MAB3У: YORUGLIK INTERFERENSIYASI

Reja:1) Elektromagnit to'lqin shkalasi

2) To'lqin tenglamasi

3) Kogeret to'lqinlar va ularni hosil qilish usullari

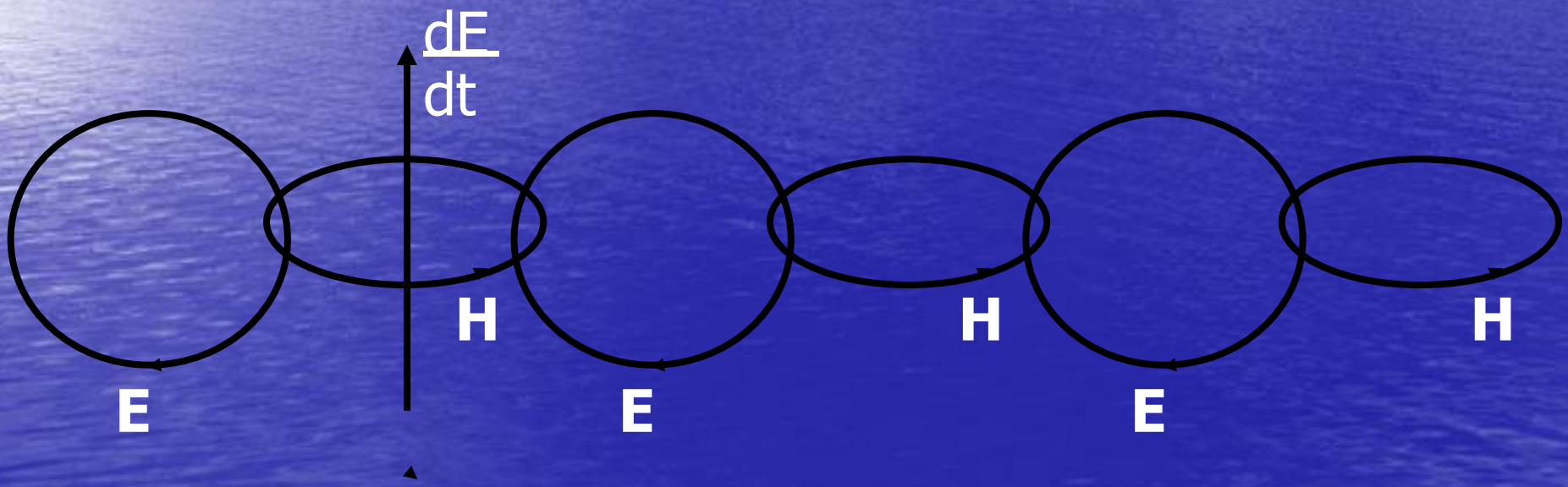
4) Interferensiyani kuchayish va susayish shartlari

5) Interferension manzarani xisoblash

6) Yupqa pardadagi interferensiya

$$E = E_m \cos(\omega t + \varphi_0) = E_m \cos(2\pi\nu + \varphi_0)$$

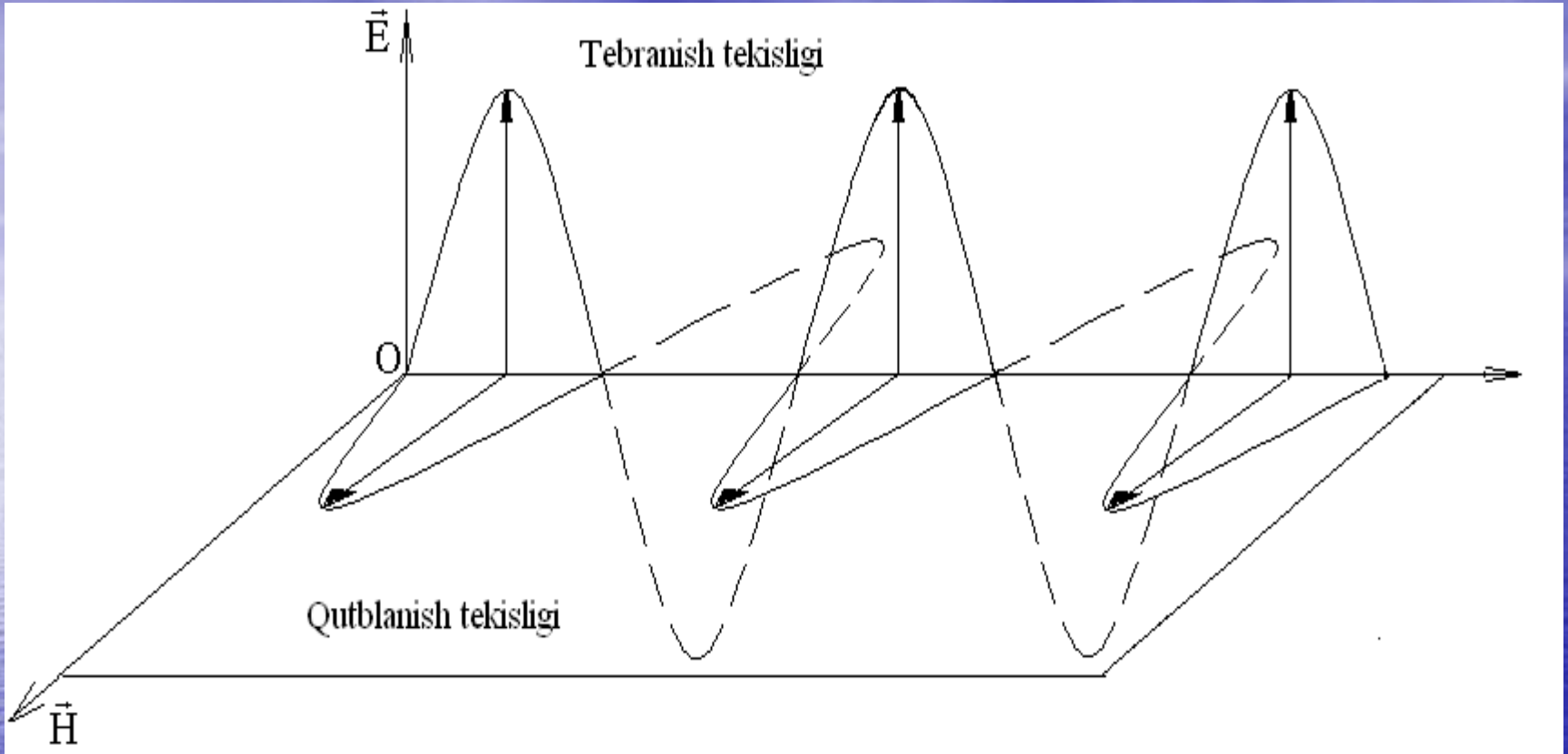
$$H = H_m \cos(\omega t + \varphi_0) = H_m \cos(2\pi\nu + \varphi_0)$$

