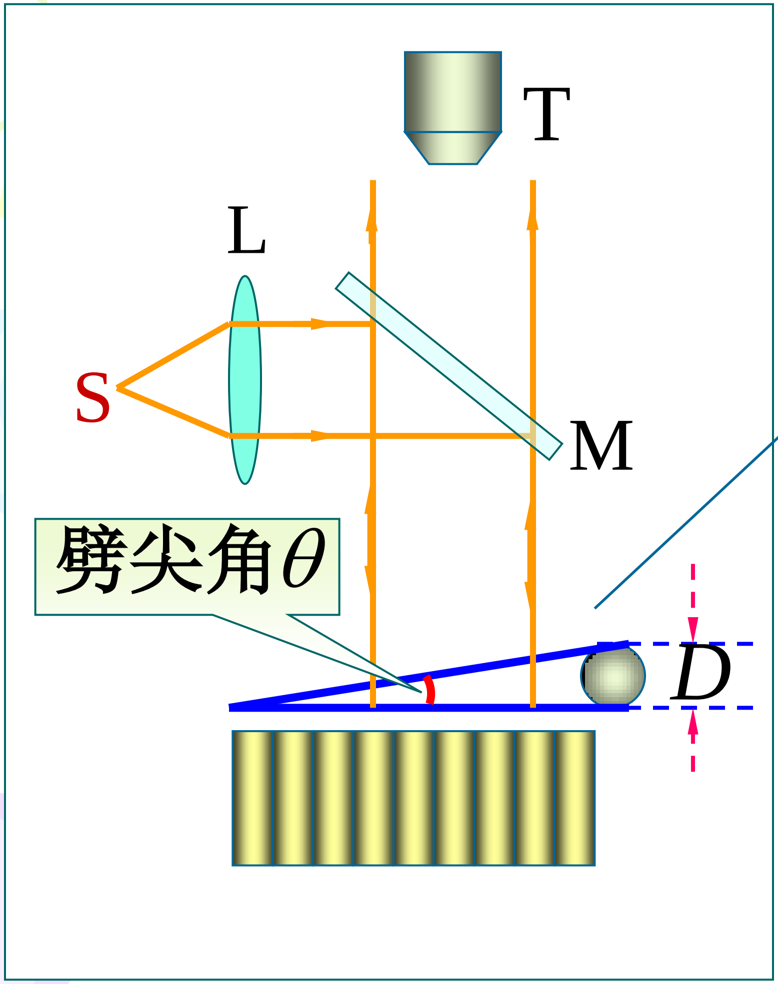
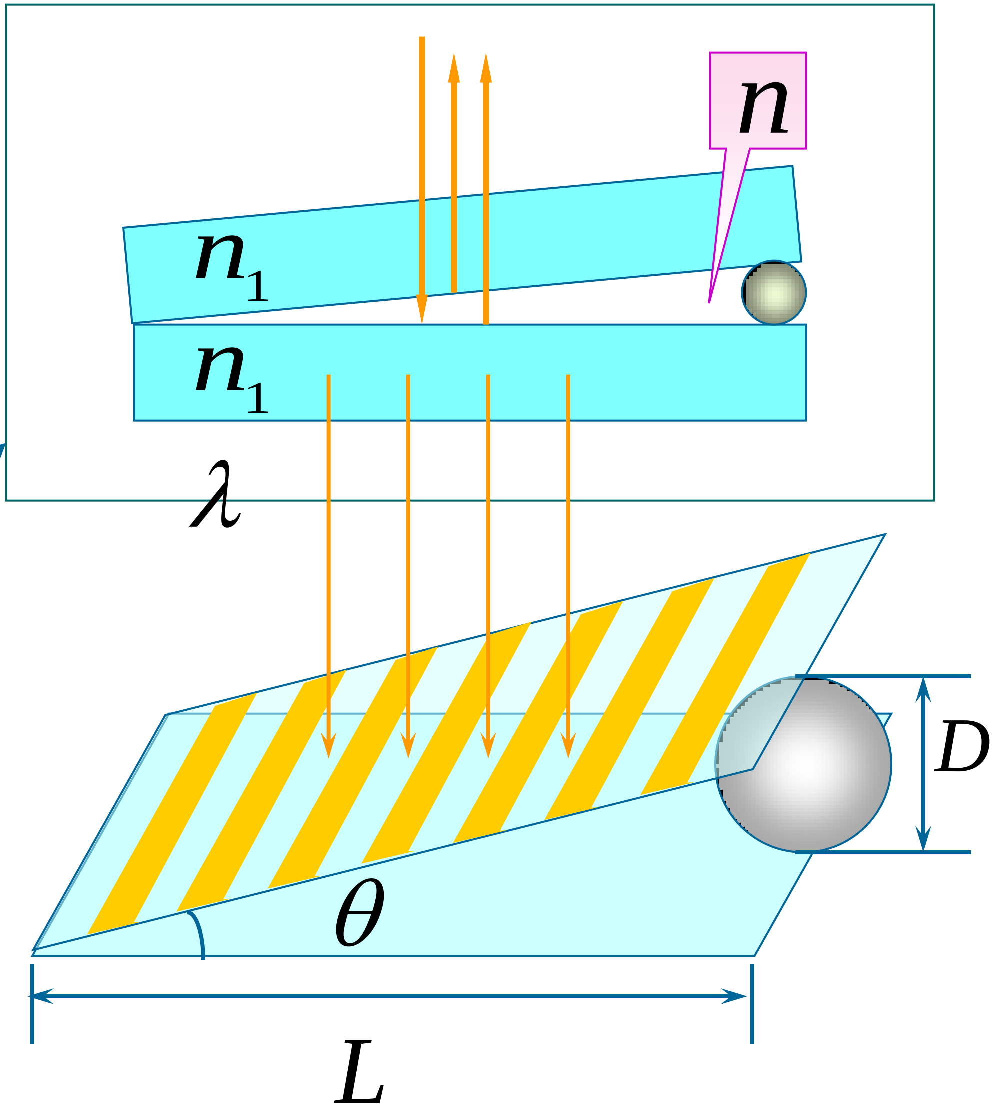
薄膜干涉的应用

