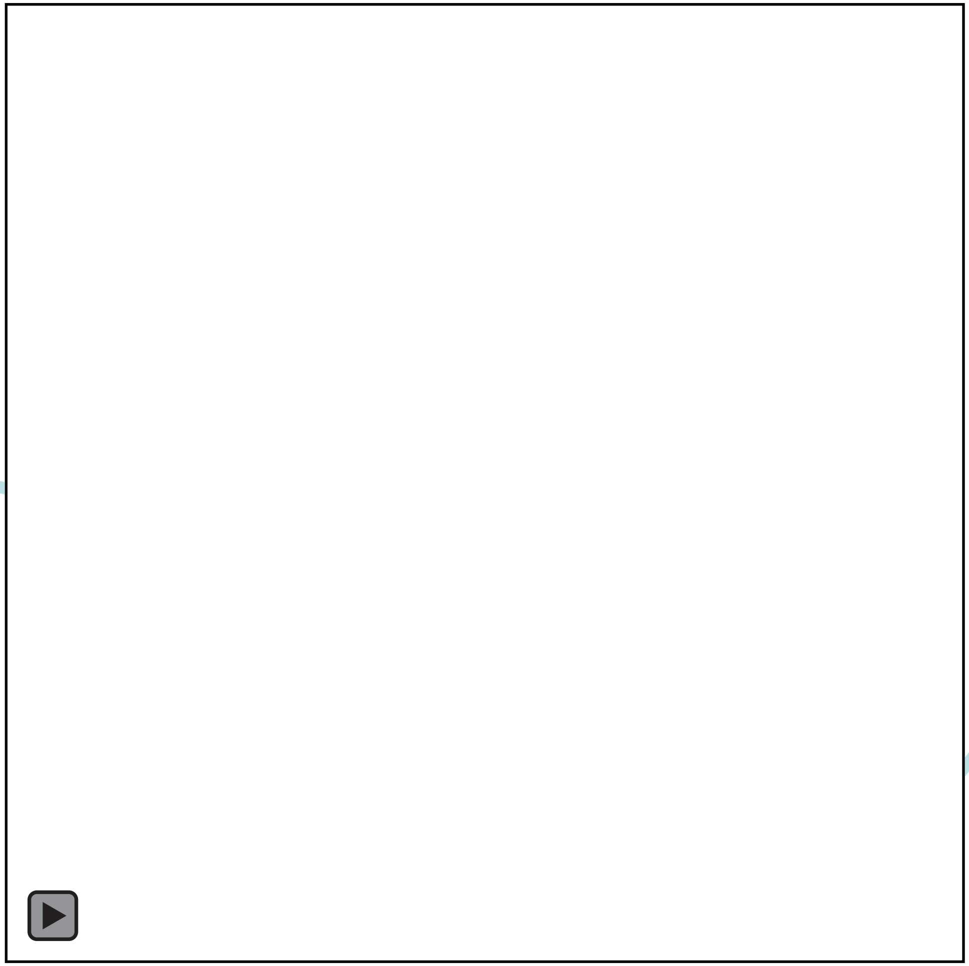
Prüfungen

08.02.2017
10.03.2017
05.05.2017
29.06.2017
Oktober.2017
Nov/Dez.2017

Alte Prüfungen:
http://lampx.tugraz.at/~hadley/physikm/problems/problems.de.php

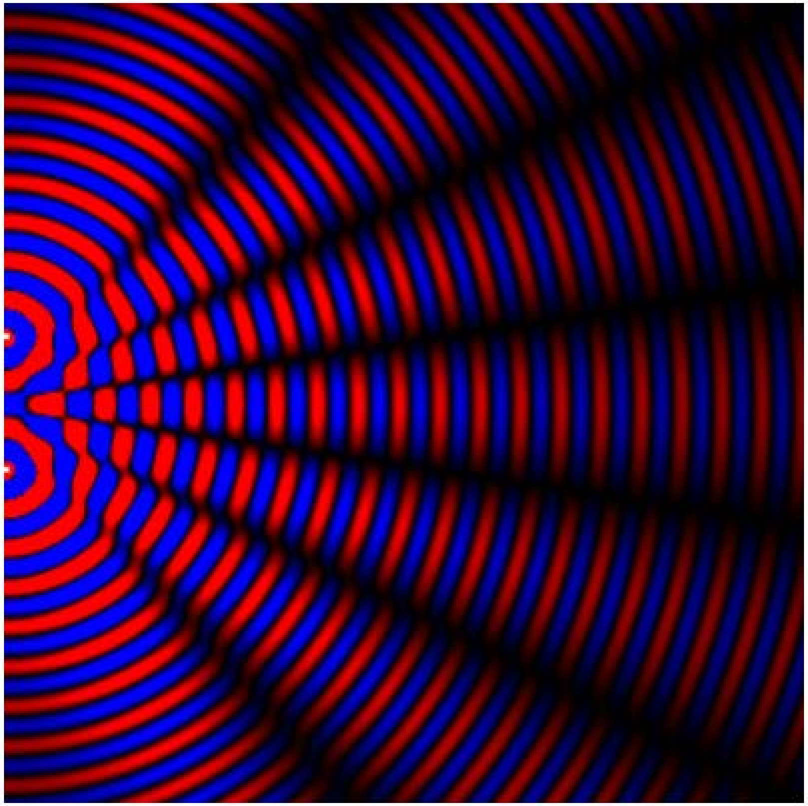
Interferenz zweier Oberflächenwellen

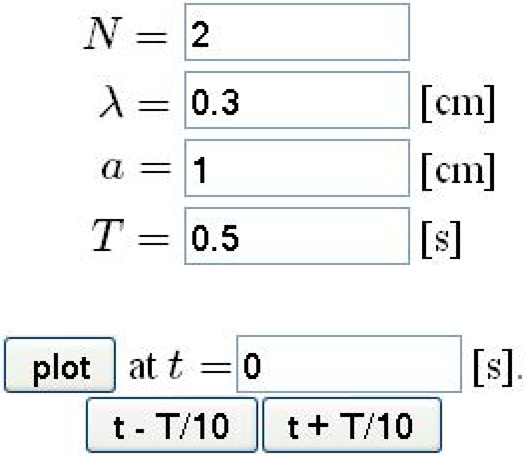
Nahfeld



Fernfeld
