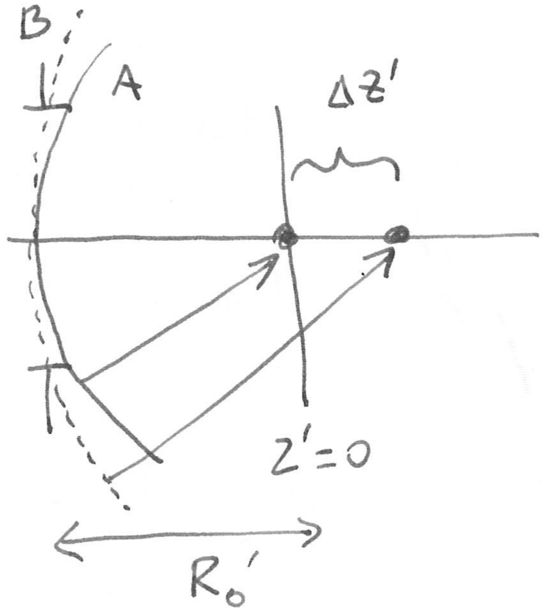
1 rozostření

L3



(A) $$e^{ik\sqrt{x_p^2+y_p^2+R_0'^2}} \approx e^{ikR_0'\left(1+\frac{x_p^2+y_p^2}{2R_0'^2}\right)} \rightarrow e^{ikR_0'}, \quad e^{ik\frac{x_p^2+y_p^2}{2R_0'}}$$

(B) $$e^{ik\sqrt{x_p^2+y_p^2+(R_0'+\Delta z')^2}}$$

$$\approx e^{ik(R_0'+\Delta z')\left[1+\frac{x_p^2+y_p^2}{2(R_0'+\Delta z')^2}\right]}$$

$$\rightarrow e^{ik(R_0'+\Delta z')}$$

$$\rightarrow e^{ik\frac{x_p^2+y_p^2}{2(R_0'+\Delta z')}} \approx e^{ik\frac{x_p^2+y_p^2}{2R_0'}\left(1-\frac{\Delta z'}{R_0'}\right)}$$

$$\rightarrow e^{ik\frac{x_p^2+y_p^2}{2R_0'}}, \quad e^{-ik\frac{x_p^2+y_p^2}{2R_0'^2}\Delta z'}$$

$$\equiv e^{ikW_D}$$

$$W_D = -\frac{x_p^2+y_p^2}{2R_0'^2}\Delta z' \Leftarrow e^{ikW_D}$$

rotační symetrie

$$a(\underbrace{X', Y'}_{\text{normované}}, \Delta z') \simeq \iint_{-\infty}^{\infty} P(\underbrace{X_p, Y_p}_{\text{normované}}, \Delta z') \, e^{i2\pi(X_p X' + Y_p Y')} \, dX_p \, dY_p$$

$$X_p = R_p \cos\phi \qquad X' = R' \cos\psi$$

$$Y_p = R_p \sin\phi \qquad Y' = R' \sin\psi$$

$$P(X_p, Y_p, \Delta z') = P(R_p, \Delta z')$$

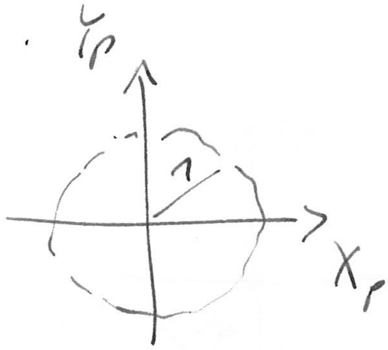
$$X_p X' + Y_p Y' = R_p R' (\underbrace{\cos\phi \cos\psi + \sin\phi \sin\psi}_{\cos(\phi - \psi)})$$

$$\iint_{-\infty}^{\infty} \cdots \, dX_p \, dY_p = \int_0^{\infty} \int_0^{2\pi} \cdots \, R_p \, dR_p \, d\phi$$

$$\int_0^{2\pi} e^{i 2\pi R_p R' \cos(\phi - \psi)} \, d\phi = 2\pi J_0(2\pi R_p R')$$

$$a(R', \Delta z') \cong \int_0^{\infty} P(R_p, \Delta z') J_0(2\pi R_p R') R_p \, dR_p$$

difr. limit



$$P(R_p, \Delta z' = 0) = \mathrm{circ}(R_p)$$

norm.

