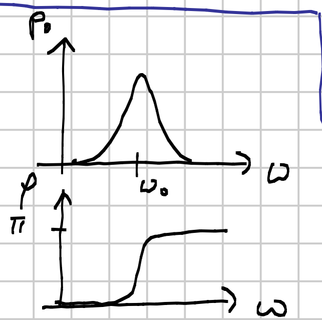
Debye-Sears-Effekt:

Beugung von Licht an einem Phasengitter, das durch eine Schallwelle entsteht. ($\rho \sim n$)



$c_u = N\lambda\nu_u \frac{x}{d}$

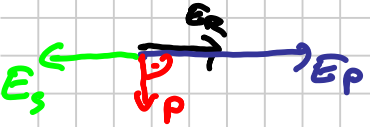
Lorentz Oszi



Polarisation $p(t)$ schwingt mit Phasenverschiebung $\tan\varphi = \frac{2\gamma\omega}{\omega_0^2 - \omega^2} \approx \frac{\gamma}{\omega_0 - \omega}$.

In Resonanz $\varphi = \frac{\pi}{2}$

Sekundärwelle E_s immer um $\frac{\pi}{2}$ verschoben zu $p(t)$.



$\Rightarrow$ z.B. resultierende Welle $E_r = E_p + E_s$ in Resonanz abgeschwächt