§20. $x = A\cos(\omega t+\varphi)$

$\omega = \frac{2\pi}{T}$, $\nu = \frac{1}{T}$, $\omega = 2\pi\nu$.

$v = -\omega A\sin(\omega t+\varphi)$

$a = -\omega^2 A\cos(\omega t+\varphi) = -\omega^2 x$

$(\cos' = -\sin)$.

$\Delta\varphi = (2k\pi)$ $\Delta\varphi = (2k+1)\pi$

$F = ma = -kx \Rightarrow \omega = \sqrt{\frac{k}{m}}$ $T = 2\pi/\omega = 2\pi\sqrt{\frac{m}{k}}$

弹簧: $\omega = \sqrt{\frac{k}{m}}$, $T = 2\pi\sqrt{\frac{m}{T}}$

单摆: $\omega = \sqrt{\frac{g}{L}}$, $T = 2\pi\sqrt{\frac{L}{g}}$

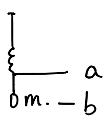
$E = E_k + E_p = \frac{1}{2}m\left(\frac{dx}{dt}\right)^2 + \frac{1}{2}kx^2 = \frac{1}{2}kA^2$

$\frac{\pi}{6}: 30°$

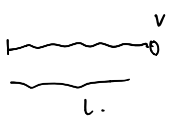
$\frac{\pi}{2}: 90°$ $\frac{\pi}{3}: 60°$

Eg. 20.2. (1) $\varphi_0 = \pi$ (2) $\varphi_0 = 0$ (3) $\frac{A}{2} = A\cos(\varphi)$, $\varphi_0 = 60°$

20.7. $\Delta\varphi = (2k+1)\pi$.

20.9. 

动力学: $\frac{d^2x}{dt^2} = -\omega^2 x$ $\omega = \sqrt{\frac{k}{m}}$

20.10. 

$\int_0^l \frac{1}{2}\frac{m'}{l}\left(\frac{x}{l}\cdot v\right)^2 dx = f(m')$.

$\frac{1}{2}\frac{m'}{l}\frac{v^2}{l^2}$ $\cancel{\frac{1}{3}x^3\Big|_0^l}$ $\frac{1}{3}l^3 = \sim$.

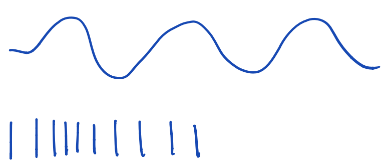
(2) $\omega = \sqrt{\frac{k}{m}} = \left(k/(m+\frac{m'}{3})\right)^{\frac{1}{2}}$

---

§21. $y = A\cos\omega\left(t \mp \frac{x}{u}\right) = A\cos(\omega t \mp kx)$.

$T = 2\pi/\omega$ $\nu = 1/T$

$u = \lambda/T$ $k = 2\pi/\lambda$. (波数).



横

纵

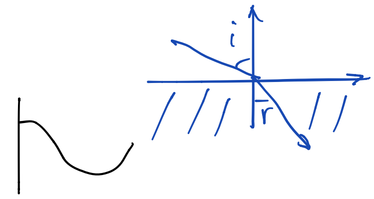
横波: $u = \sqrt{G/\rho}$ $u = \sqrt{K/\rho}$

纵波: $u = \sqrt{E/\rho}$ $u = \sqrt{F/\rho_l}$ (线)

: $\frac{F}{S} = E\frac{\Delta L}{L}$ $\frac{F}{S} = G\frac{\Delta d}{D}$

$\Delta p = -k\frac{\Delta V}{V}$

$\bar{w} = \frac{1}{2}\rho w^2 A^2$ $\quad I = \bar{w}u = \frac{1}{2}\rho w^2 A^2 u$ (波强) $\quad$ $\boxed{折射}$ $\quad n_{21} = \frac{\sin i}{\sin r} = \frac{u_1}{u_2}$



? 驻波. $\quad y = 2A\cos\frac{2\pi}{\lambda}x \cos wt$

Ee.21. $\quad$ 21.2. $\quad u = 0.8 \quad A = 0.05 \quad w = \pi 4 \quad (4t - 1 + \frac{\pi}{2})$