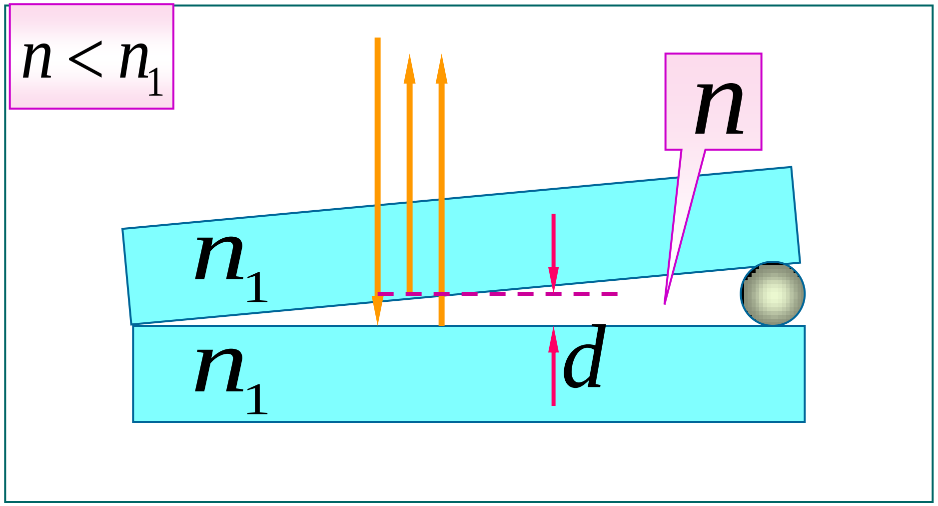
劈尖





薄膜干涉的应用

劈尖的干涉条件的计算：

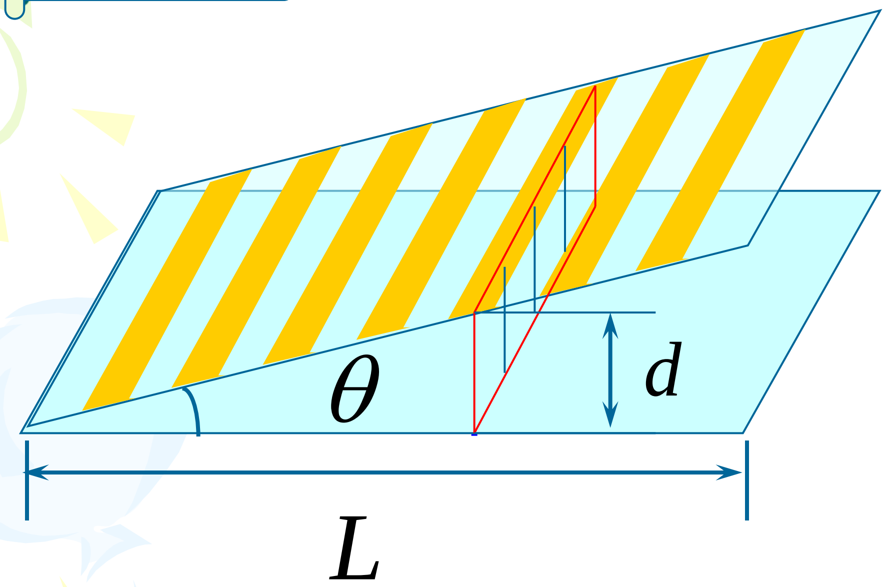


$$\Delta = 2nd + \frac{\lambda}{2}$$

$$\Delta = \begin{cases} k\lambda, \quad k = 1,2,\cdots & \text{明纹} \\ (2k+1)\dfrac{\lambda}{2}, \quad k = 0,1,\cdots & \text{暗纹} \end{cases} \Rightarrow d = \begin{cases} \left(k - \dfrac{1}{2}\right)\dfrac{\lambda}{2n} & \text{（明纹）} \\ k\lambda/2n & \text{（暗纹）} \end{cases}$$

