

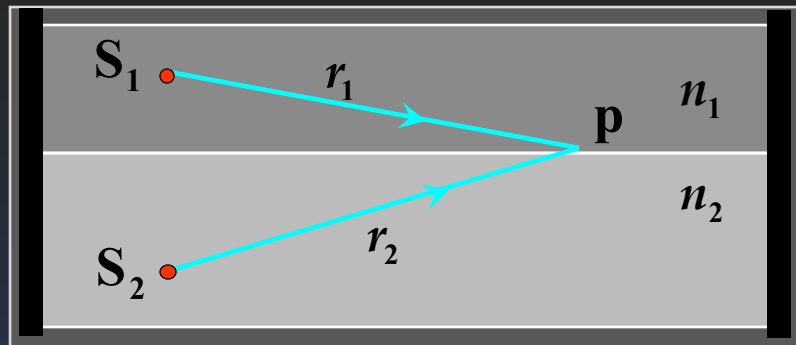
The background features a 3D optical diagram on a dark blue gradient. In the top-left corner, a small light source emits a beam of light. This beam passes through a transparent, rectangular prism. After exiting the prism, the beam is deflected and passes through a circular aperture. The light emerging from the aperture is depicted as a broad, multi-colored cone, with a spectrum of colors (red, orange, yellow, green, blue, and purple) visible, suggesting dispersion or a spectral analysis. The overall scene is set against a dark blue background with subtle geometric shapes.

光学总结

一、干涉

光程: $L = nr$

光程差 $\delta = n_2 r_2 - n_1 r_1$



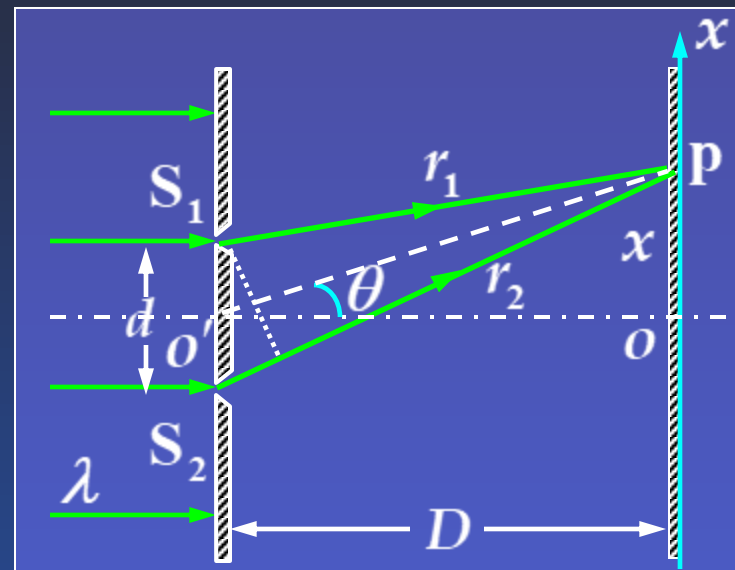
1. 杨氏双缝干涉

波长 λ , 缝距 d , 屏距 D

偏角 θ 与光程差的关系:

$$\delta = d \sin \theta = \begin{cases} \pm 2k \frac{\lambda}{2} & \text{明纹} \\ \pm (2k+1) \frac{\lambda}{2} & \text{暗纹} \end{cases}$$

$$\tan \theta = \frac{x}{D}$$



$$\text{当 } \theta < 5^\circ \text{ 时, } \sin \theta \sim \theta \sim \tan \theta \quad \delta = d \frac{x}{D} = \begin{cases} \pm 2k \frac{\lambda}{2} & \text{明纹} \\ \pm (2k+1) \frac{\lambda}{2} & \text{暗纹} \end{cases}$$