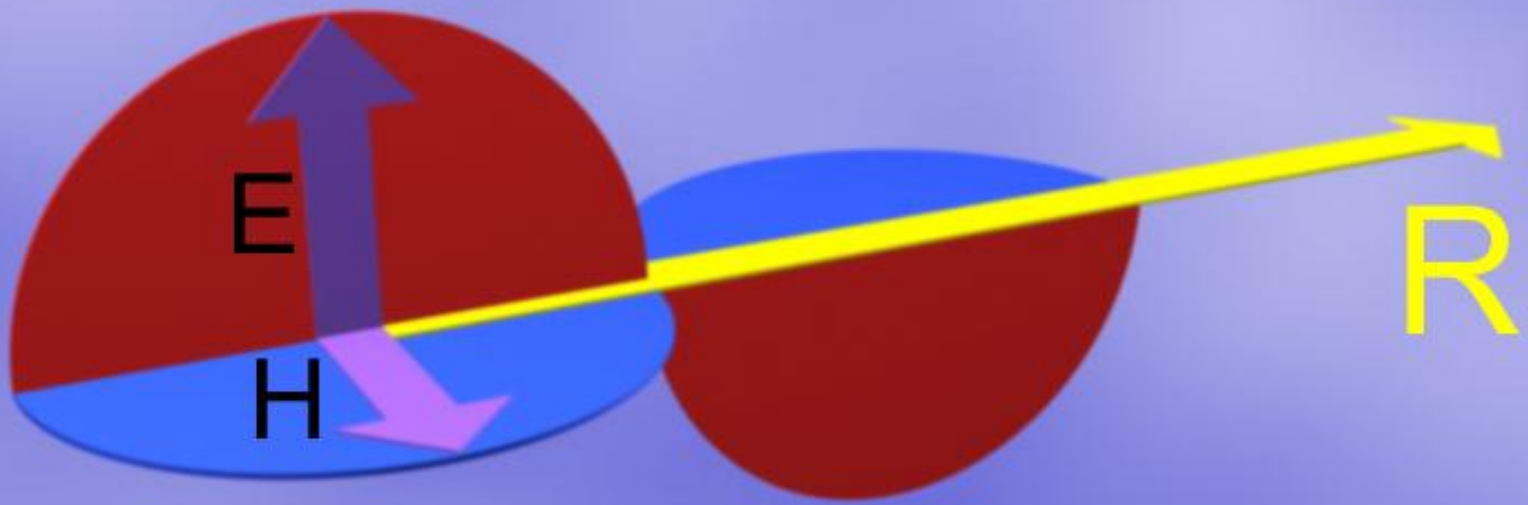


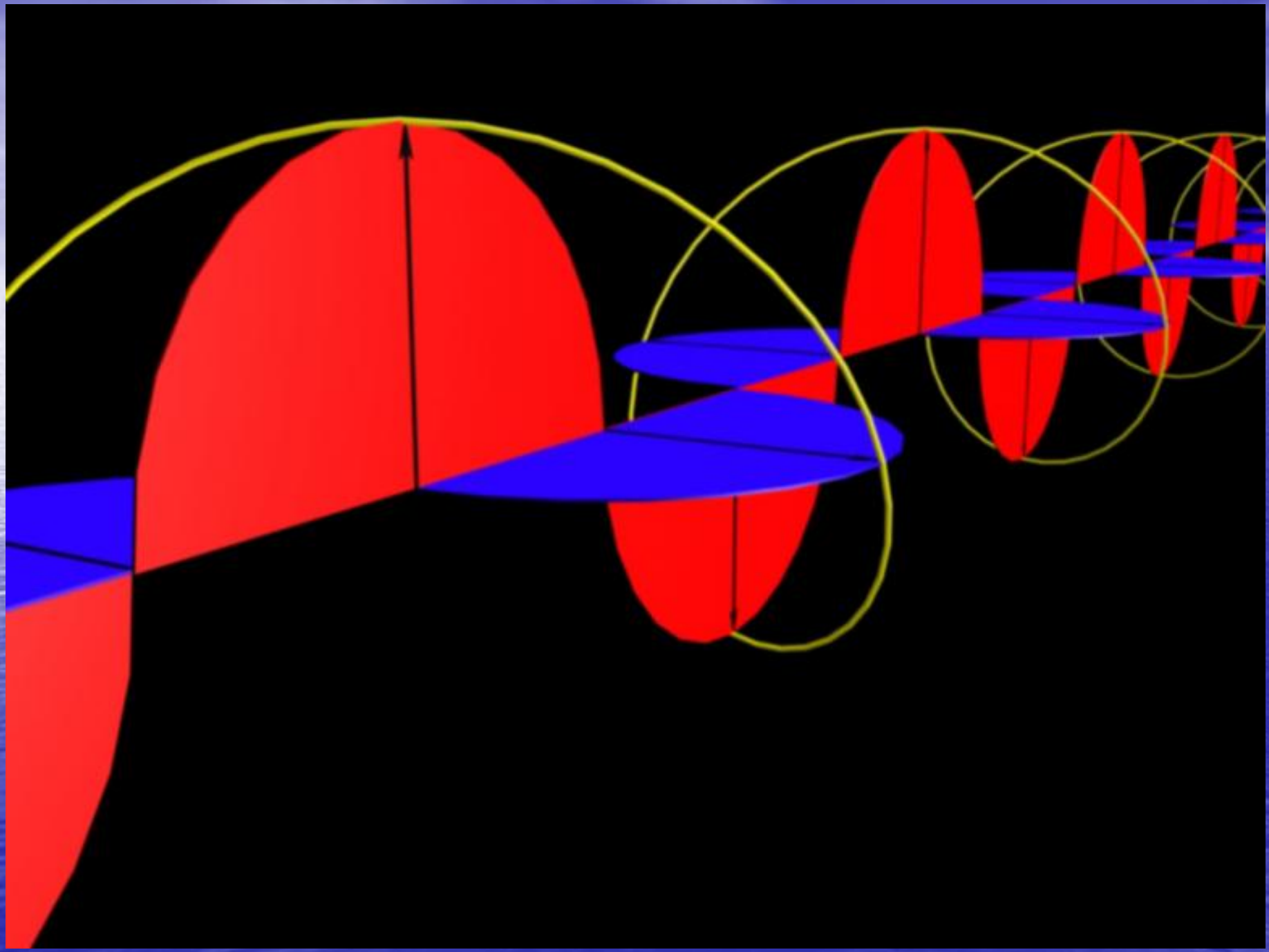
Ko’rinadigan yorug’lik to’lqinlarining chastotalari va to’lqin uzunligi quyidagi chegarada yotadi:

$\nu = (0{,}4 \div 0{,}75) \cdot 10^{15}$ Gs, λ=0,40-0,75*μkm*

Nurlanish turi	To’lqin uzunligi, m	To’lqin chastotasi Gs	Nurlanish manbai
Radioto’lqinda	$10^{3} - 10^{-4}$	$3 \cdot 10^{5} \div 3 \cdot 10^{12}$	Tebranish konturi, Gers vibratori, lampali generator
Infraqizil nurlar	$5 \cdot 10^{-4} - 8 \cdot 10^{-7}$	$6 \cdot 10^{11} - 3.75 \cdot 10^{14}$	lampalar
Ko’rinadigan nurlar	$7{,}5 \cdot 10^{-7} - 4 \cdot 10^{-7}$	$4.0 \cdot 10^{14} - 7.5 \cdot 10^{14}$	Quyosh nuri, lampalar, lazerlar
Ultrabinafsha nurlar	$4 \cdot 10^{-7} - 10^{-9}$	$7.5 \cdot 10^{17} - 5 \cdot 10^{19}$	Lampalar, lazerlar
Rentgen nurlari	$2 \cdot 10^{-9} - 6 \cdot 10^{-12}$	$1.5 \cdot 10^{17} - 5 \cdot 10^{19}$	Rentgen trubkasi
γ- nurlar	$\langle 6 \cdot 10^{-12}$	$\rangle 5 \cdot 10^{19}$	Radioaktiv nurlanish yadroviy jarayonlar