薄膜干涉的应用

讨论



$$\Delta = 2nd + \frac{\lambda}{2}$$

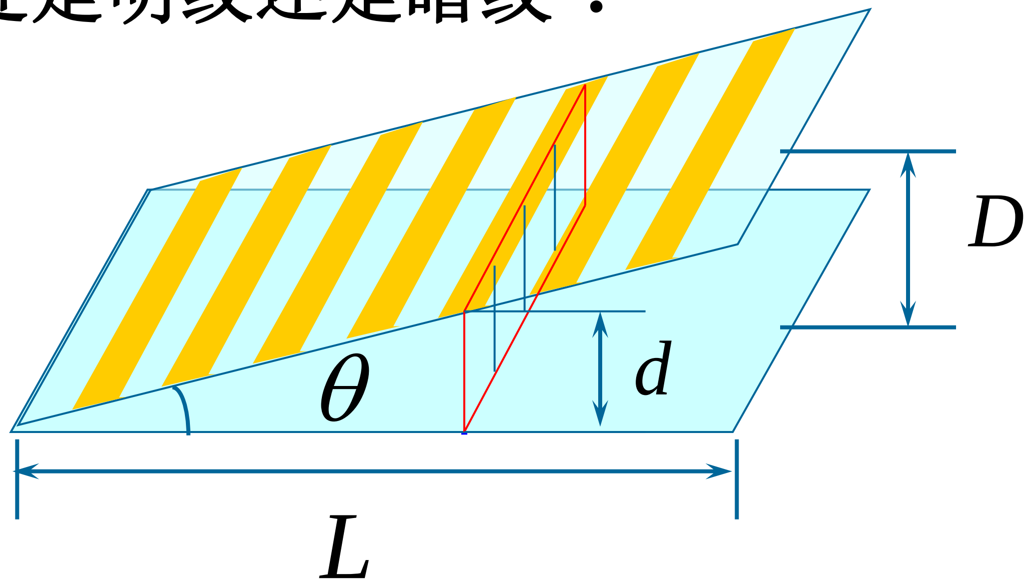
$$d = \begin{cases} (k - \frac{1}{2})\frac{\lambda}{2n} & \text{（明纹）} \\ k\lambda/2n & \text{（暗纹）} \end{cases}$$

1）凡是薄膜厚度d相同的地方，光程差相同，这些点的轨迹形成同一级干涉条纹

-----等厚干涉

讨论

2）空气劈尖棱边处是明纹还是暗纹？



$$\Delta = 2nd + \frac{\lambda}{2}$$

$$d = 0 \quad \Delta = \frac{\lambda}{2}$$

为暗纹.