$r >> \lambda$

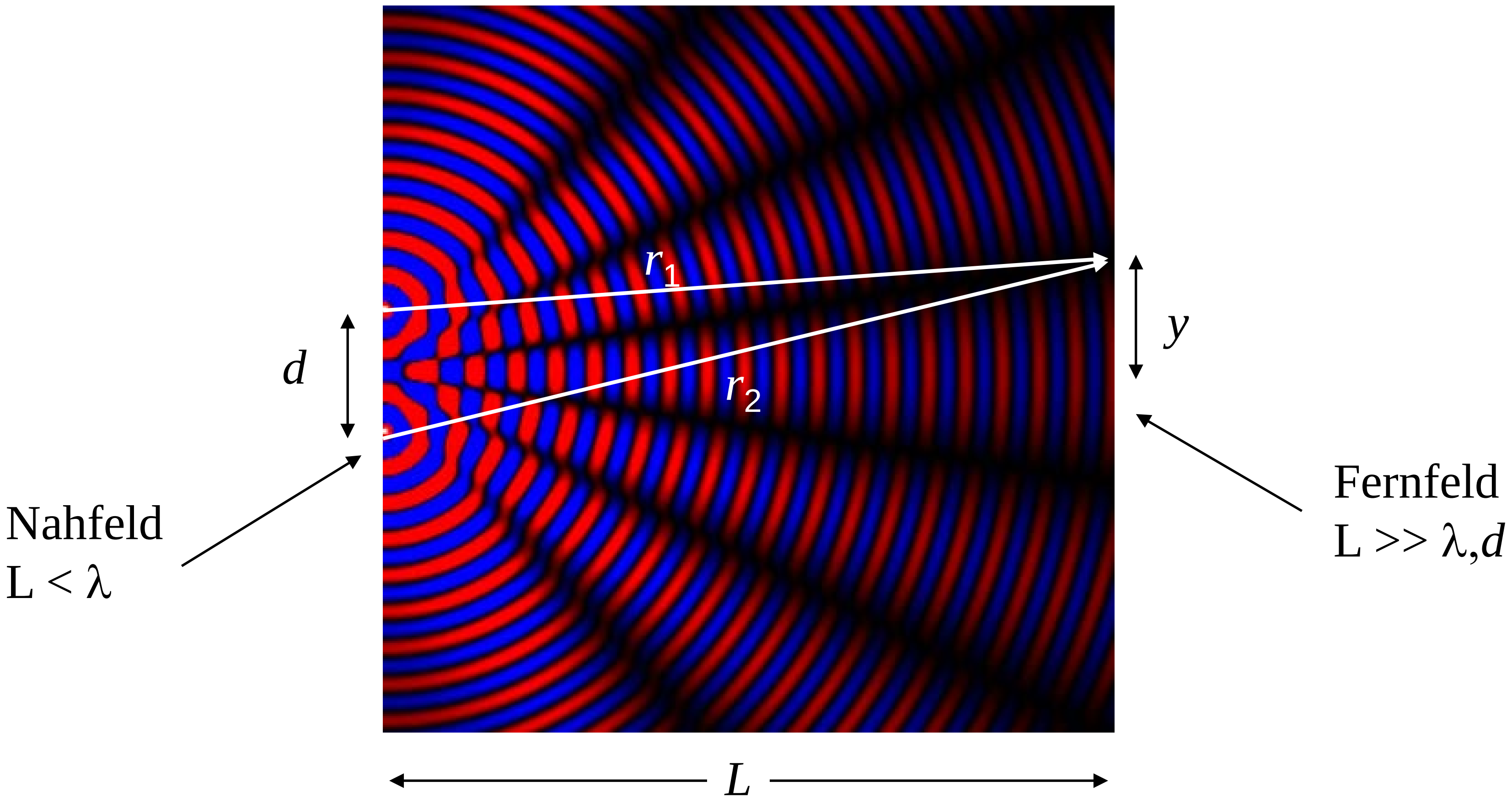
Doppelspalt





http://lampx.tugraz.at/~hadley/physikm/apps/huygens.de.php

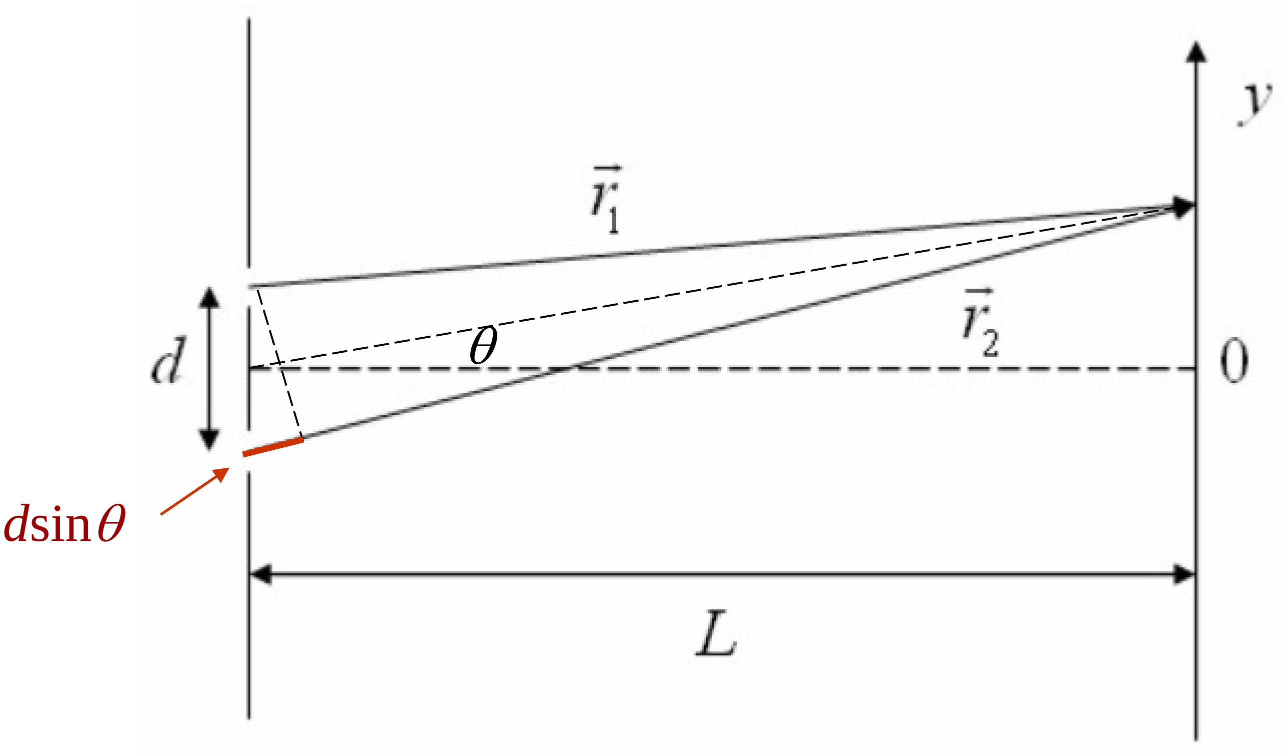
Nahfeld / Fernfeld



Konstruktive Interferenz: $|\vec{r}_2| - |\vec{r}_1| = n\lambda$

Destruktive Interferenz: $|\vec{r}_2| - |\vec{r}_1| = \left(n + \frac{1}{2}\right)\lambda$