2. 薄膜干涉

☆ 2、3两束光线的光程差：

$$\delta = 2n_2 e \cos \gamma + \frac{\lambda^*}{2}$$

$$\delta = 2e \sqrt{n_2^2 - n_1^2 \cdot \sin^2 i} + \frac{\lambda}{2}$$

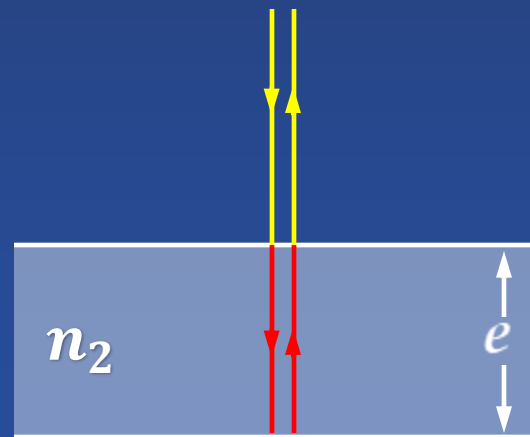
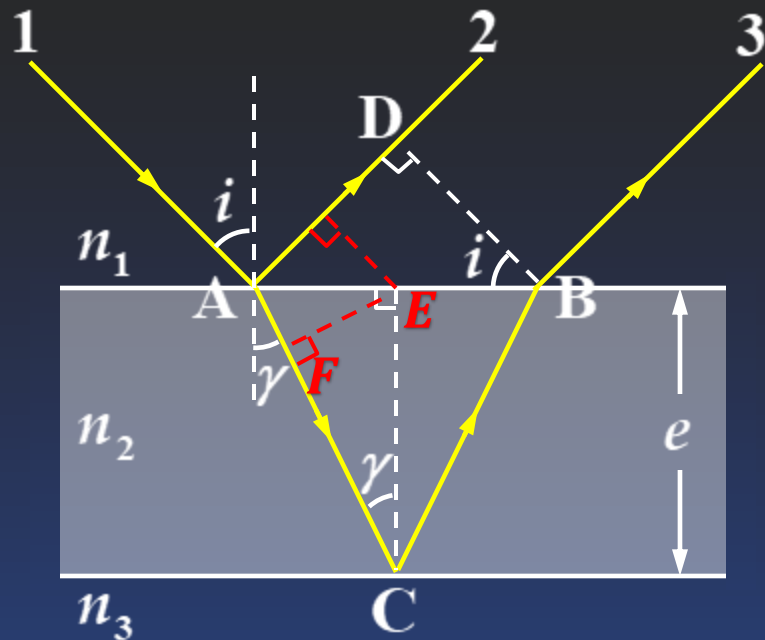
☆ 增透、增反问题

增透膜：使反射光干涉相消！

增反膜：使反射光干涉相长！

3. 等厚干涉

$$\delta = 2n_2 e + \frac{\lambda^*}{2} = \begin{cases} \pm 2k \frac{\lambda}{2} & \text{明} \\ \pm (2k+1) \frac{\lambda}{2} & \text{暗} \end{cases}$$



4. 劈尖

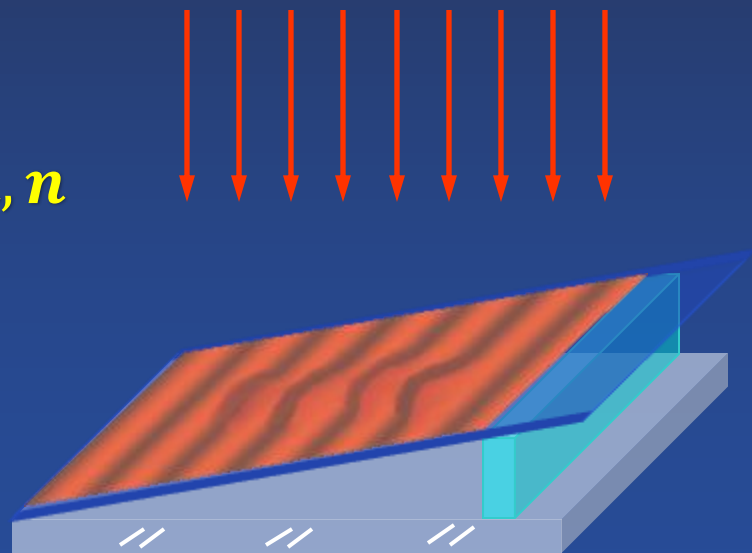
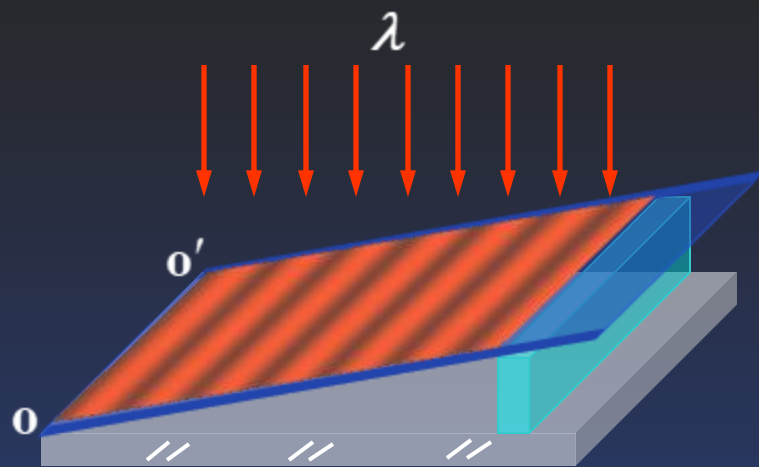
$$\delta = 2ne + \frac{\lambda^*}{2} = \begin{cases} \pm 2k \frac{\lambda}{2} & \text{明} \\ \pm (2k + 1) \frac{\lambda}{2} & \text{暗} \end{cases}$$