$\vec{E}$
Tebranish tekisligi
O
Qutblanish tekisligi
$\vec{H}$


E
H
R



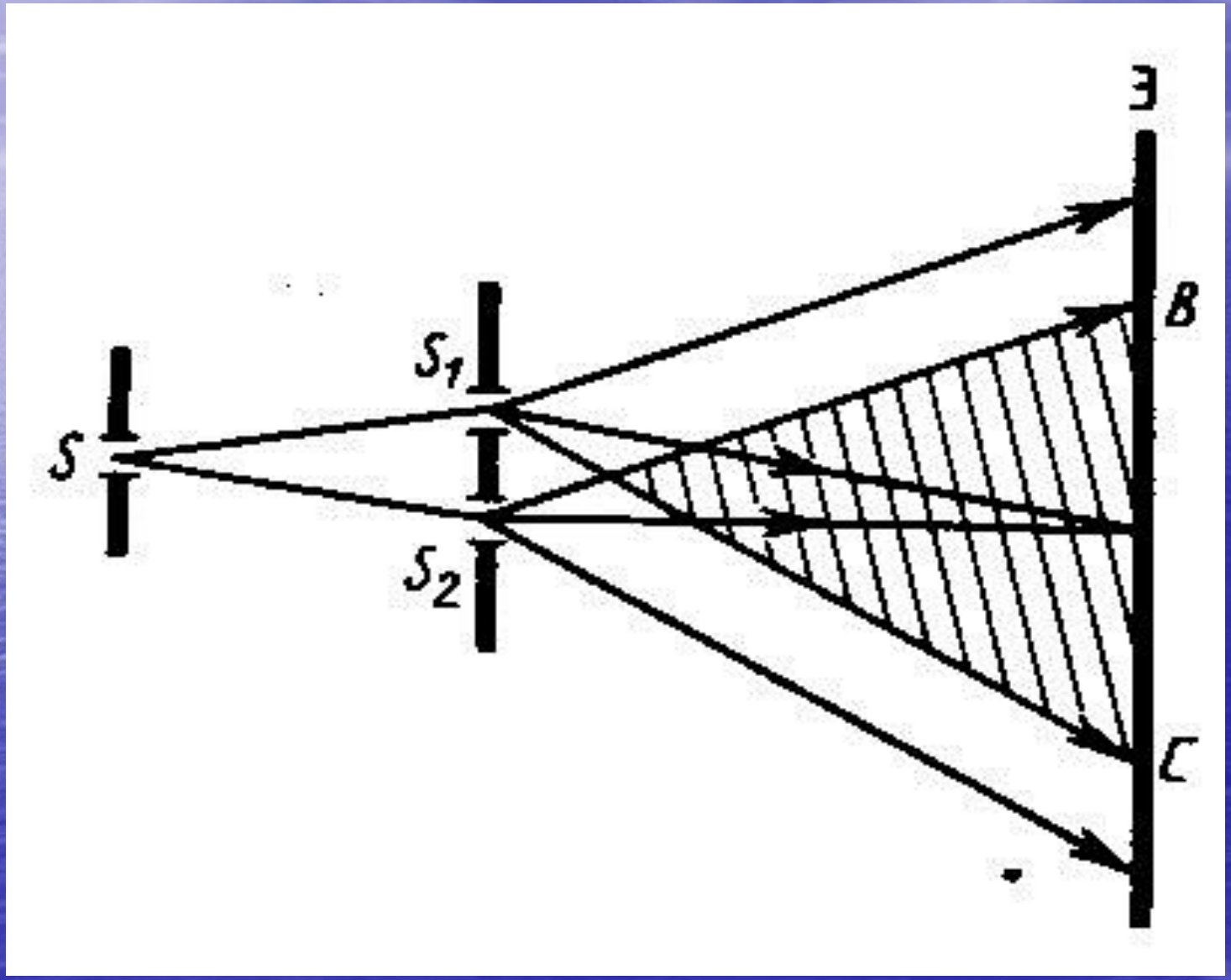
YORUG'LIK CHASTOTASI

$\nu=(0{,}75\div0{,}40)\cdot10^{15}$ Gs

TO'LQIN UZUNLIGI

$\lambda_0=(0{,}40\div0{,}75)$mkm

Yung tajribasi



Ikkita kogerent to'lqin berilgan

$E_1=E_{1m}COS(\omega t+\varphi_{10})$ $E_2=E_{2m}COS(\omega t+\varphi_{20})$

Bu to'lqinlar fazoning ,biror nuqtasida qo'shiladi natijaviy tolqinning amplitudasi quyidagi tenglama bilan ifodalanadi.

