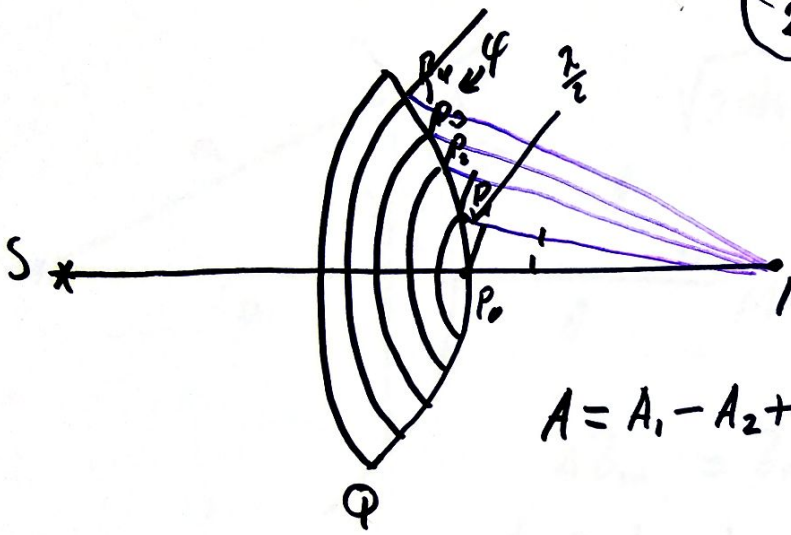
Зоны Френеля.

$\left(\frac{\lambda}{2}\right)$ $P_1M - P_0M = P_2M - P_1M = \ldots = \frac{\lambda}{2}$.

$\frac{\lambda}{2} \leftrightarrow \pi$



$$A = A_1 - A_2 + A_3 - A_4 + \ldots + (-1)^{m-1} A_m \qquad (*)$$

$\Delta = m\frac{\lambda}{2}$

$r_m = \sqrt{a^2 - (a-h)^2} = \sqrt{\left(b + m\frac{\lambda}{2}\right)^2 - (b+h)^2}$

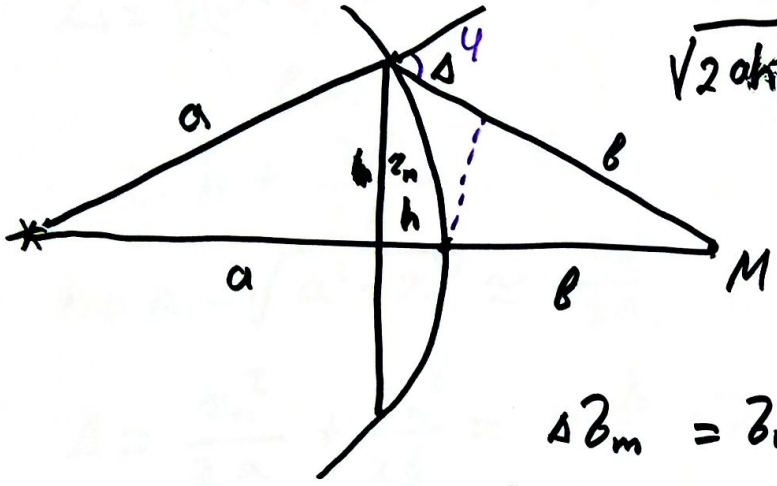
$a \gg r_m,\ b \gg r_m \qquad (1 \pm x)^k \approx (1 \pm kx)$

$x \ll 1$

$\sqrt{2ah - h^2} = \sqrt{2bm\frac{\lambda}{2} + m^2\frac{\lambda^2}{4} - 2bh - h^2}$