Fernfeld

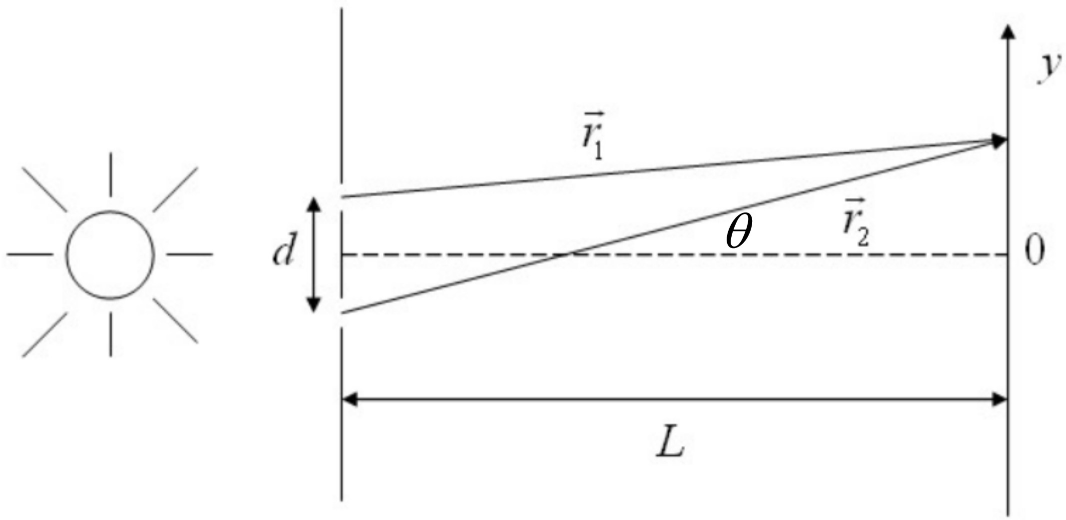


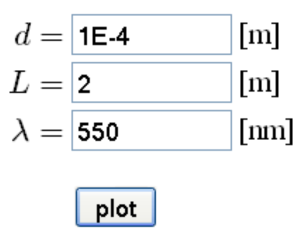
Konstruktive Interferenz: $|\vec{r}_2| - |\vec{r}_1| = n\lambda \approx d\sin\theta \quad \Rightarrow \theta \approx \frac{n\lambda}{d}$

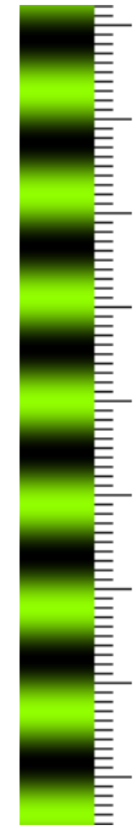
Destruktive Interferenz: $|\vec{r}_2| - |\vec{r}_1| = \left(n+\tfrac{1}{2}\right)\lambda \approx d\sin\theta \quad \Rightarrow \theta \approx \frac{\left(n+\tfrac{1}{2}\right)\lambda}{d}$

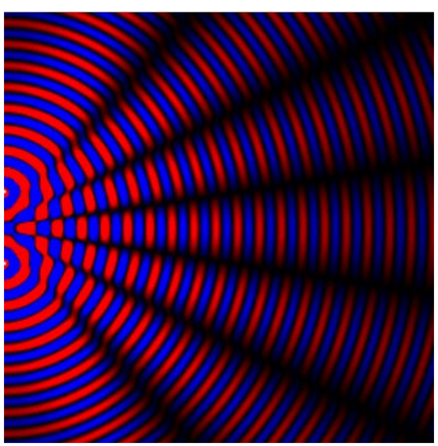
Doppelspalt

destruktive Interferenz: $|\vec{r}_2| - |\vec{r}_1| = \left(n + \tfrac{1}{2}\right)\lambda \approx d \sin\theta$