$y = A\cos w(t - \frac{x}{u}) = 0.05 \cos(1 - 4t \mp \frac{\pi}{2})$ (负向). $\quad \frac{\frac{\pi}{2} - 1}{4} = -\frac{x}{u}$

? 21.3. $\quad \cancel{2\times10^{-2}\cos 2\pi(200t - 2.0(x - \frac{\pi}{2}))}$

$\cancel{-2x + \pi}$

21.5. $\quad 0.04\cos\frac{2\pi}{5}(t - \frac{x}{0.08} + \frac{\pi}{2})$

$w = 2\pi/T = 2\pi/5$

$T = \frac{0.4}{u} = \frac{0.4}{0.08} = 5$

21.13. (1). $\quad y = 2A\cos\frac{2\pi}{\lambda}x \cos wt$

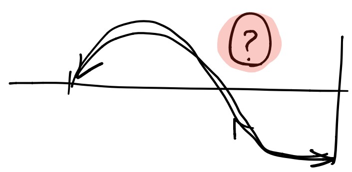
$w = 750, \quad A = 0.01, \quad \frac{2\pi}{\lambda} = 20 \Rightarrow \lambda = \frac{\pi}{10}$

波节: λ, 代入, $\frac{dy}{dt} = -2wA\cos\frac{2\pi}{\lambda}x \cdot \sin wt$

21.14. (1). $\cancel{A\cos(2\pi\nu t + \frac{\pi}{2})}$ $\quad A\cdot\cos(2\pi\nu t + 2\pi\nu\frac{x}{u} - \frac{\pi}{2})$

(2). $\cancel{A\cos(2\pi\nu t + \frac{\pi}{2})}$. $\quad \frac{\lambda}{2}$.

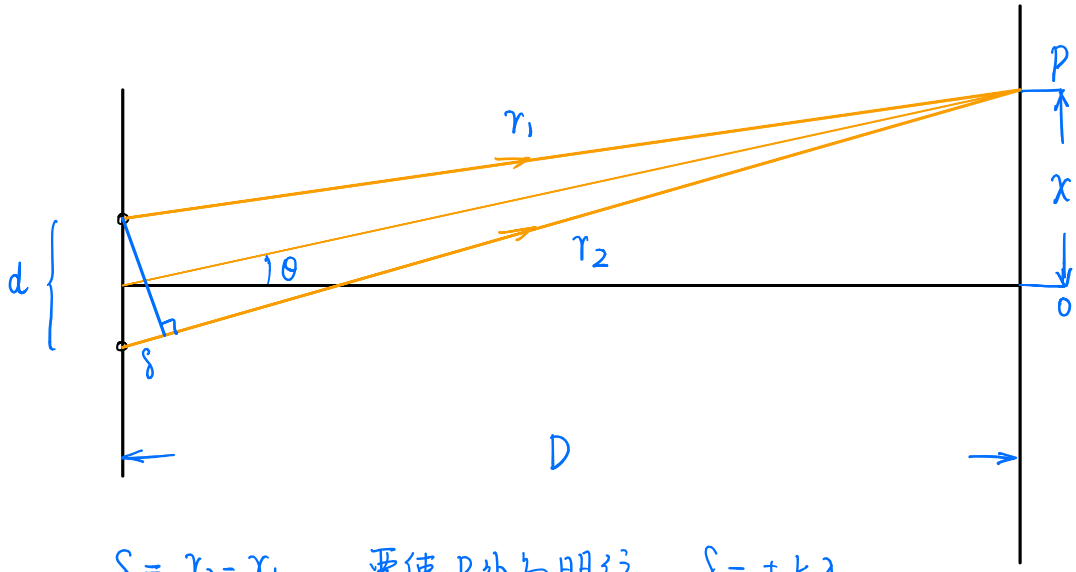
$A\cos(2\pi\nu t + 2\pi\nu\frac{x}{u} - \frac{\pi}{2})$ $\quad$?