$h \cdot 2a = 2bm\frac{\lambda}{2} - 2bh.$

$h_m = \frac{b\lambda}{2(a+b)}m$



$\Delta_m = 2\pi a h_m = \frac{\pi a b \lambda}{a+b} m.$

$\Delta_{m} = \Delta_m - \Delta_{m-1} = \frac{\pi a b \lambda}{a+b} = const$

$A_1 > A_2 > A_3 \ldots\ldots > A_m$

$A_m = \frac{A_{m-1} + A_{m+1}}{2}.$

$A = \frac{A_1}{2} + \underbrace{\left(\frac{A_1}{2} - A_2 + \frac{A_3}{2}\right)}_{=0} + \underbrace{\left(\frac{A_3}{2} - A_4 + \frac{A_5}{2}\right)}_{=0} + \ldots + (-1)^{m-1}\frac{A_m}{2} \quad (**)$

$A = \frac{A_1}{2} + (-1)^{m-1}\frac{A_m}{2}.$ — не огр. $A = \frac{A_1}{2}$!

r_m - ? $\Delta = m\frac{\lambda}{2}$.

$$\Delta = \sqrt{(b+h)^2 + r_m^2} - b \approx (b+h)\left(1 + \frac{r_m^2}{2(b+h)^2}\right) - b = h + \frac{r_m^2}{(b+h)\cdot 2} =$$

$b \gg h$

$$\simeq h + \frac{r_m^2}{2b}$$

$$h = a - \sqrt{a^2 - r_m^2} \simeq \frac{r_m^2}{2a}.$$

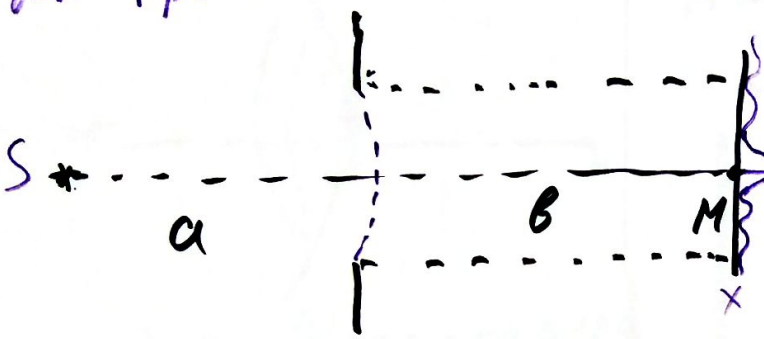
$$\Delta = \frac{r_m^2}{2a} + \frac{r_m^2}{2b} = m\frac{\lambda}{2} \Rightarrow r_m^2\left(\frac{1}{a} + \frac{1}{b}\right) = m\lambda$$

$$r_m = \sqrt{\frac{2ab}{a+b}m}$$

$r_m \sim \sqrt{m}$!

Зонная пластинка. Фраунгофер.

2-я Френеля



$$(**)\quad A = \frac{A_1}{2} + (-1)^{m-1}\frac{A_m}{2}$$

$R \ll a,\ R \ll b$

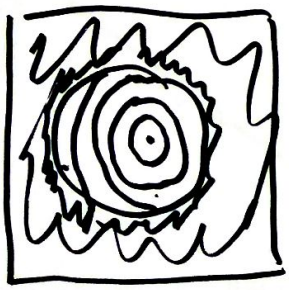
$A_1 \approx A_m$!

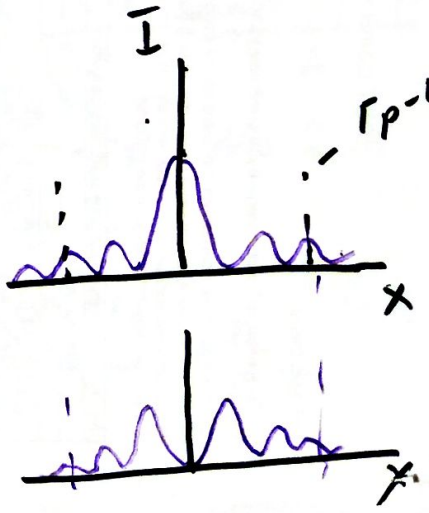
m – чет. $\Rightarrow A = 0$ – min.