薄膜干涉的应用

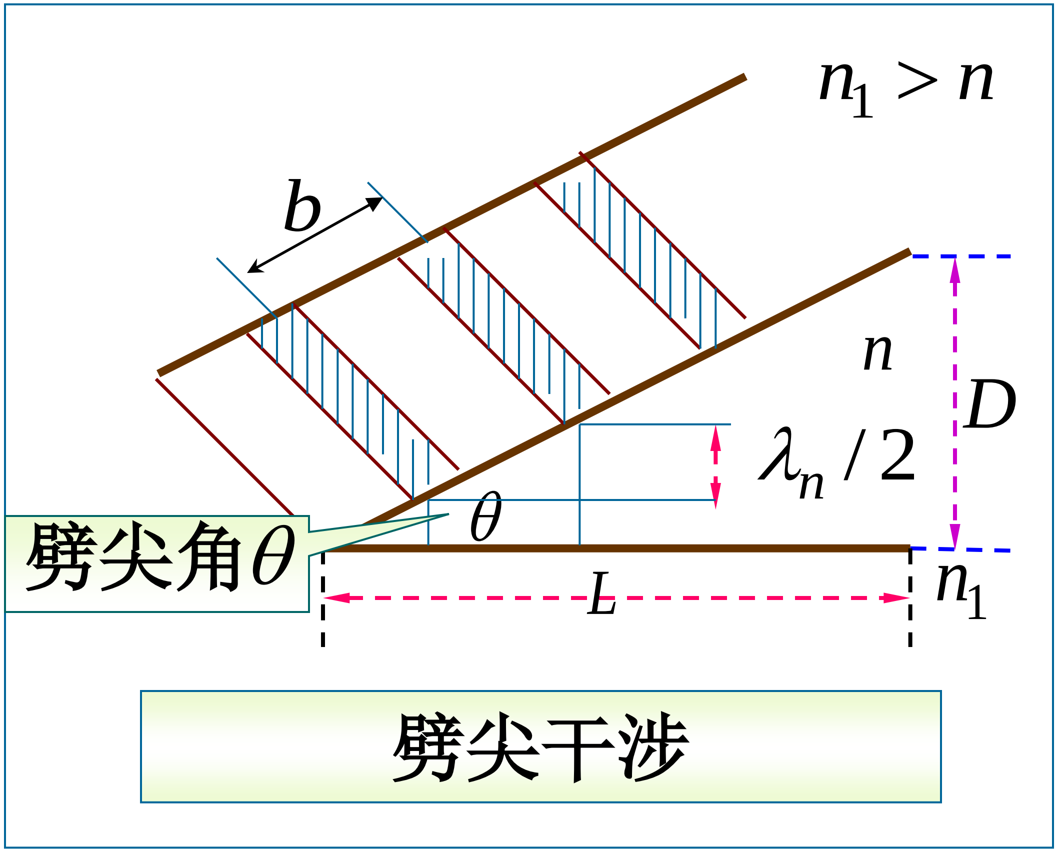
3）求条纹间距（明纹或暗纹）　　已知：λ, n, θ

$$d_{k+1} - d_k = \frac{\lambda}{2n} = \frac{\lambda_n}{2}$$

——(相邻明纹/暗纹间的厚度差)