$$E_m^2 = E_{1m}^2 + E_{2m}^2 + 2E_{1m}E_{2m}\cos(\varphi_1 - \varphi_2)$$

Bu formuladagi fazalar farqi vaqt o'tishi bilan o'zgarmas boladi

$$\Delta\varphi = \varphi_1 - \varphi_2 = \text{const}$$

$$E_{2m}=E_{21m}+E_{22m}+E_{1m}E_{2m}\cos(\varphi_1-\varphi_2)$$

$$1.\Delta\varphi=2k\pi \quad (k=0,1,2,\ldots\ldots)$$

$$E_m=E_{1m}+E_{2m}$$

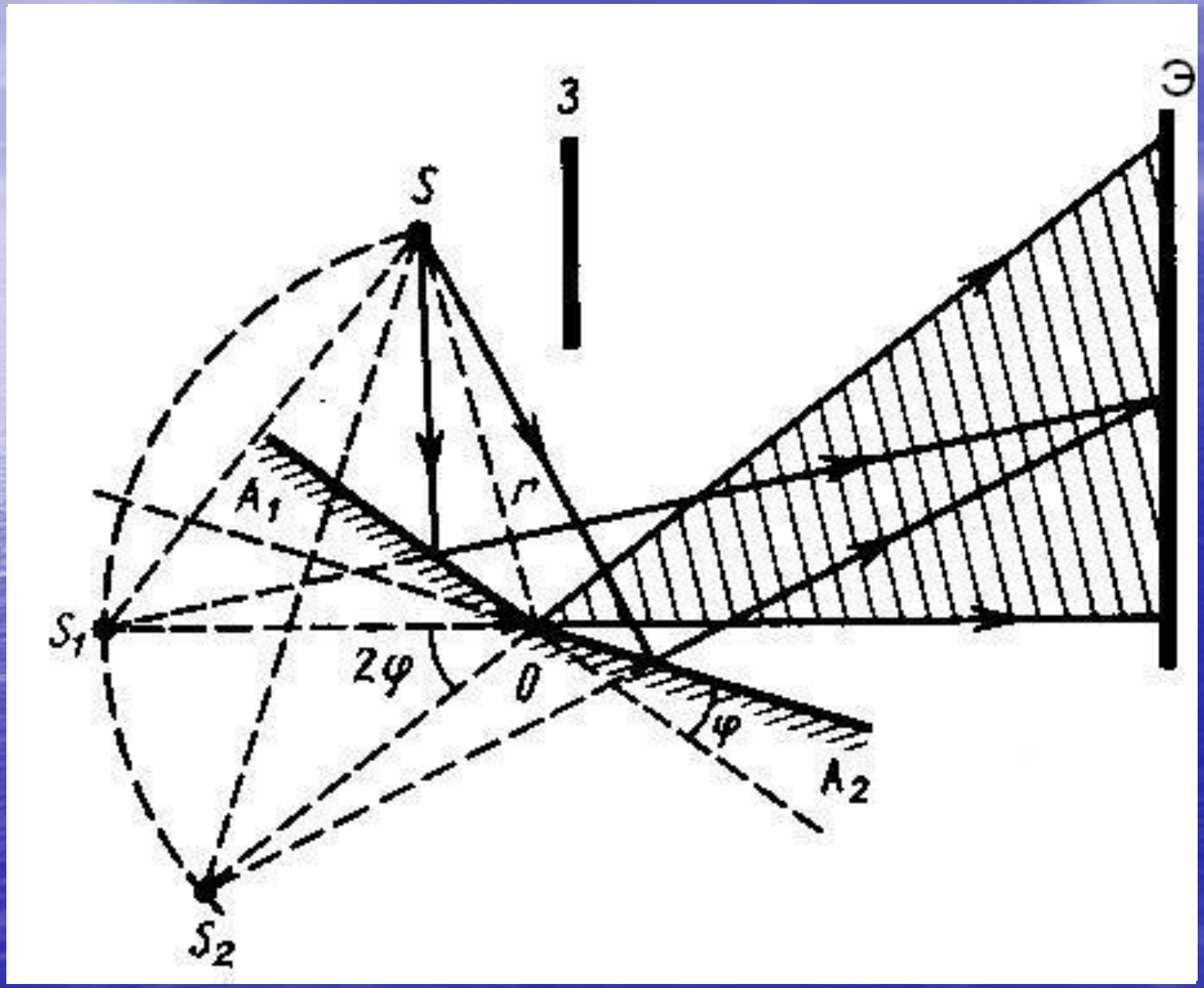
$$2.\Delta\varphi=(2k-1)\pi \quad (k=0,1,2,\ldots\ldots)$$