$$a(R') \approx \int_0^1 R_p\, J_0(\underbrace{2\pi R' R_p}_{x})\, dR_p$$

$$= \frac{1}{(2\pi R')^2} \int_0^{2\pi R'} x\, J_0(x)\, dx \qquad \Big/ \qquad \int_0^{\alpha} x J_0(x)\, dx = \alpha J_1(\alpha)$$

$$\Uparrow$$

$$\frac{d}{dx}\left[x^n J_n(x)\right] = x^n J_{n-1}(x)$$

$$= \frac{J_1(2\pi R')}{2\pi R'}$$

první min: $J_1(x) = 0 \qquad x = 3.8$

$$2\pi \Delta R' = 3.8$$

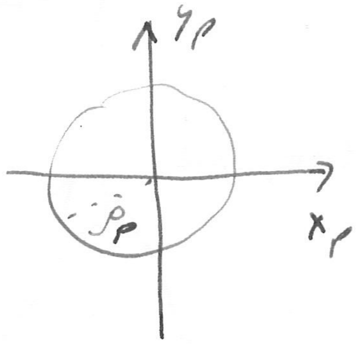
$$\Delta R' = \frac{3.8}{2\pi} \approx 0{,}61$$

přirodní obr. souřadnice

$$\Delta r' = \frac{\lambda R_0'}{\rho_p} \cdot \Delta R' = 0{,}61\, \lambda \frac{R_0'}{\rho_p} = 0{,}61 \frac{\lambda}{u}$$

osová intenzita obrazu

$$x_p^2 + y_p^2 = R_p^2 \rho_p^2$$



normovaná rad. pup. souř.

$$e^{ikW_D} = e^{-i\frac{k}{2}\frac{R_p^2 \rho_p^2 \Delta z'}{R_0'^2}}$$

u'^2

$$a_0(\Delta z') \equiv a(R'=0, \Delta z') \approx \int_0^1 e^{ikW_D} R_p \, dR_p$$

$$a_0(\Delta z') \simeq \int_0^1 e^{-i \underbrace{\frac{k}{2} u'^2 \Delta z'}_{\alpha} R_p^2} R_p \, dR_p$$

$$\int_0^1 e^{-i\alpha R_p^2} R_p \, dR_p = \Big/ \begin{array}{l} x = R_p^2 \\ dx = 2 R_p \, dR_p \end{array} \Big/$$

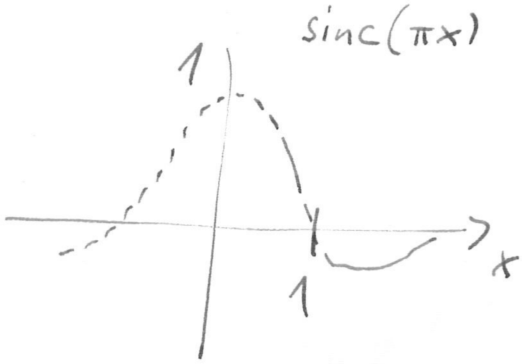
$$= \frac{1}{2} \int_0^1 e^{-i\alpha x} dx = \frac{1}{2} \frac{1}{-i\alpha} \left(e^{-i\alpha} - 1 \right)$$

$$= \frac{1}{\alpha} e^{-i\frac{\alpha}{2}} \underbrace{\left(\frac{e^{i\frac{\alpha}{2}} - e^{-i\frac{\alpha}{2}}}{2i} \right)}_{\sin\frac{\alpha}{2}}$$

$$= \frac{1}{2} e^{-i\frac{\alpha}{2}} \frac{\sin\frac{\alpha}{2}}{\frac{\alpha}{2}} = \frac{1}{2} e^{-i\frac{\alpha}{2}} \operatorname{sinc}\left(\frac{\alpha}{2}\right)$$

$$a_0(\Delta z') \sim \frac{1}{2} e^{-i \frac{k}{4} u'^2 \Delta z'} \operatorname{sinc}\left(\frac{k}{4} u'^2 \Delta z'\right)$$

$$I_0(\Delta z') \sim \operatorname{sinc}^2\left(\pi \frac{u'^2 \Delta z'}{2\lambda}\right)$$



pokles na nulu

$$I_0(\Delta z'_0) = 0$$

$$\Rightarrow \quad \frac{u'^2 \Delta z'_0}{2\lambda} = 1$$

$$\boxed{\Delta z'_0 = \frac{2\lambda}{u'^2}}$$