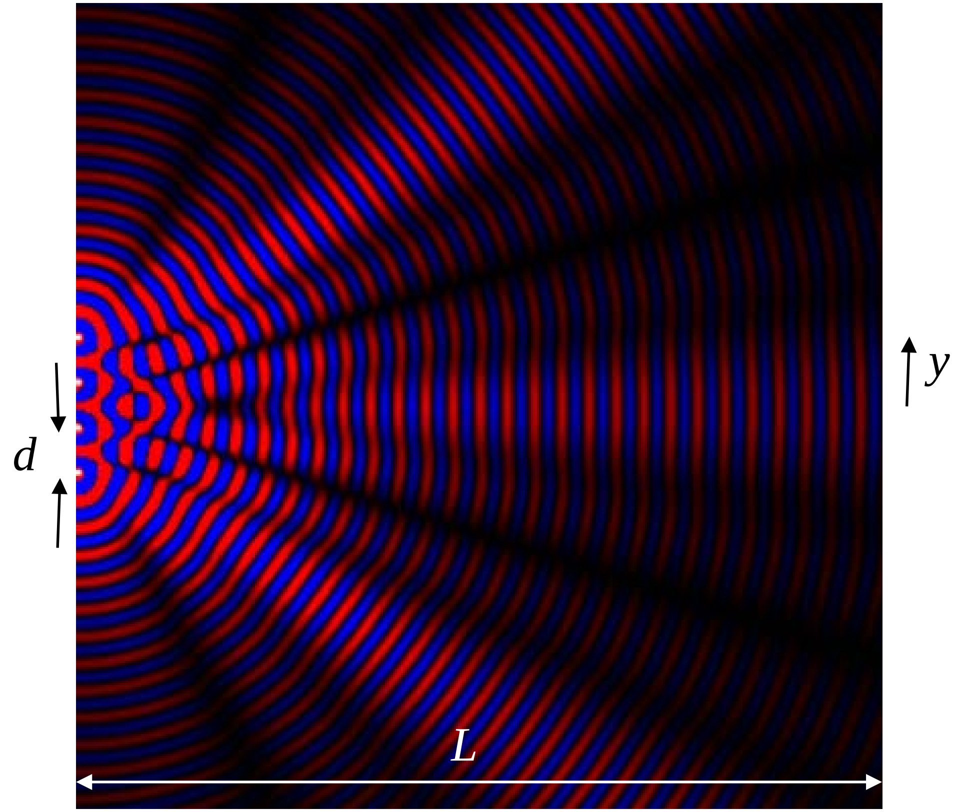




$$I \approx \frac{4A}{L} \cos^2\left(\frac{kdy}{2L}\right)$$

http://lampx.tugraz.at/~hadley/physikm/apps/double_slit.de.php

Interferenz am N-fach Spalt

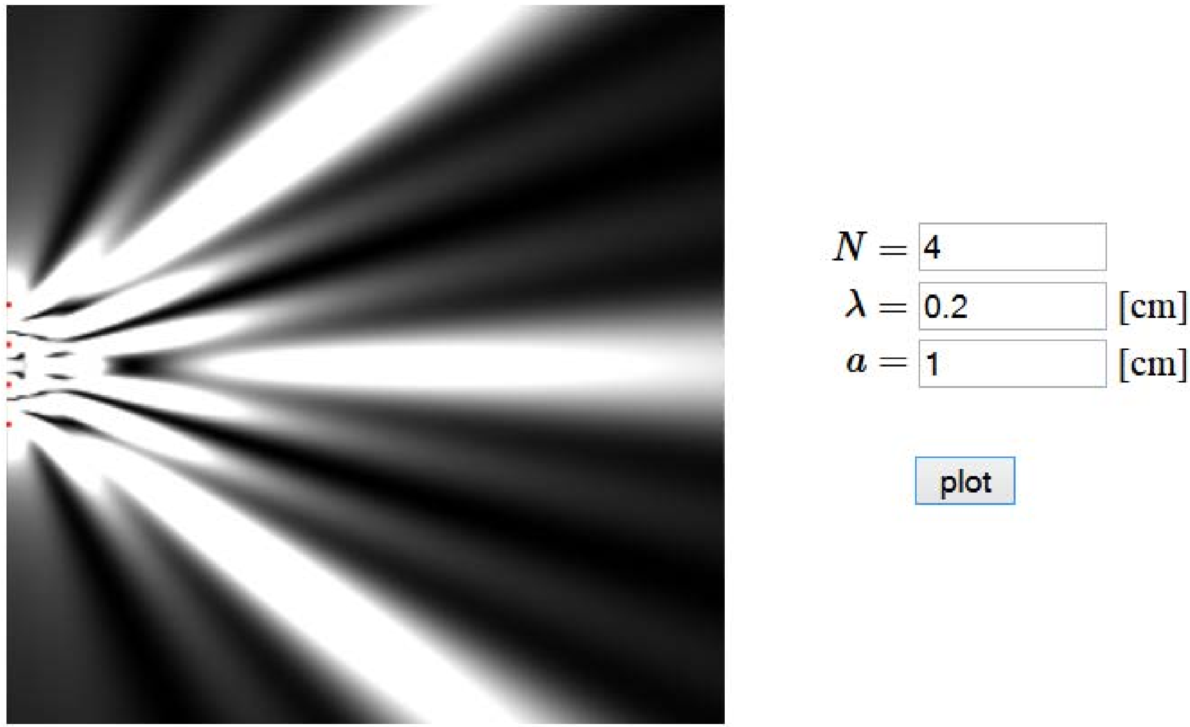


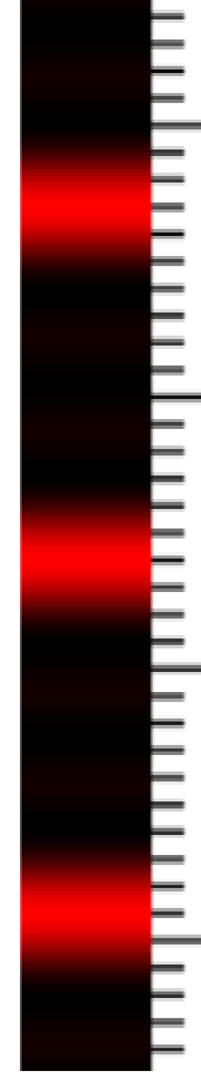
Wenn zwei konstruktiv interferieren, interferieren alles konstruktiv.

Konstruktive Interferenz: (Fernfeld)

$$\left|\vec{r}_2\right| - \left|\vec{r}_1\right| = n\lambda \approx d \sin\theta \quad \Rightarrow \theta \approx \frac{n\lambda}{d}$$

Intensität vieler interferierender Punktquellen

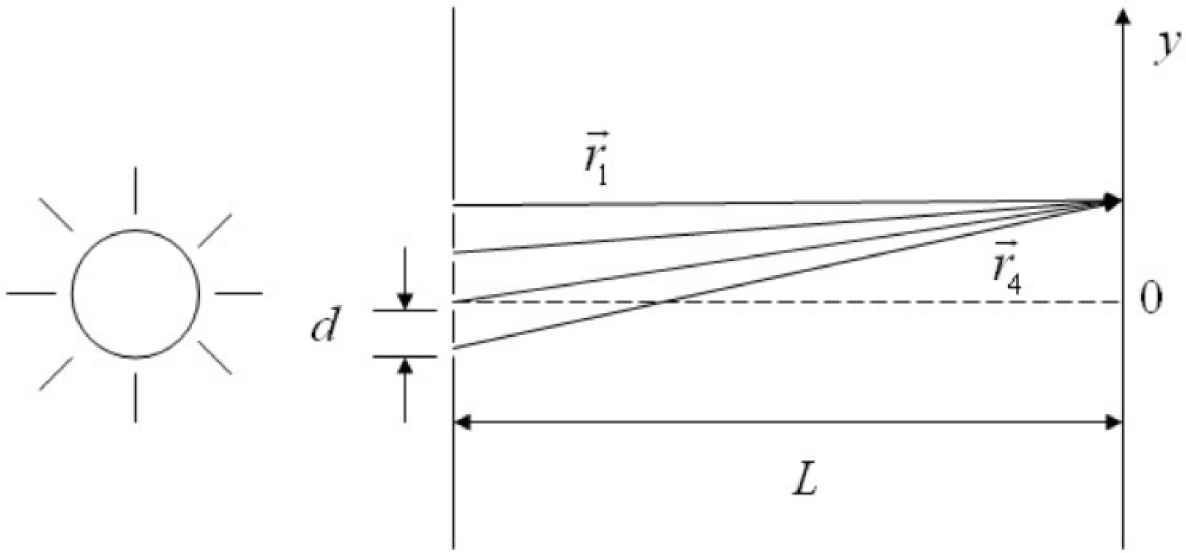


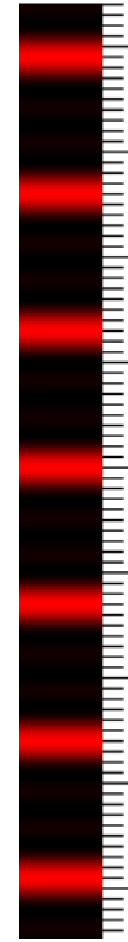


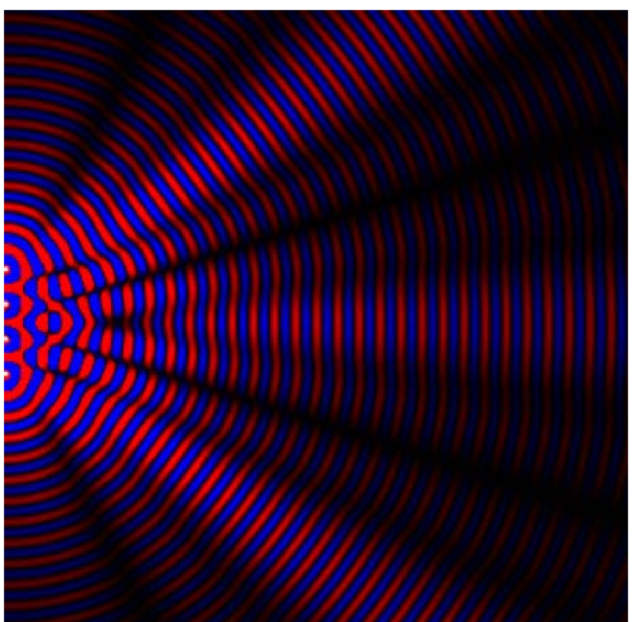
$$\sum_{j=1}^{N} \frac{A_j}{\sqrt{|\vec{r}-\vec{r}_j|}} e^{i(k|\vec{r}-\vec{r}_j|-\omega t+\phi_j)} = \left(\sum_{j=1}^{N} \frac{A_j}{\sqrt{|\vec{r}-\vec{r}_j|}} e^{i(k|\vec{r}-\vec{r}_j|+\phi_j)} \right) e^{-i\omega t}.$$

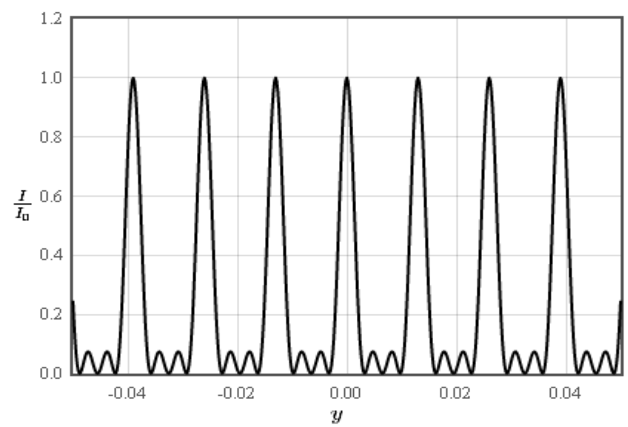
http://lamp.tu-graz.ac.at/~hadley/physikm/apps/huygensintensity.de.php