$$E_m=|E_{1m}-E_{2m}|$$

$$3.\ (2k-1)\pi<\Delta\varphi<2k\pi$$

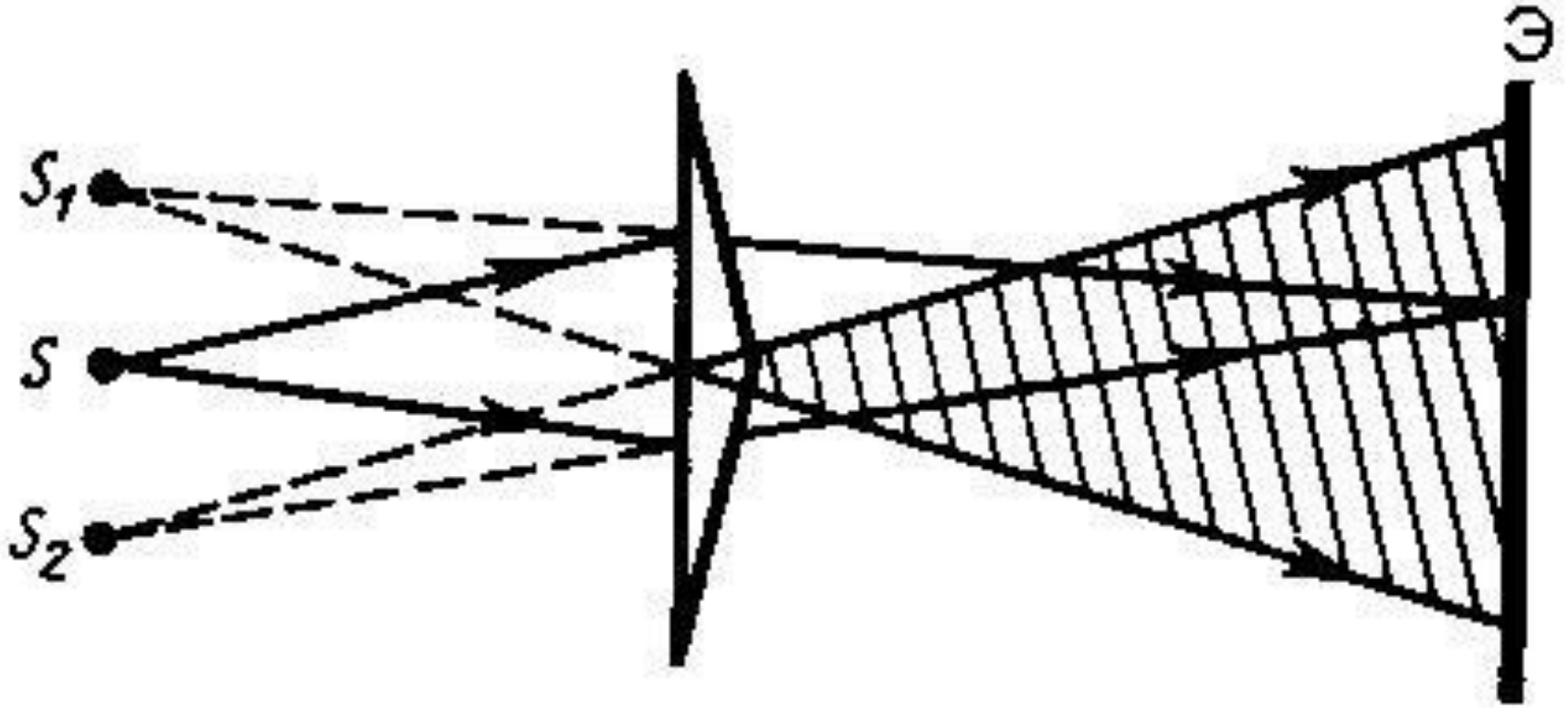
$$|E_{1m}-E_{2m}|<E_m<E_{1m}+E_{2m}$$

Kogerent manbalarni xosil qilish



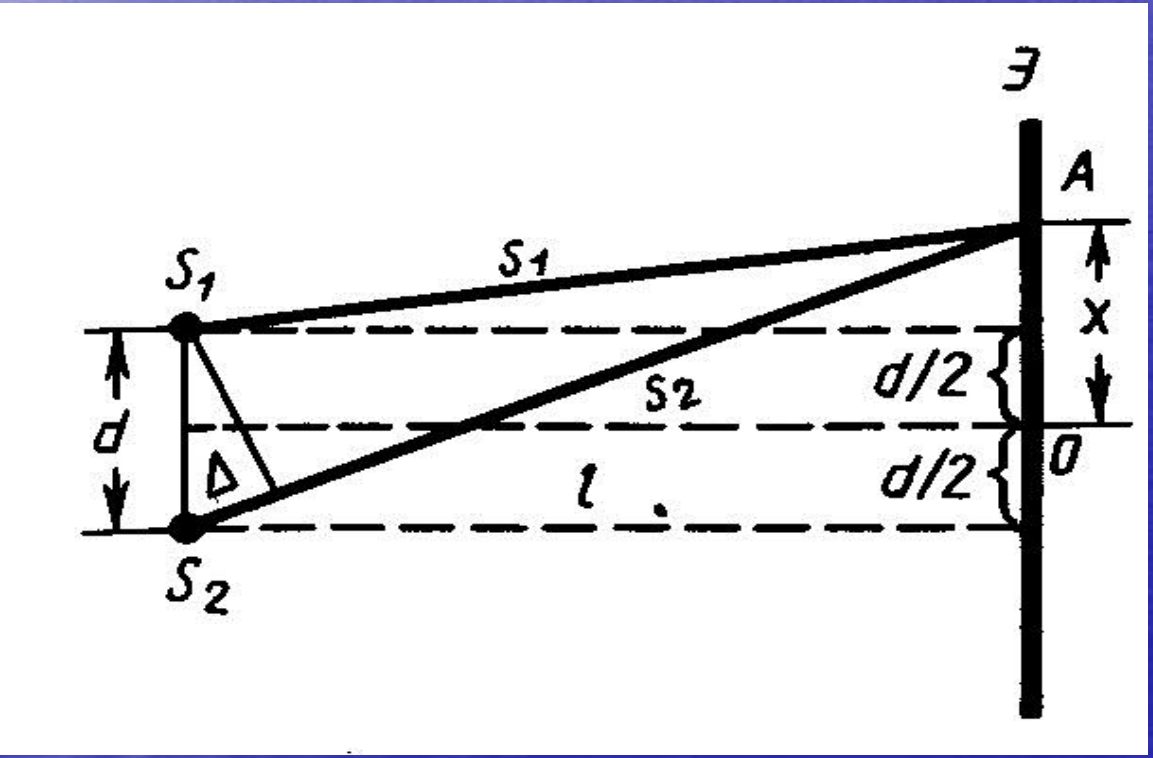
Kogerent manbalarni xosil qilish

$$s_2^2 - s_1^2 = 2xd,$$



Loyd oynasi