Summary. 驻波公式. 形成

§22. $\lambda' = \frac{\lambda}{n}$, λ：真空波长.

光程. nr , r 路程. (折合到真空).



$x = k\frac{D}{d}\lambda.$

(D很大)

$\frac{x}{D} = \tan\theta \approx \sin\theta = \frac{\delta}{d}$

$\Rightarrow x = \delta \cdot \frac{D}{d}$

$\delta = r_2 - r_1$ 要使P处为明纹. $\delta = \pm k\lambda$

(即 δ 相差 λ 个整倍)

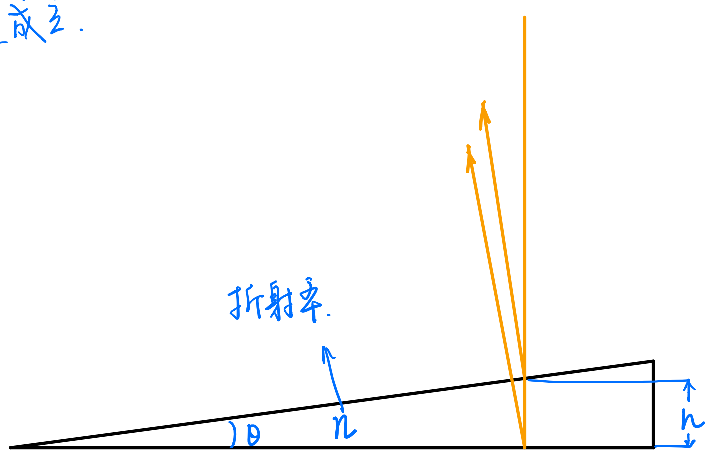
暗纹：$\delta = \pm(2k-1)\frac{\lambda}{2}$ $(k = 1, 2 \cdots)$

(即 δ 相差半个整倍)

$\Delta\varphi = 2\pi\frac{\delta}{\lambda} = \pm 2k\pi$ (明) $= \pm(2k-1)\pi$ (暗)

☆ $\Delta\varphi = \frac{2\pi}{\lambda}\delta$ 光程差 , $\delta = n_1 r_1 - n_2 r_2$.

恒成立.



$\delta = 2nh + \frac{\lambda}{2}$

附加光程差

上表面反射的半波损失.

☆(认为其光走了半个波长).

$2n\Delta h = \lambda$

$\boxed{\sin\theta \approx \theta}$

$\Rightarrow \Delta h = \frac{\lambda}{2n}$. $\Rightarrow L = \boxed{\frac{\lambda}{2n\theta}}$

条纹间距 △

别忘了还有AD段

$N = \frac{\Delta H}{\Delta h}$ 条纹数目 △

$\delta h = \frac{\lambda}{2}$

等倾: Page.198.

$\delta = n(AB+BC) - AD + \frac{\lambda}{2}$

$= 2nh\cos\gamma + \frac{\lambda}{2}$ 直接背 不如推.

$= 2h\sqrt{n^2 - \sin^2 i} + \frac{\lambda}{2}$ γ是反射角, n为折射率

☆ $2n_2 e\cos\gamma$ / $2e\sqrt{n_2^2 - n_1^2\sin^2 i}$ 一般形式

$\Delta e = e_2 - e_1 = \frac{\lambda}{2n}$

Δ (中心处): $\delta = 2ne + \frac{\lambda}{2}$

$e\uparrow$

4246

Eg. 22.2.

0.6 $\times 10^{-3}$

2.5

$\Delta x = 2.27\times 10^{-3}\,m = \lambda\frac{D}{d} \Rightarrow \lambda = \sim.$

22.14.

$\lambda = 589.3\times 10^{-9}\,m$

$L = \frac{\lambda}{2n\theta}$

平移距离 条纹移动条数

$\uparrow$ $\uparrow$

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

☆ ~~Mic~~ 麦克耳孙干涉仪.

$\boxed{\Delta L = \frac{N\lambda}{2}}$ what.