关键：空气厚度 e 与距离 x 的关系

$$\theta = \frac{e}{x}$$

☆ 工件凹凸与移动问题

☆ 劈尖中物理量的计算： $x, \theta, e, k, \lambda, n$

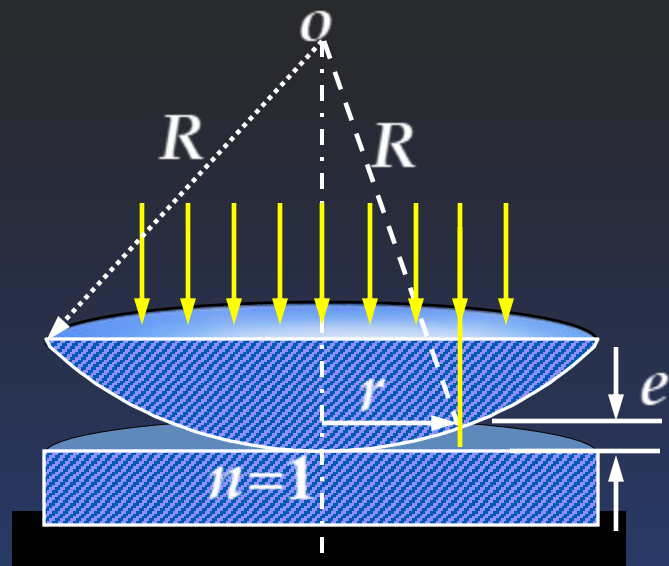


5. 牛顿环

$$\delta = 2ne + \frac{\lambda^*}{2} = \begin{cases} \pm 2k \frac{\lambda}{2} & \text{明} \\ \pm (2k+1) \frac{\lambda}{2} & \text{暗} \end{cases}$$

关键：空气厚度 e 与条纹半径 r 的关系

$$r^2 = 2Re$$



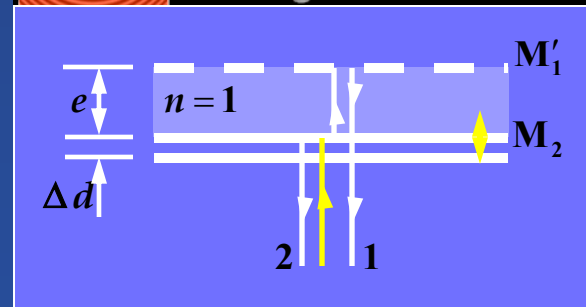
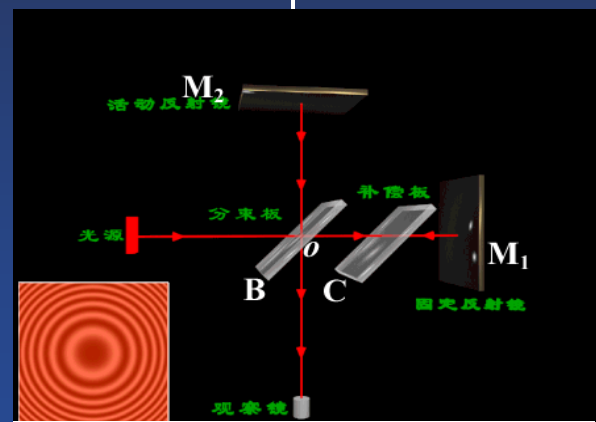
☆ 条纹移动问题