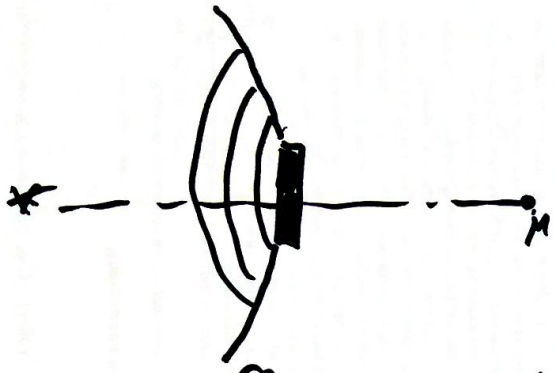
m – нечет $\Rightarrow A = A_1$ – max

$A = \frac{A_1}{2}$, $I \sim A^2$ $\quad I_0 \sim \frac{A_1^2}{4}$ – м/о

max $\quad I_{max} \sim A_1^2 = 4 I_0$!





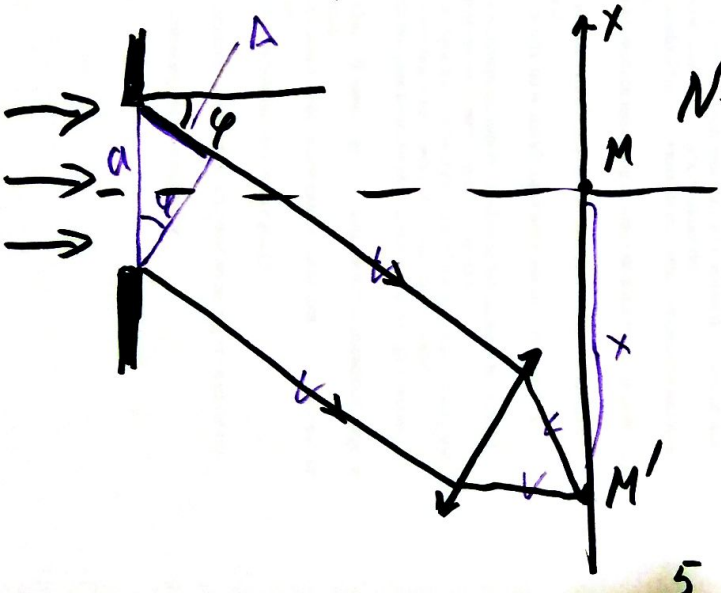


$$A = \frac{A_{m+1}}{2}$$

Пуассон.

д-я Фраунгофера

а. (в)



$\Delta = a \sin\varphi$

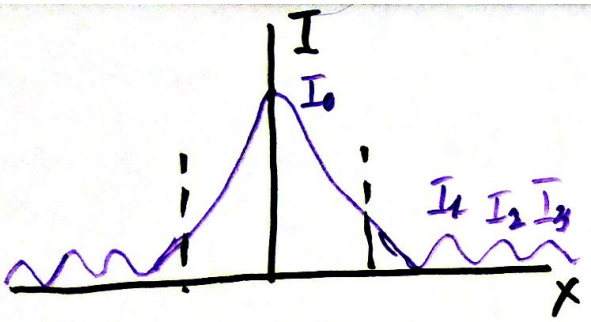
$$N = \frac{\Delta}{\frac{\lambda}{2}} = \frac{a\sin\varphi}{\frac{\lambda}{2}} = \frac{2a\sin\varphi}{\lambda}$$

max: N – чёт $N = 2m$

$a\sin\varphi = m\lambda$

min: $N = (2m+1)$

$a\sin\varphi = (2m+1)\frac{\lambda}{2}$



$I_0 : I_1 : I_2 : I_3 = 1 : 0{,}047 : 0{,}017 : 0{,}008$