$\delta = n_2 e = 1.2\times 460\times 10^{-3} = k\lambda$ 在亮斑处才看的清

$\Delta\varphi = \frac{2\pi}{\lambda}\delta = \boxed{\frac{2\pi}{\lambda}}\cdot 2n_2 e$

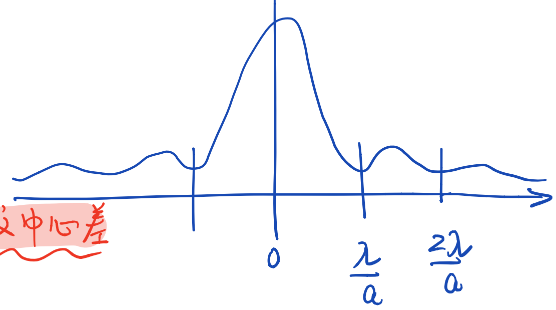
$\Delta\delta = 2(n-1)e. = \Delta m\lambda$ ✓
7

$\delta = 2\Delta h = m\lambda$

$\Delta\delta = (n-1)h = 4\lambda$

§23. 暗: $a\sin\theta = \pm k\lambda$

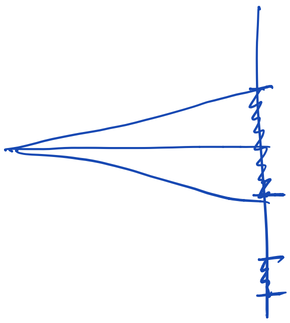
明: $a\sin\theta = \pm(2k+1)\frac{\lambda}{2}$.



角位置?

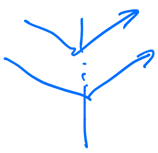
$f\frac{\lambda}{a}$

☆注意是指的2暗纹中心差



明 $\begin{cases} (\Delta x_0 = 2f\frac{\lambda}{a}) \\ (\Delta\theta_0 = 2\frac{\lambda}{a}) \end{cases}$

明 $\begin{cases} \Delta x = f\Delta\theta \\ \Delta\theta = \frac{\lambda}{a}. \end{cases}$



$\delta = a\sin\theta + a\sin\varphi$.

角宽度??

(1) $a\sin\theta = \lambda \Rightarrow a = \sim$

(2) $\Delta\theta_0 = 2\frac{\lambda}{a} = \sim$

$\Delta x_0 = 2f\frac{\lambda}{a} = \sim$

$\Delta x = f\frac{\lambda}{a} = \frac{1}{2}\Delta x_0 = 1$

(3). $a\,\cancel{\sin\theta}^{\,\frac{x}{f}} = (2k+1)\frac{\lambda}{2}$

$k = \sim$.

爱里斑 (半径): $\theta = \sin\theta = 1.22\frac{\lambda}{D}$

最小判别角: $\delta\theta = 1.22\frac{\lambda}{D}$ (角分辨率).

瑞利判断. 0.8

$R = \frac{1}{\delta\theta}$ (分辨本领)

eg. (1). $\delta\theta = 1.22\frac{\lambda}{D} = 1.22 \times \frac{550\times10^{-9}}{3\times10^{-3}}$

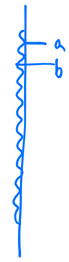
(2).

$\boxed{\theta \approx \frac{10^{-2}}{L}} \Rightarrow L \leq \frac{10^{-2}}{\delta\theta}$

(1). $\delta\theta = 1.22\frac{\lambda}{D} = 1.22 \times \frac{550\times10^{-9}}{5\times10^{-3}}$

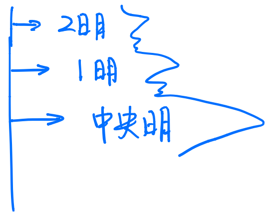
$L \leq \frac{120\times10^{-2}\,m}{\delta\theta} = \cdots$

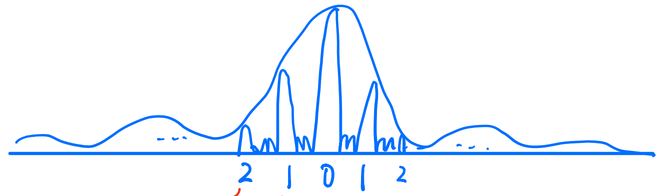
光栅. $d=a+b$.