$$b \sin\theta = \frac{\lambda}{2n}$$

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

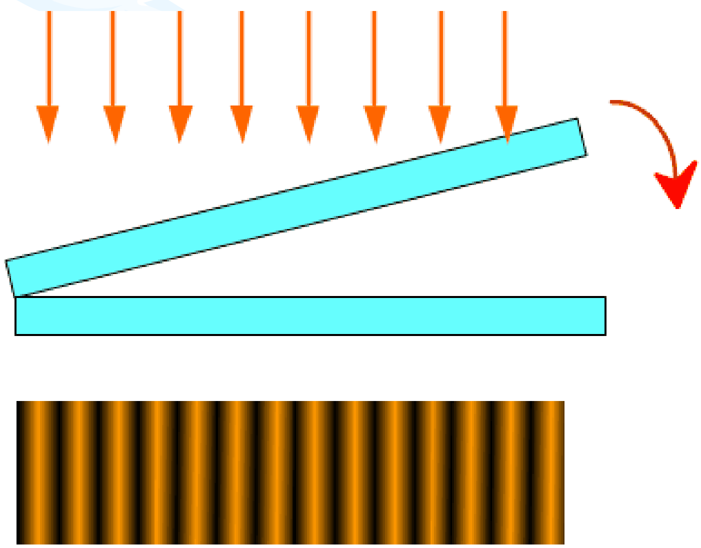


条纹是等间隔排列的

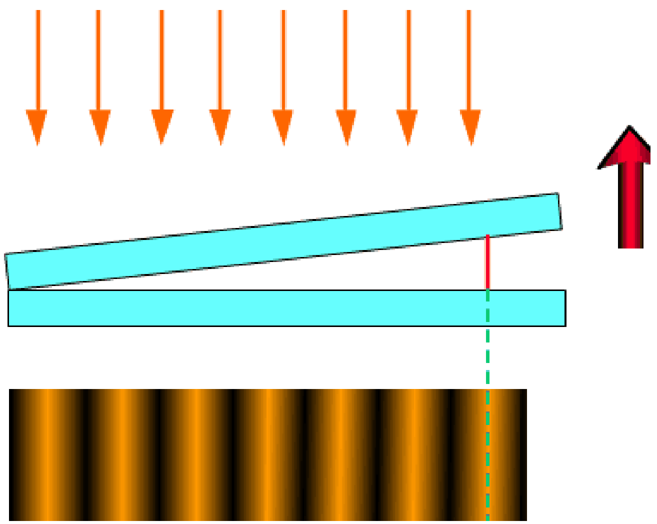
薄膜干涉的应用

4）干涉条纹的移动

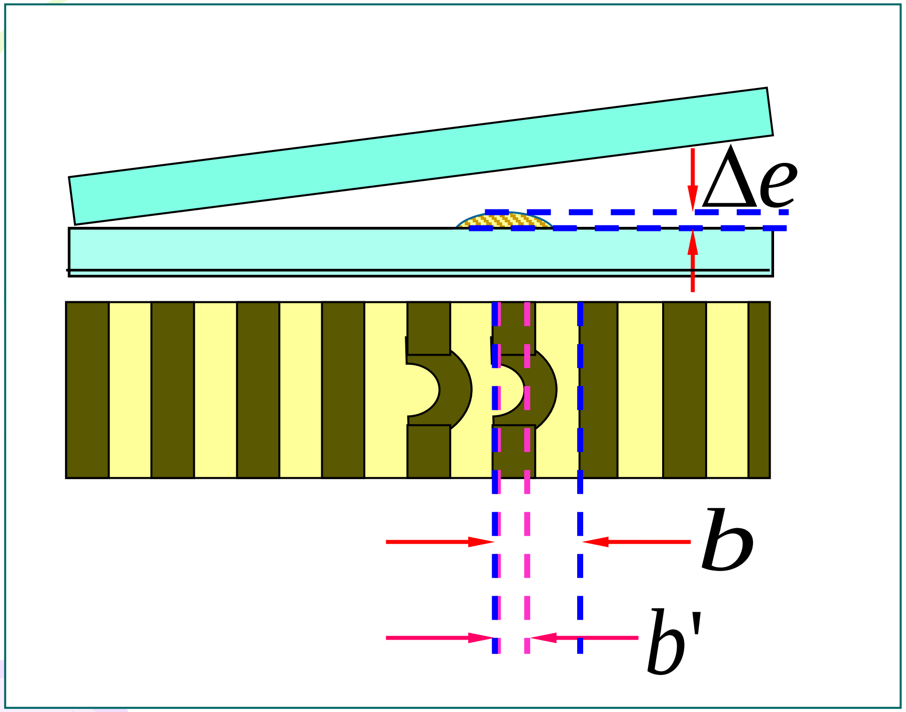