Interferenz am N-fach Spalt







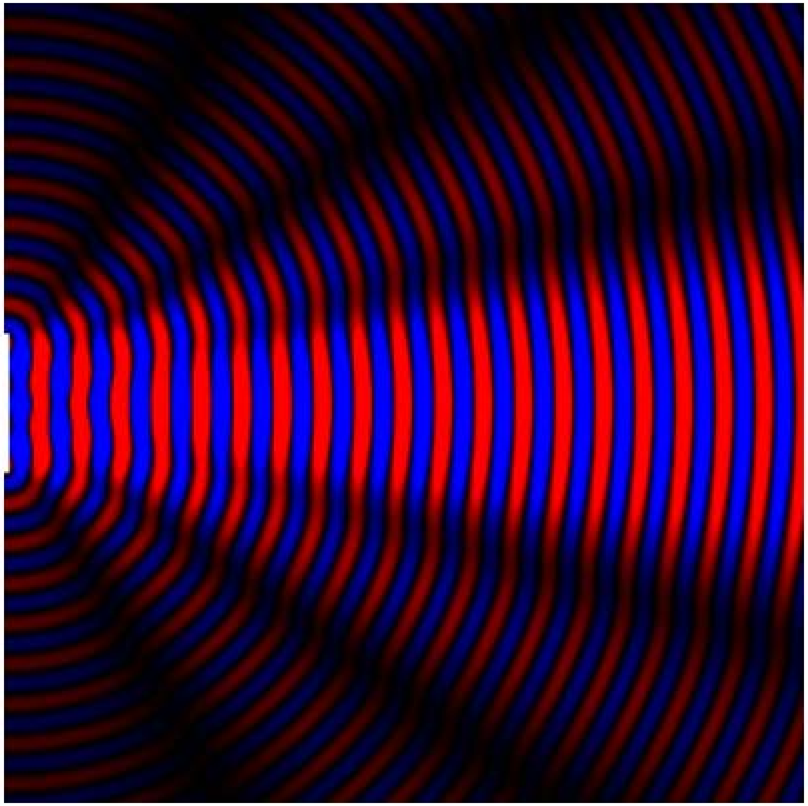


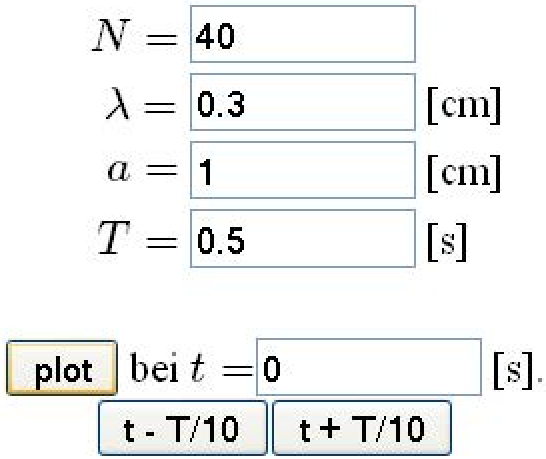
Konstruktive Interferenz: $\left|\vec{r}_2\right| - \left|\vec{r}_1\right| = n\lambda \approx d\sin\theta \approx \frac{yd}{L}$

(Fernfeld)