单缝衍射

多缝干涉.





$\delta = d\sin\theta = \pm k\lambda$ 　 d是2缝间距

明纹中心 △ 主极大明纹

$\Delta\varphi = \frac{2\pi}{\lambda}\delta = \pm 2k\pi$

$I = N^2 I_{单}$ (主极大光强)

N是缝数

相邻明纹: $\begin{cases} \Delta\theta = \frac{\lambda}{d} \\ \Delta x = f\frac{\lambda}{d} \end{cases}$ 　 $\theta_k = \frac{k\lambda}{d}$ 　 $x_k = f\frac{\lambda k}{d}$

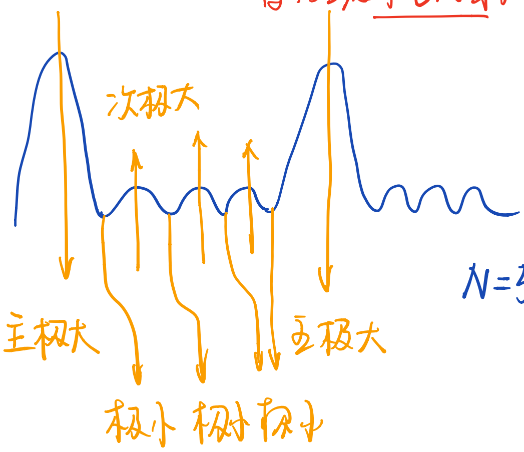
$\boxed{多光干涉}$

暂不考虑单光衍射

暗纹: $\delta = Nd\sin\theta = \pm m\lambda$.

$\begin{cases} \Delta\theta = \frac{\lambda}{Nd} \\ \Delta x = f\frac{\lambda}{Nd} \end{cases}$? 　 $\theta_m = \frac{m\lambda}{Nd}$ 　 $x_m = f\frac{m\lambda}{Nd}$

☆



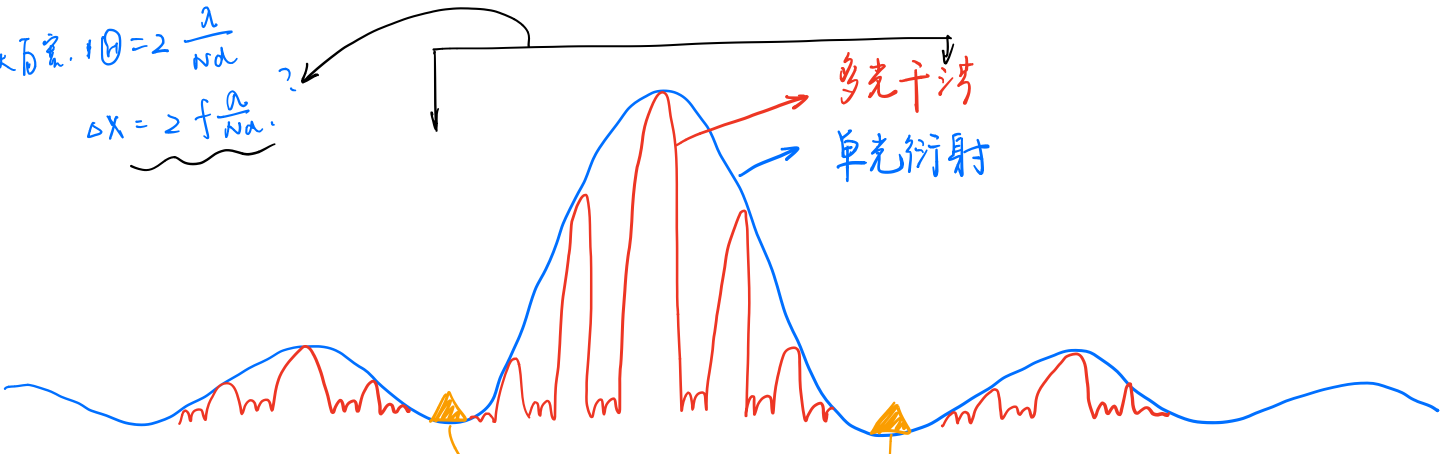
N=5缝干涉.