☆ 劈尖中物理量的计算： r, R, e, k, λ, n

6. 等倾干涉与迈克尔逊干涉仪

☆ 条纹移动问题

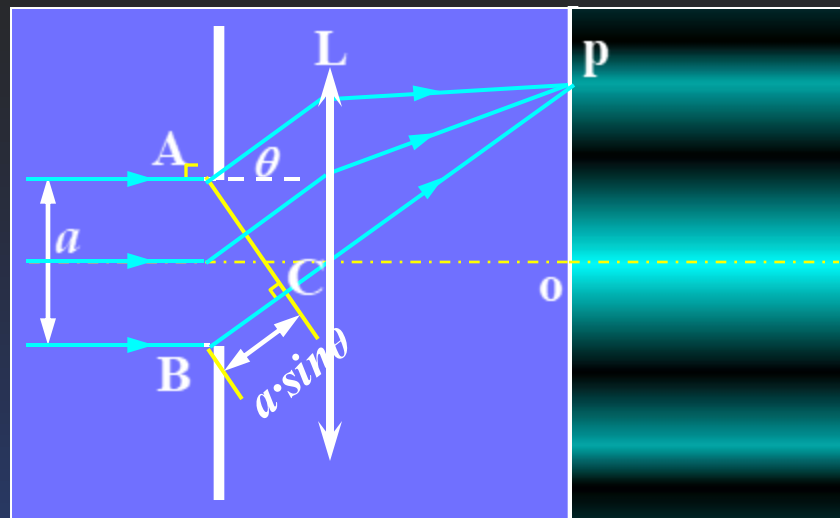
☆ 中央条纹的光程差最大，级次最高



二、衍射

1. 夫琅禾费单缝衍射

- 屏的中央是一条明纹:宽、亮。
- 衍射 θ 处的最大光程差:
 $a \sin\theta$ 进行半波带分割。



$$\theta \neq 0^\circ : a \cdot \sin\theta = \begin{cases} \pm 2k \frac{\lambda}{2} & \text{暗纹} \\ \pm (2k + 1) \frac{\lambda}{2} & \text{明纹} \end{cases} \quad (k = 1, 2, 3, \dots)$$