http://lampx.tugraz.at/~hadley/physikm/apps/N_slit.de.php

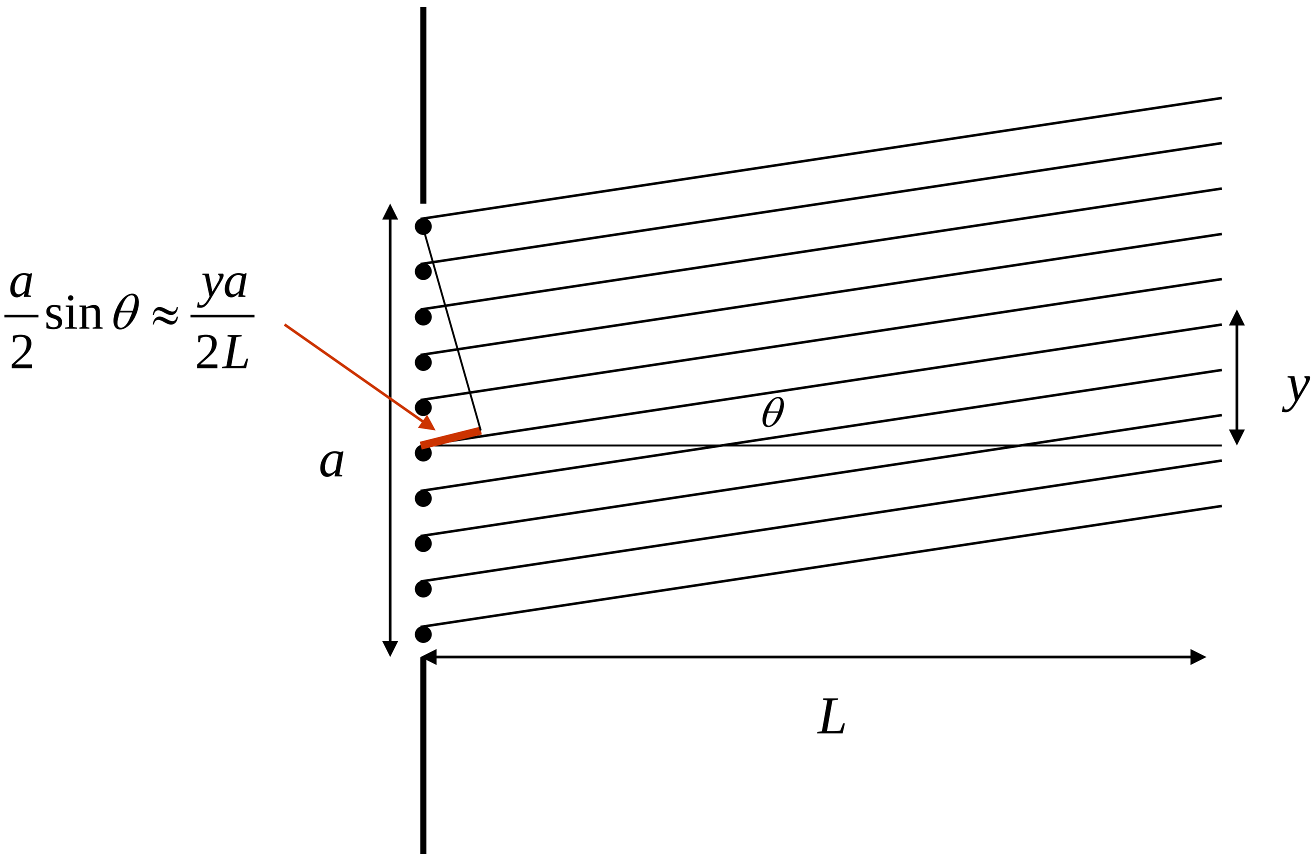
Einfachspalt





http://lampx.tugraz.at/~hadley/physikm/apps/single_slit.de.php

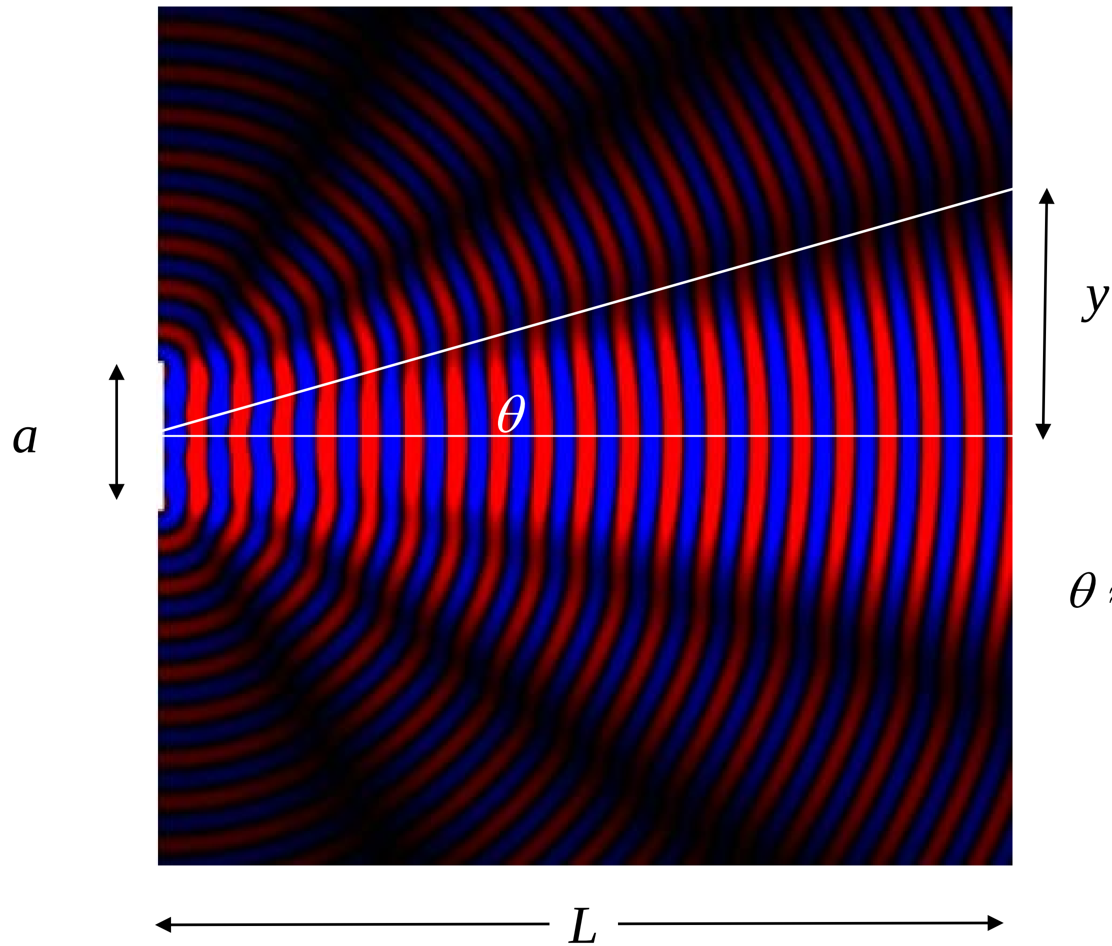
Einfachspalt (Fernfeld)



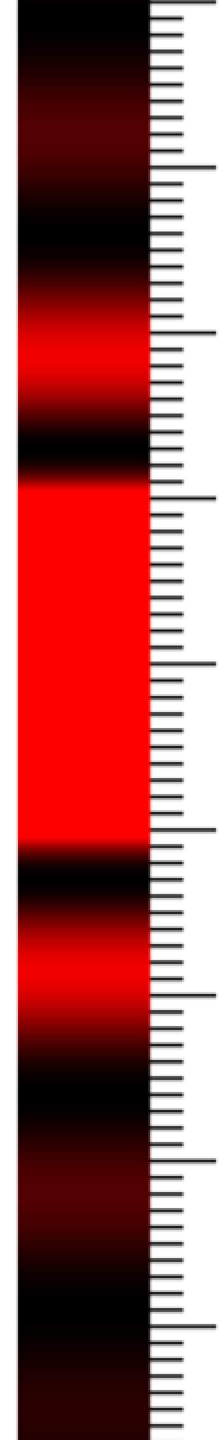
Konstruktive Interferenz: $\left|\vec{r}_2\right| - \left|\vec{r}_1\right| = n\lambda \approx \frac{a}{2}\sin\theta \approx \frac{ay}{2L}$

Destruktive Interferenz: $\left|\vec{r}_2\right| - \left|\vec{r}_1\right| = \left(n + \tfrac{1}{2}\right)\lambda \approx \frac{a}{2}\sin\theta \approx \frac{ay}{2L}$

Einfachspalt Beugung



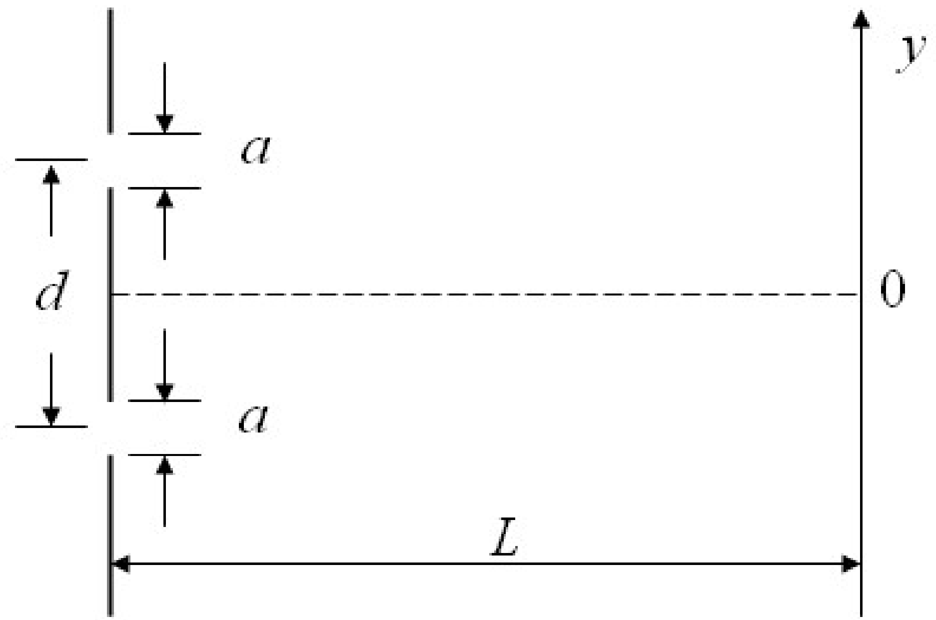
$$\theta \approx \frac{\lambda}{a}$$

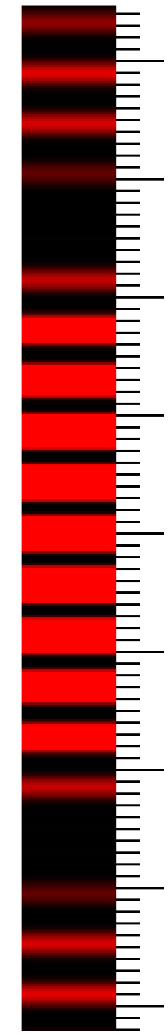


Destruktive Interferenz: $\left|\vec{r}_2\right| - \left|\vec{r}_1\right| = \frac{\lambda}{2} \approx \frac{a}{2}\sin\theta \approx \frac{ya}{2L} \approx \frac{a}{2}\theta$