N缝干涉, 2个主极大间

有 N-2个次极大, N-1个极小

主极大宽度. $\Delta\theta = 2\frac{\lambda}{Nd}$

$\Delta x = 2f\frac{\lambda}{Nd}$. ?



$\delta = d\sin\theta = k\lambda$

$= k'\lambda$ (单衍)

$k = \pm\frac{d}{a}k'$ (k'为单缝衍射暗纹)

eg.: $k = \pm \frac{d}{a} k' = 7 \Rightarrow d = 7a$

(1). $N=5$. (2). $d\sin\theta = \lambda \Rightarrow d = \frac{\lambda}{\sin\theta}$ 横轴就是角位置.

(3). $3 = \frac{d}{a} 1 \Rightarrow \boxed{d} = 3a$

?

(4) $\cancel{d\sin\theta = k\lambda \quad k=1,2,4,5,7}$ $\theta = \pm\frac{\pi}{2}$ 条纹最高级次出现在 $\theta=\pm\frac{\pi}{2}$ 处

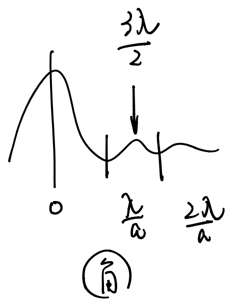
$d = k\lambda \quad k = \frac{d}{\lambda} = 10$

(1). $\cancel{4 = \frac{d}{a} \Rightarrow d = 4a}$ $d\sin\theta_2 = 2\lambda \Rightarrow d = \frac{2\lambda}{\sin\theta_2} = 6\mu m$.

(2) $4 = \frac{d}{a} \Rightarrow a = \frac{d}{4} = 1.5\mu m$.

(3). $\theta = \pm\frac{\pi}{2}$ 处 $d = \pm k\lambda \Rightarrow k = \frac{d}{\lambda} = 10$. $\underline{\underline{2(k-1)+1 = 19}}$

(1). $\Delta x =$



$a\sin\theta = (2k+1)\frac{\lambda}{2}$
$= 3\lambda$

$x \approx f\sin\theta = (2k+1)\frac{\lambda}{2a}f$

$\frac{\lambda}{a}$

(2). $d\sin\theta = k\lambda$. $x_1 = f\frac{\lambda}{d}$

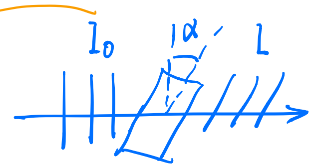
故 $\underline{\underline{x = \pm\frac{k\lambda}{d}f}}$

§24. 光的偏振.

- 完全偏振光
  - 线 → 平面偏振光
  - 椭圆
  
- 非~（自然）
- 部分偏振光 （有主优方向）

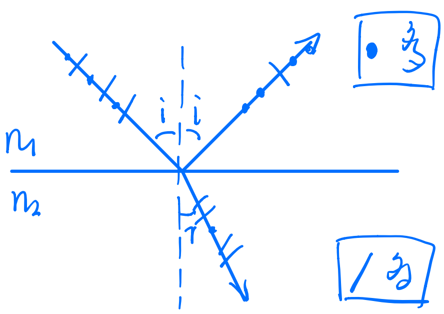
物质的二向色性 → 起偏器.

马吕斯定律： $I = I_0 \cos^2\alpha$



eg. $\frac{1}{2}I_1 \cdot \cos^2\frac{\pi}{6} = \frac{1}{2}I_0 \cdot \cos^2\frac{\pi}{3} = \frac{1}{3}$ $\cos 30^\circ = \frac{\sqrt{3}}{2}$ $\sin 30^\circ = \frac{1}{2}$

24.3.



$\tan i_b = \frac{n_2}{n_1}$ 时 反射光为完全偏振.

此时反射光与折射垂直

$i_b + \gamma = 90^\circ$