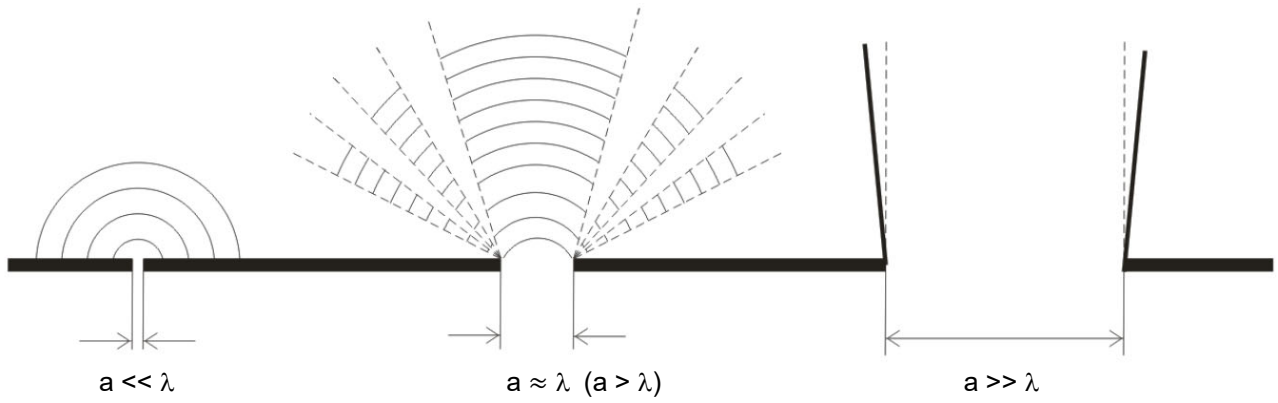
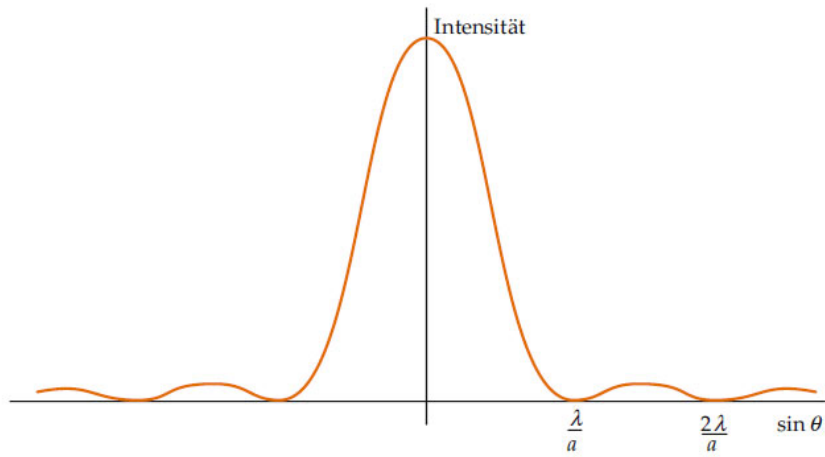


Beugung am Einzelspalt



$a \approx \lambda$ ($a > \lambda$)



Intensitätsverteilung

- ganze Welle auf Schirm
 $y(\theta)$
- Beitrag von dz
 $dy(z) = A_0 \frac{dz}{a} \sin(kx - \omega t + \delta(z))$
- ganze Welle auf Schirm
 $y = A_0 \sin(kx - \omega t)$
- Beitrag von dz
 $dy(z) = A_0 \frac{dz}{a} \sin(kx - \omega t)$

$$y(\theta) = \int_0^a dy(z)$$

$$dy(z) = A_0 \frac{dz}{a} \sin(kx - \omega t + \delta(z))$$

$$\delta(z) = \frac{2\pi}{\lambda} \Delta s(z)$$

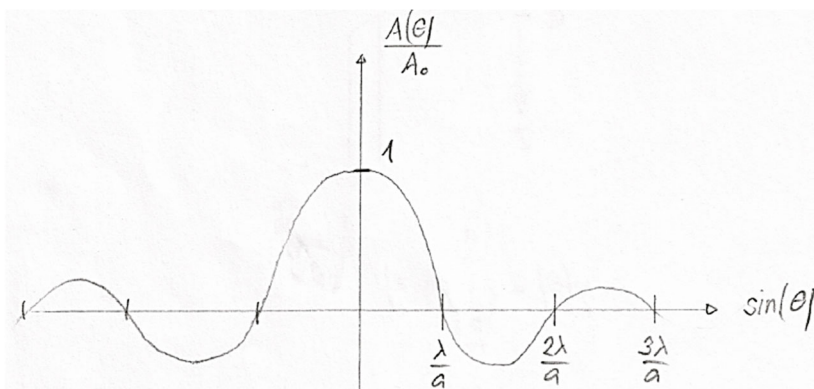
$$= k \cdot \Delta s(z)$$

$$\sin(\theta) = \frac{\Delta s(z)}{Z}$$

$$dy(z) = A_0 \frac{dz}{a} \sin(kx - \omega t + kz \sin(\theta))$$

$$\begin{aligned}
 y(\theta) &= \int_0^a dy(z) \\
 &= \frac{A_0}{a} \int_0^a \sin(kx - \omega t + kz \sin(\theta)) dz \\
 &\quad \left| \text{Subst.: } u := kx - \omega t + kz \sin(\theta) \right. \\
 &\quad \quad \quad \vdots \\
 &= -\frac{A_0}{ka \sin(\theta)} \left(\cos(kx - \omega t + ka \sin(\theta)) - \cos(kx - \omega t) \right)
 \end{aligned}$$

$$\begin{aligned}
 &\quad \left| \cos(\alpha) - \cos(\beta) = -2 \sin\left(\frac{\alpha+\beta}{2}\right) \sin\left(\frac{\alpha-\beta}{2}\right) \right. \\
 &= A_0 \underbrace{\frac{\sin\left(\frac{ka}{2} \sin(\theta)\right)}{\frac{ka}{2} \sin(\theta)}}_{=: A(\theta)} \cdot \sin\left(kx - \omega t + \frac{ka}{2} \sin(\theta)\right)
 \end{aligned}$$



Dunkelstellen : $\sin\left(\frac{ka}{2} \sin(\theta)\right) = 0$

$$\frac{ka}{2} \sin(\theta) = m \cdot \pi \quad \left| \quad k = \frac{2\pi}{\lambda} \right.$$

$$\sin(\theta) = m \cdot \frac{\lambda}{a}$$

Hellstellen : ... (Extremwertaufgabe, transzendente Gleichung)

$$\sin(\theta) = \begin{cases} 0 \\ \left(\frac{1}{2} + m\right) \cdot \frac{\lambda}{a} \quad (m \neq 0) \end{cases}$$