$$\tan\theta = \frac{x}{f}$$

☆ 衍射相关物理量的计算: $a, k, \lambda, \theta, x, f$

2. 圆孔衍射

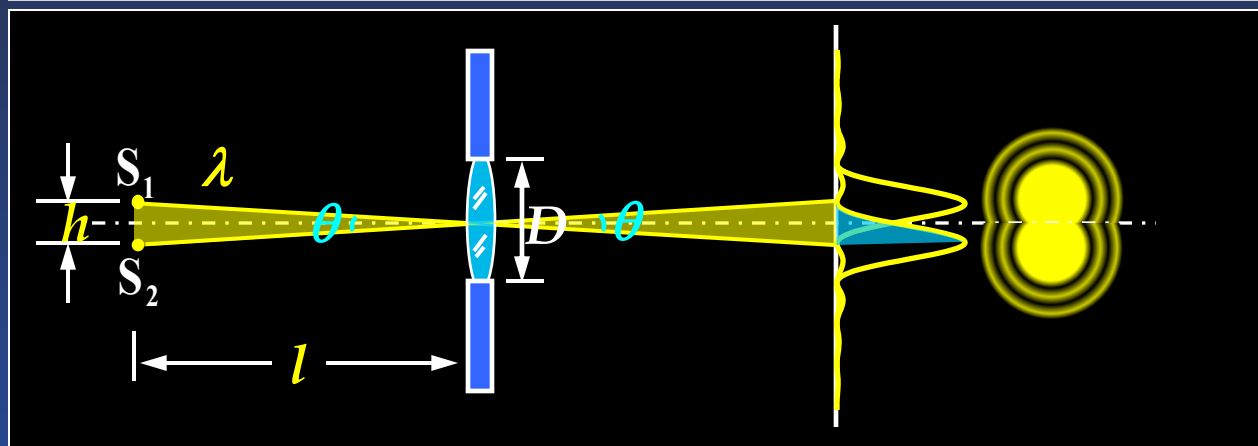
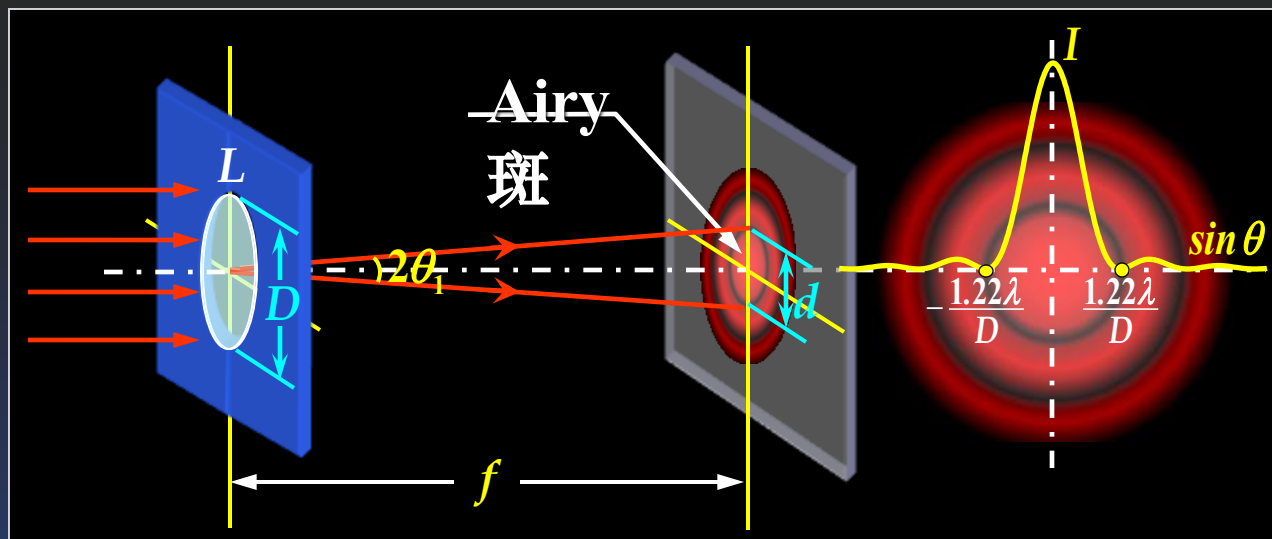
➤ 半角宽度:

$$\theta_1 = \frac{1.22\lambda}{D}$$

➤ 最小分辨角:

$$\theta_c = \frac{1.22\lambda}{D}$$

可分辨: $\theta \geq \theta_c$



➤ 被观测物体的尺寸 h , 物体到透镜的距离 L , 物体的张角 θ

$$h = L\theta_c$$

3. 光栅衍射

光栅常数: $d = a + b$

(1) 不考虑缝宽 a ($a < \lambda$):