劈尖夹角变小，条纹向 向右 移动，条纹间距 变大

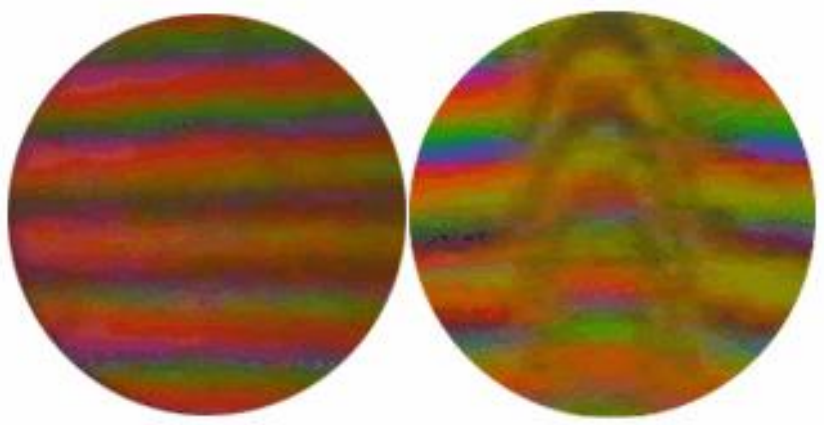


上表面上移，条纹向 向左 移动，条纹间距 不变



◆ 劈尖干涉的应用　　检验光学元件表面的平整度

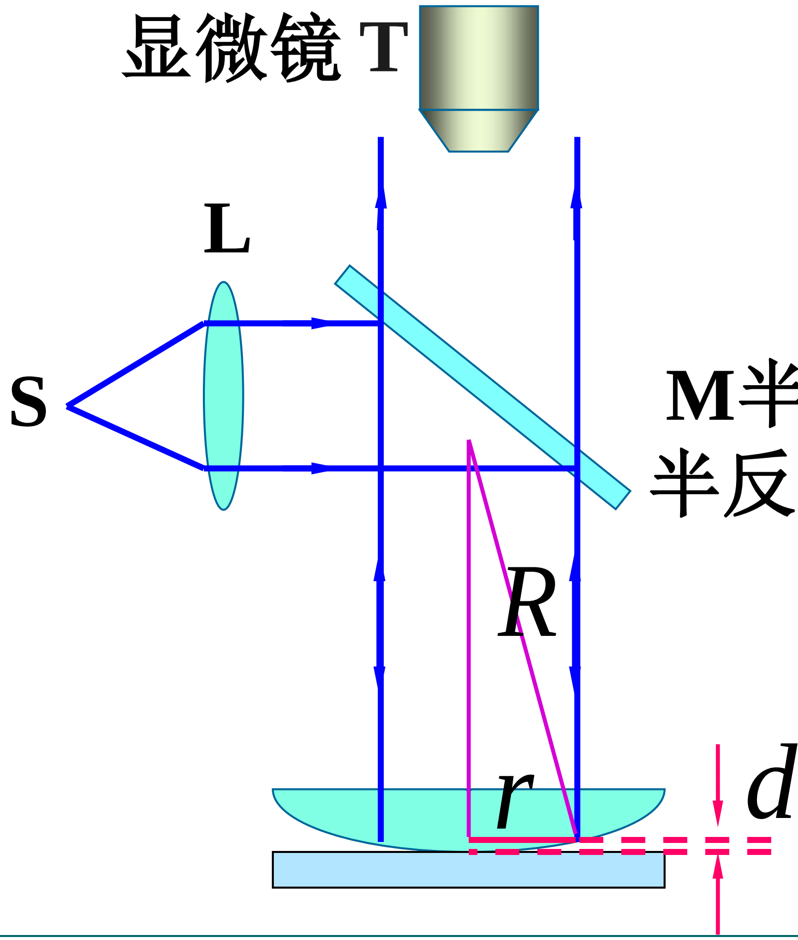


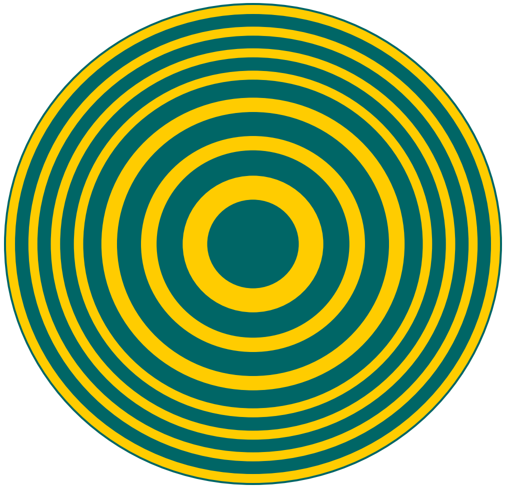


(a)　　(b)