(Fernfeld)

Beugung an zwei Einfachspalten der Breite a



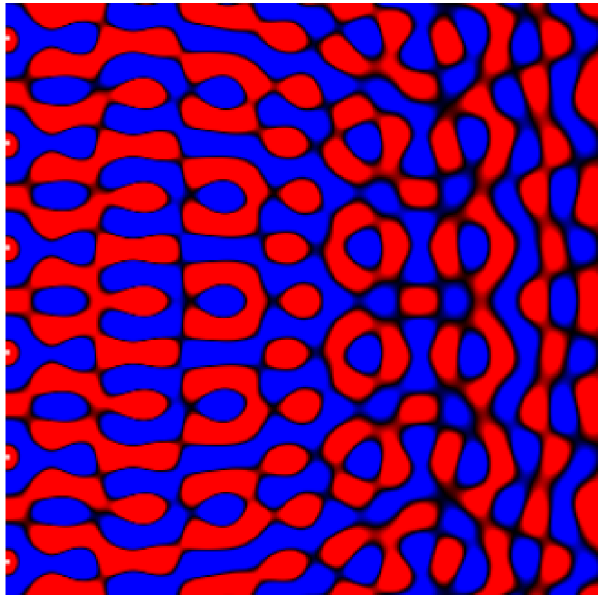


$a =$	5E-5	[m]
$d =$	3E-4	[m]
$L =$	2	[m]
$\lambda =$	650	[nm]

http://lampx.tugraz.at/~hadley/physikm/apps/2single_slit.de.php

ebene Wellen

1 Quelle/cm



$n =$ 1 [cm^{-1}]

$\lambda =$ 0.5 [cm]

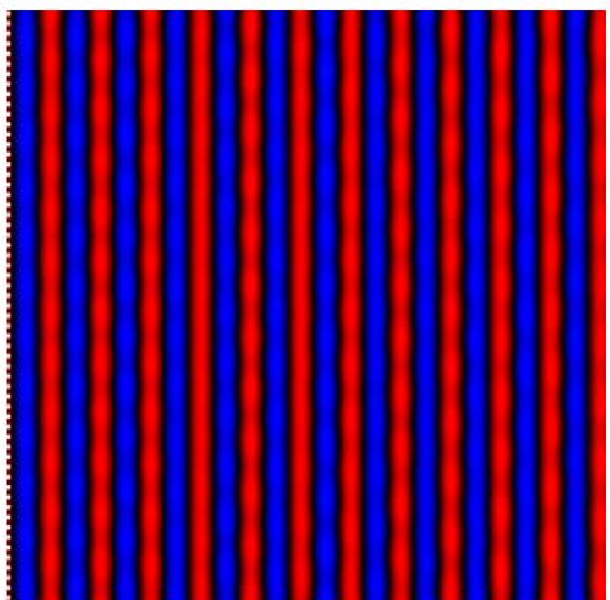
$T =$ 0.5 [s]

$\Delta\phi =$ 0 [rad/cm^{-1}]

plot at $t =$ 0 [s].

t - T/10 t + T/10

10 Quellen/cm



$n =$ 10 [cm^{-1}]

$\lambda =$ 0.5 [cm]

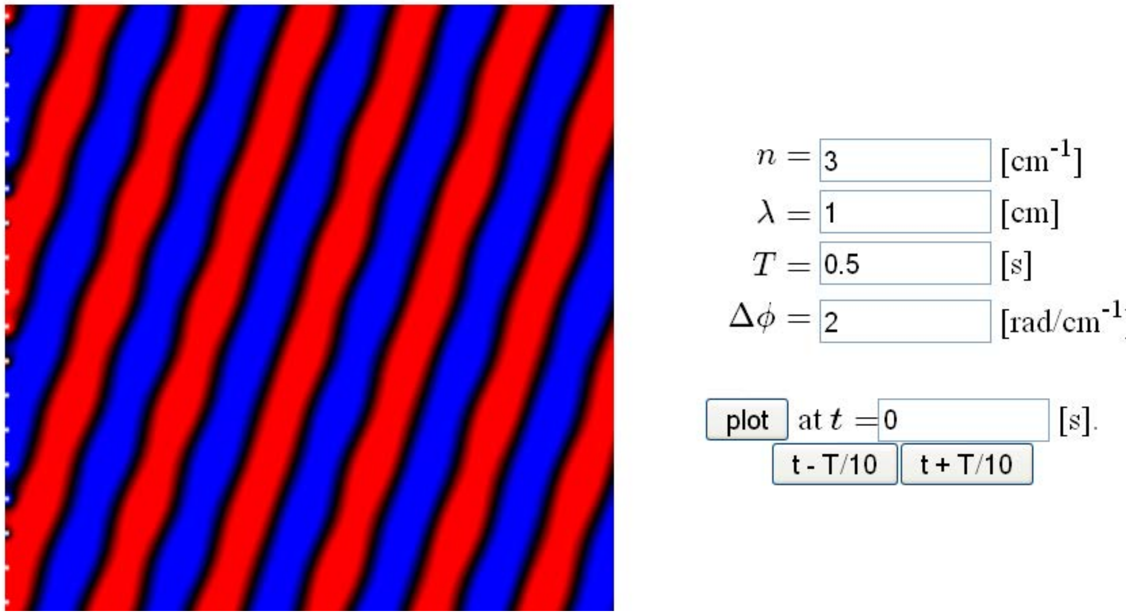
$T =$ 0.5 [s]

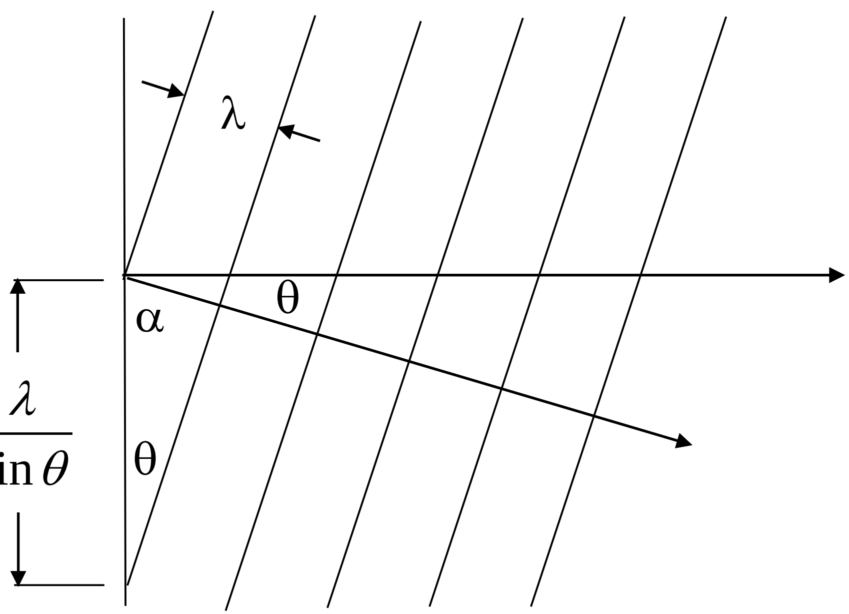
$\Delta\phi =$ 0 [rad/cm^{-1}]

plot at $t =$ 0 [s].