$$d \cdot \sin \theta = \pm k \lambda \quad \text{光栅方程}$$

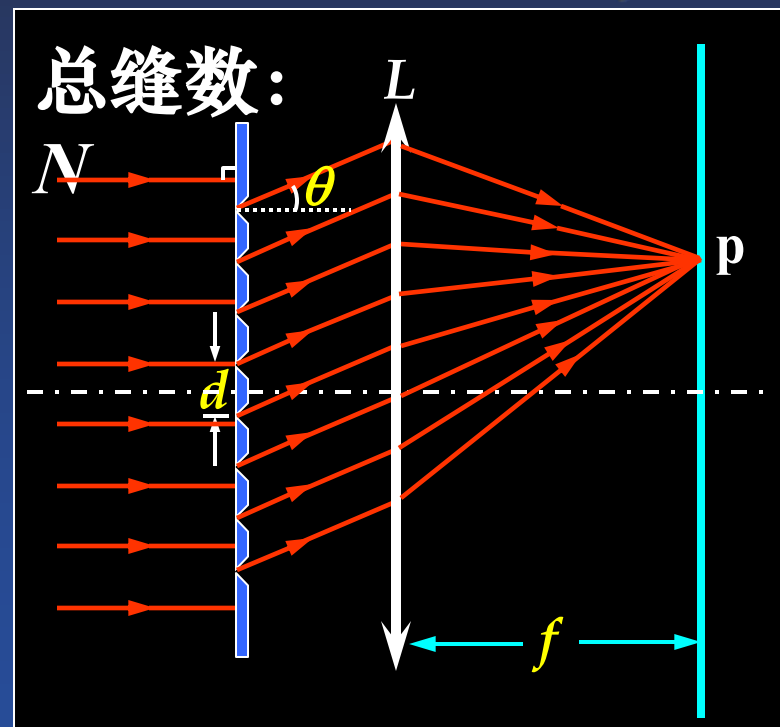
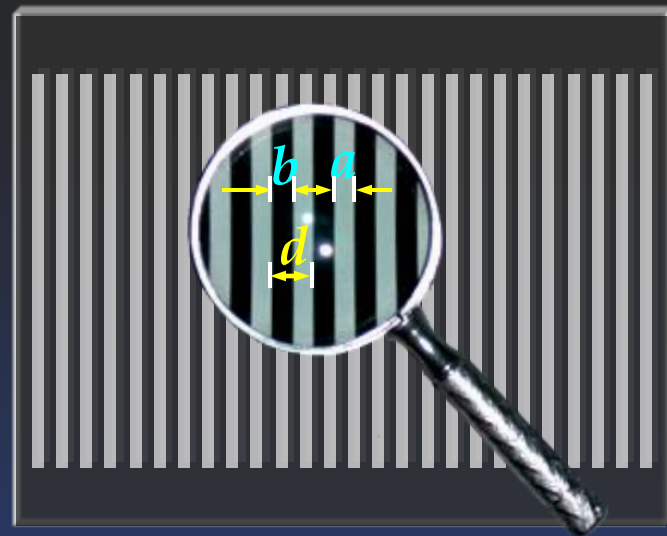
$$d \cdot \sin \theta = \pm \frac{m}{N} \lambda \quad \text{暗纹}$$

$$m = 1, 2, \dots, N-1, N+1, \dots$$

(2) 考虑缝宽 a :

$$\text{缺级: } \begin{cases} d \cdot \sin \theta = \pm k \lambda \\ a \cdot \sin \theta = \pm 2k' \cdot \frac{\lambda}{2} \end{cases}$$

☆ 中央明纹带内的条纹数目与条纹总数的计算。



三、光的偏振现象

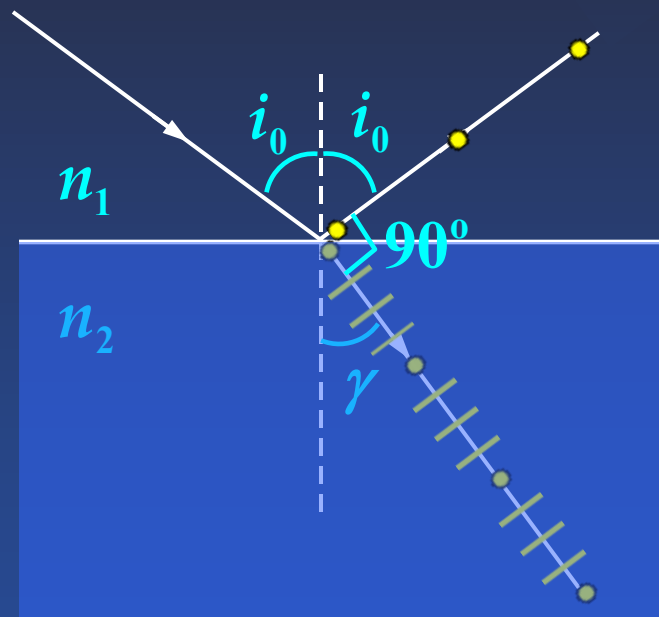
1. 马吕斯定律

$$I_2 = I_1 \cdot \cos^2 \alpha$$

2. 反射、折射光的偏振

$$\tan i_0 = \frac{n_2}{n_1}$$

(布儒斯特定律)



3. 双折射光的偏振