薄膜干涉的应用

牛顿环实验装置

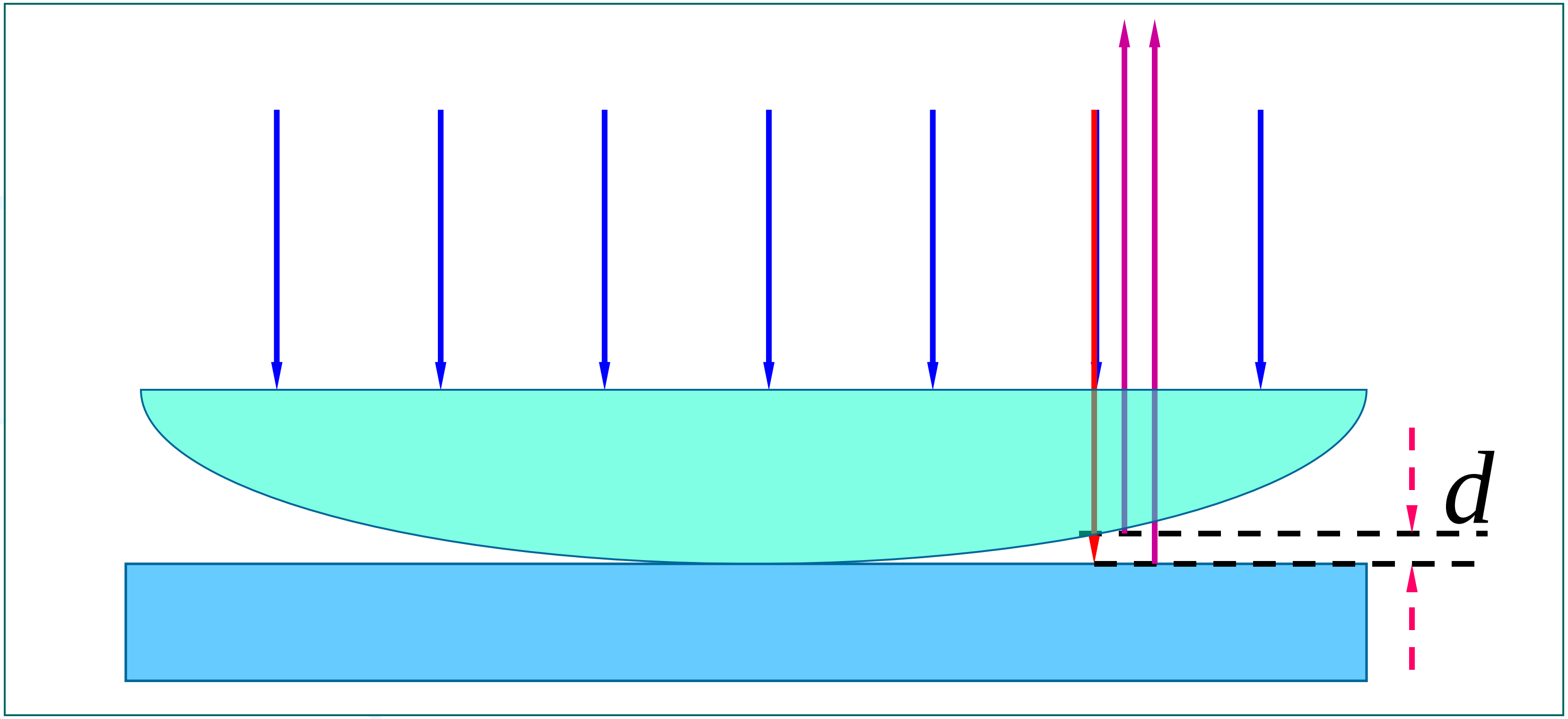




牛顿环干涉图样

薄膜干涉的应用

由一块平板玻璃和一平凸透镜组成



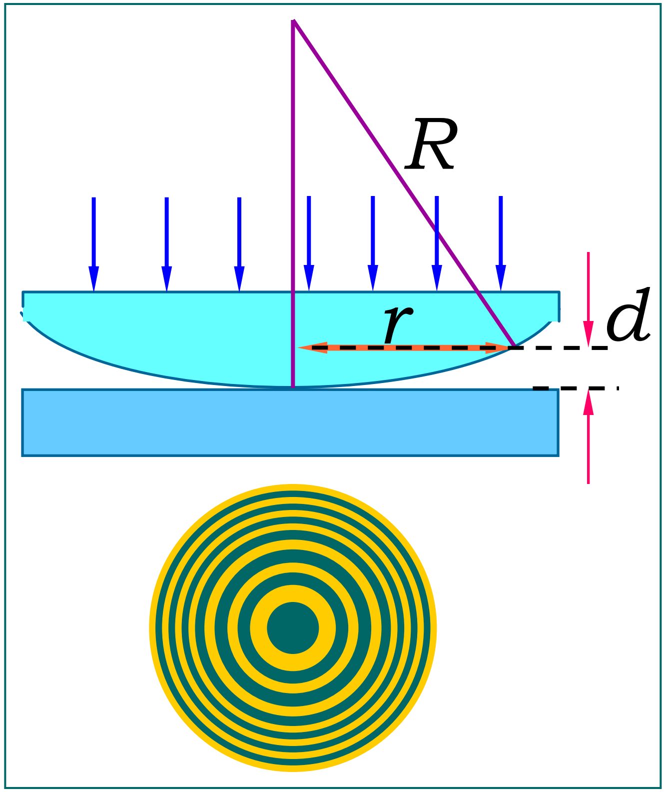
光程差

$$\Delta = 2d + \frac{\lambda}{2}$$

薄膜干涉的应用

光程差 $\Delta = 2d + \dfrac{\lambda}{2}$

$$\Delta = \begin{cases} k\lambda \quad (k = 1,2,\cdots) & \text{明纹} \\ (k+\dfrac{1}{2})\lambda \quad (k = 0,1,\cdots) & \text{暗纹} \end{cases}$$