Interferension manzarani xisoblash



$$S_2^2 = S^2 + \left(x + \frac{d}{2} \right)^2,$$

$$S_1^2 = S^2 + \left(x - \frac{d}{2} \right)^2$$

$$S_2^2 - S_1^2 = 2xd, (S_2 - S_1)(S_2 + S_1) = 2xd$$

$$S_2 - S_1 = \delta$$

$$\delta = \frac{2xd}{S_2 + S_1} \approx \frac{2xd}{2l} = \frac{xd}{l}$$

$$\Delta_{max} = \pm 2k \frac{\lambda_0}{2},$$

$$k = 0,1,2,.....$$

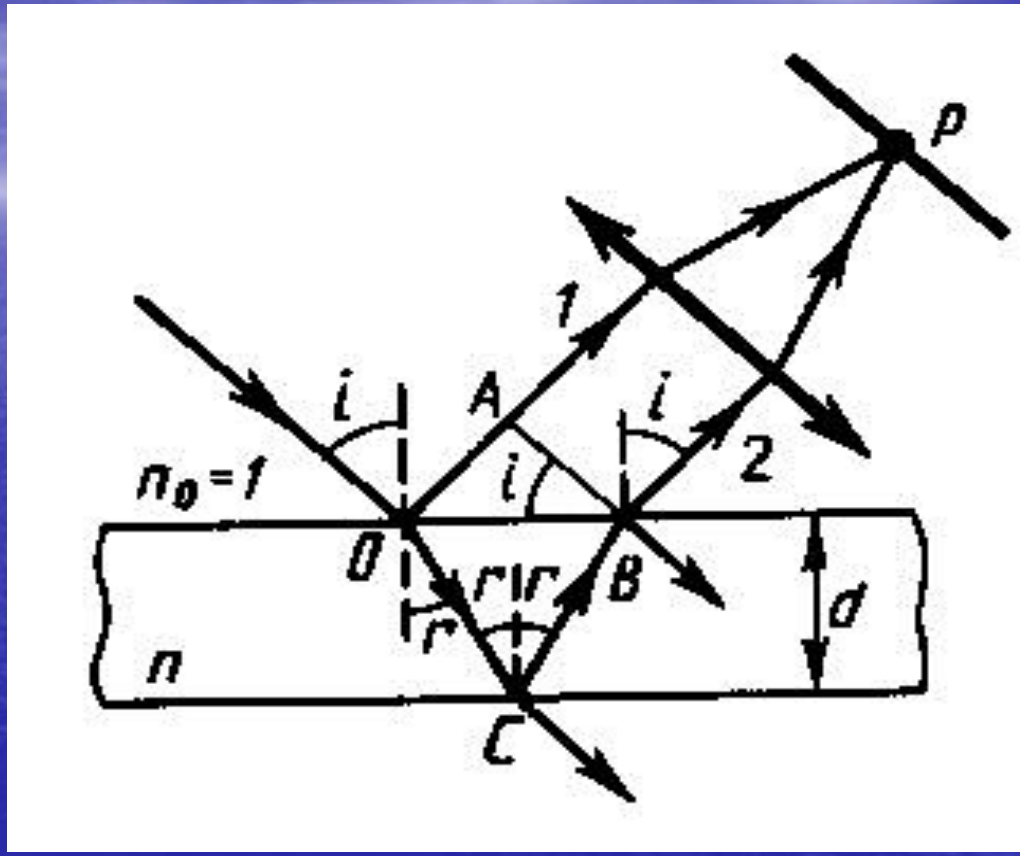
$$\Delta_{max} = \pm (2k+1) \frac{\lambda_0}{2},$$

$$k = 0,1,2,.....$$

Yupqa pardadagi interferensiya

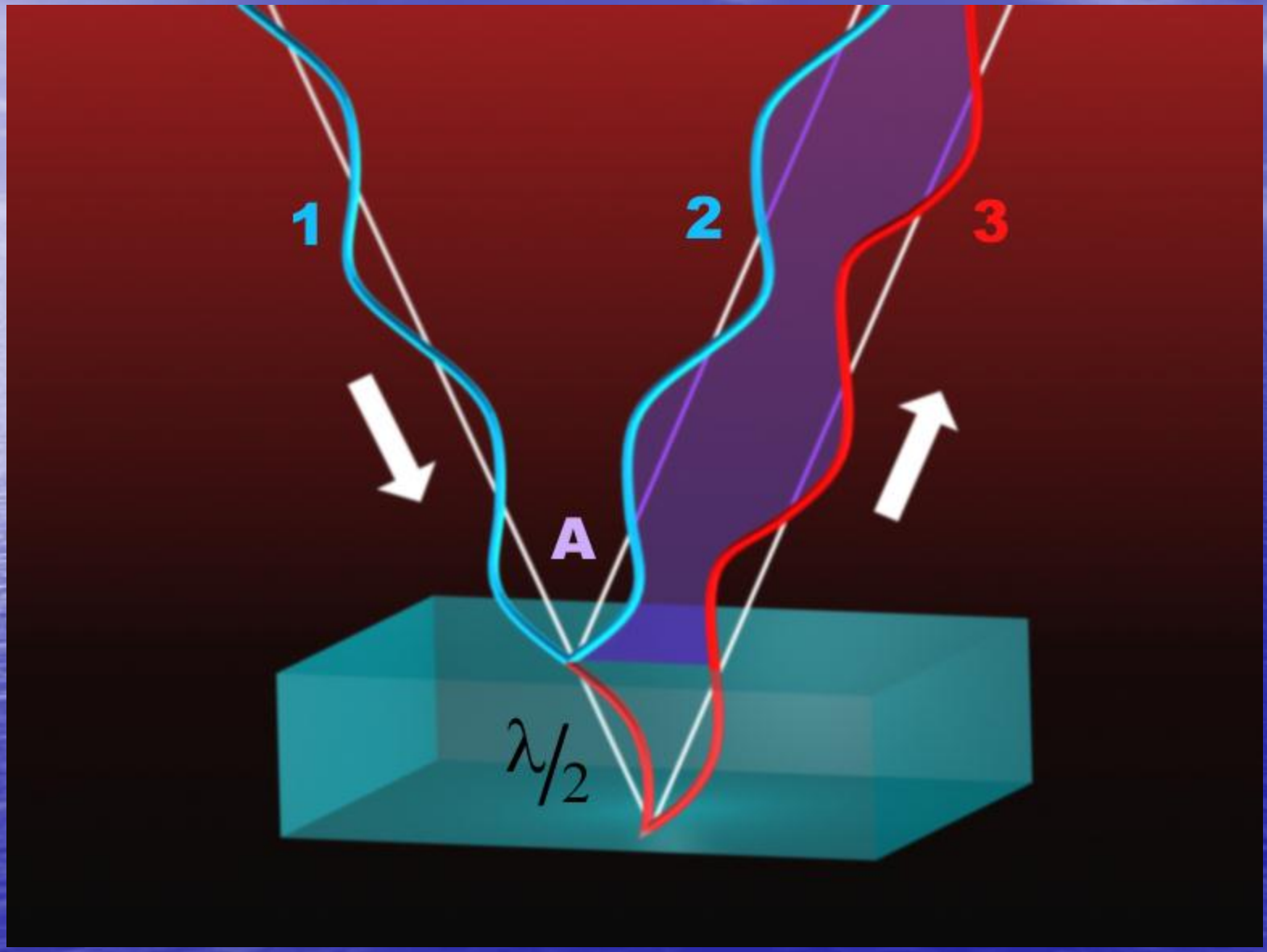
$$\Delta = (OC + BC)\cdot n - OA + \frac{\lambda_0}{2}$$