t - T/10 t + T/10

ebene Wellen

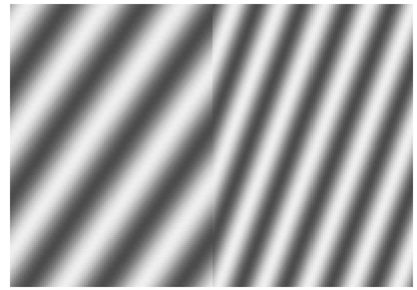


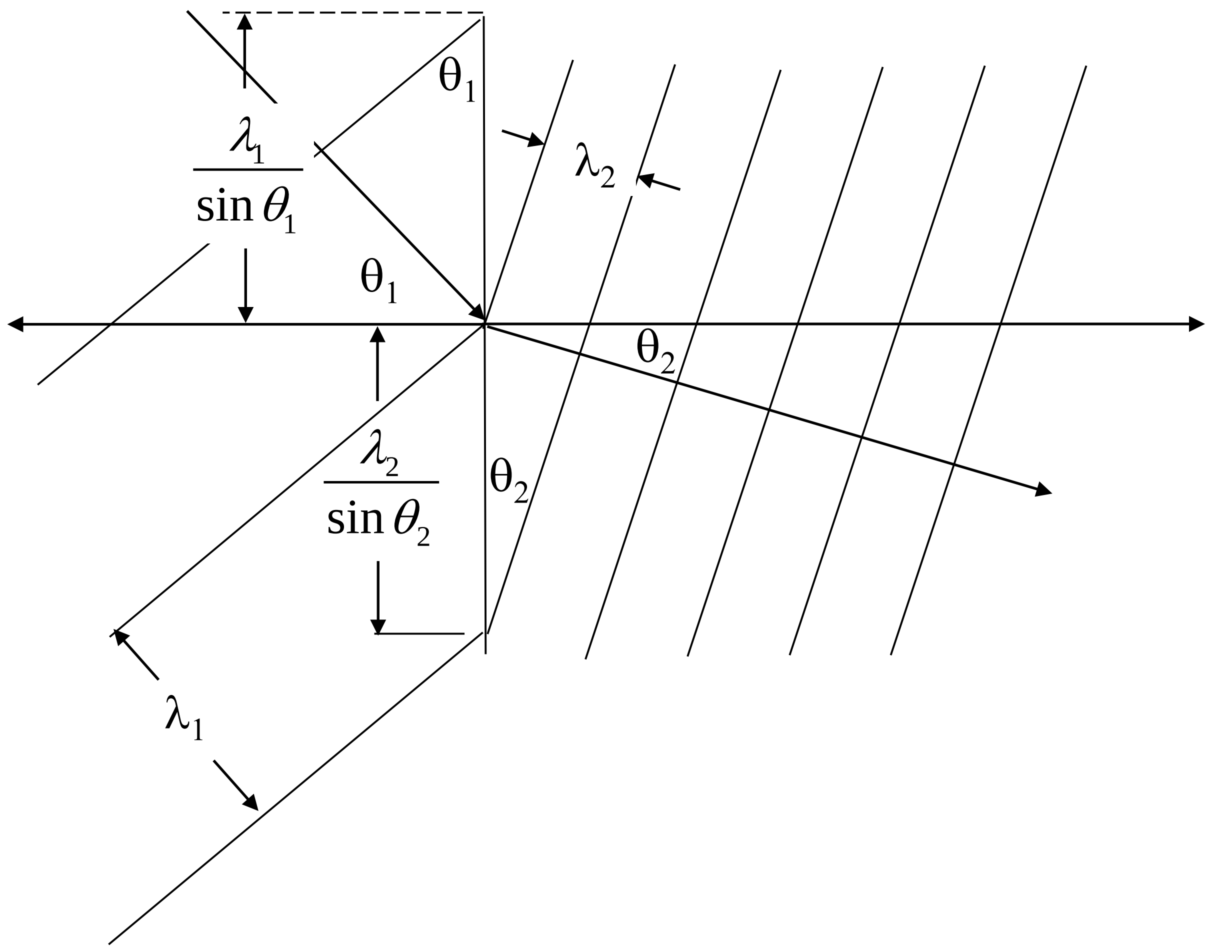


$$d = \frac{\lambda}{\sin\theta}$$

$$\alpha = \pi/2 - \theta$$

Snelliussches Brechungsgesetz





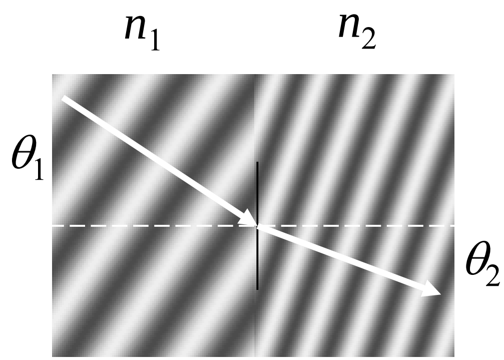
$$\frac{\lambda_1}{\sin\theta_1} = \frac{\lambda_2}{\sin\theta_2}$$

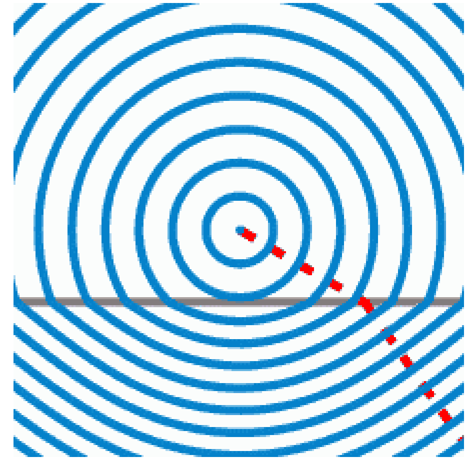
$$\lambda_1 = \frac{c_1}{f} \qquad \lambda_2 = \frac{c_2}{f}$$

$$\boxed{\frac{c_1}{\sin\theta_1} = \frac{c_2}{\sin\theta_2}}$$

http://commons.wikimedia.org/wiki/File:Wave_refraction.gif

Snelliussches Brechungsgesetz





$$\frac{\lambda_1}{\sin\theta_1} = \frac{\lambda_2}{\sin\theta_2}$$

$$\lambda_1 = \frac{c}{n_1 f} \qquad \lambda_2 = \frac{c}{n_2 f}$$

Brechungsindex

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

http://commons.wikimedia.org/wiki/File:Wave_refraction.gif

http://commons.wikimedia.org/wiki/File:Snells_law_wavefronts.gif