$$\Delta = 2d\sqrt{n^2 - \sin\iota} + \frac{\lambda_0}{2}$$

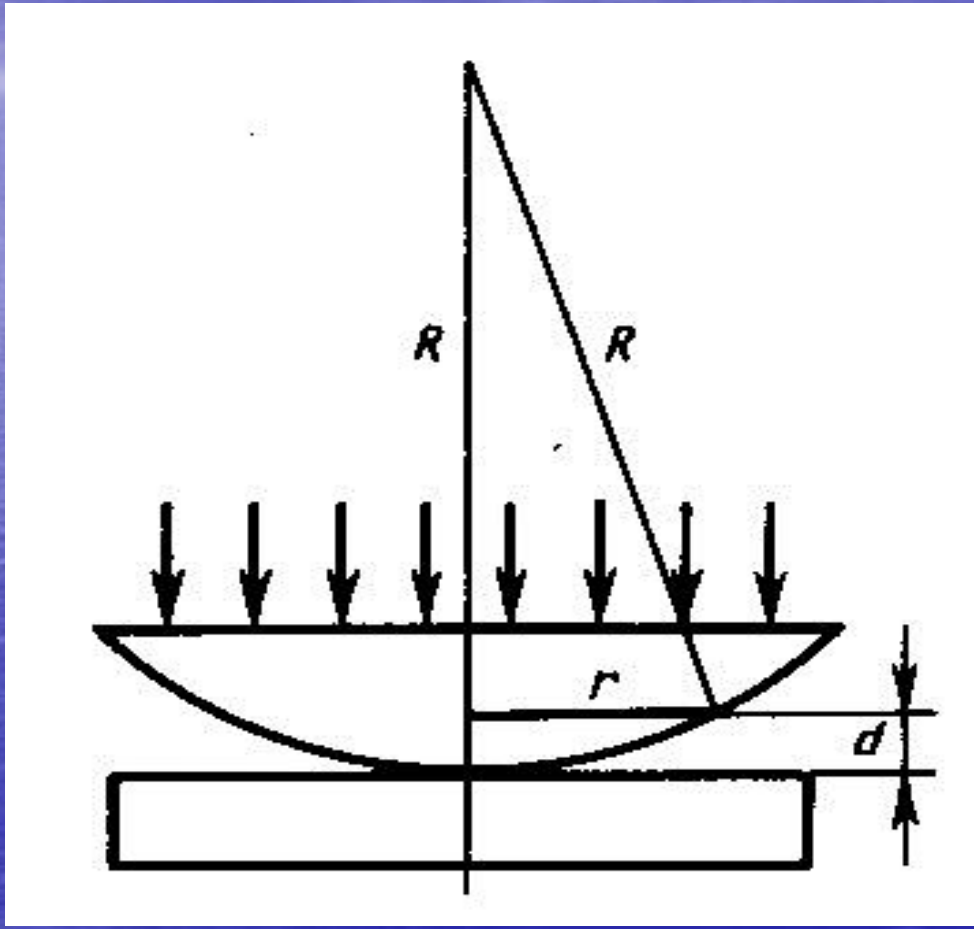


$$2d\sqrt{n^2 - \sin^2\iota} + \frac{\lambda_0}{2} = 2\kappa\frac{\lambda_0}{2}, (\kappa = 0,1,2,\ldots)$$

$$2d\sqrt{n^2 - \sin^2\iota} + \frac{\lambda_0}{2} = (2\kappa + 1)\frac{\lambda_0}{2}, (\kappa = 0,1,2,\ldots)$$


1
2
3
A
λ/2

Nyuton halqalarini kuzatish asbobi



$$\Delta = \frac{r_k^2}{R} + \frac{\lambda_0}{2} = 2k\frac{\lambda_0}{2}$$

$$\Delta = \frac{r_k^2}{R} + \frac{\lambda_0}{2} = (2k+1)\frac{\lambda_0}{2}$$

$$(r_k)_{макс} = \sqrt{(k-1/2)\lambda_0 R}$$

$$(r_k)_{min} = \sqrt{k\lambda_0 R}$$