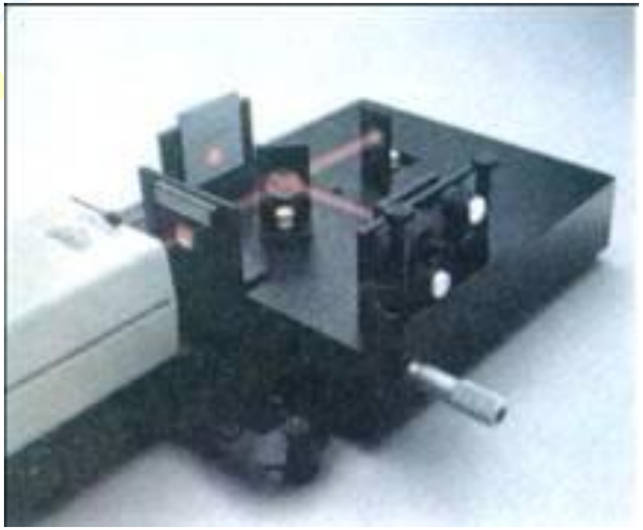


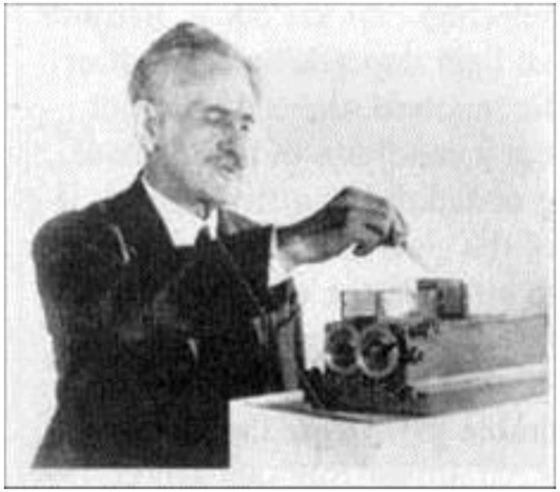
$$r^2 = R^2 - (R-d)^2 = 2dR - d^2$$

$$\because R >> d \quad \therefore d^2 \approx 0$$

$$r = \sqrt{2dR} = \sqrt{(\Delta - \frac{\lambda}{2})R} \Rightarrow \begin{cases} r = \sqrt{(k-\dfrac{1}{2})R\lambda} & \text{明环半径} \\ r = \sqrt{kR\lambda} & \text{暗环半径} \end{cases}$$

迈克耳孙干涉仪





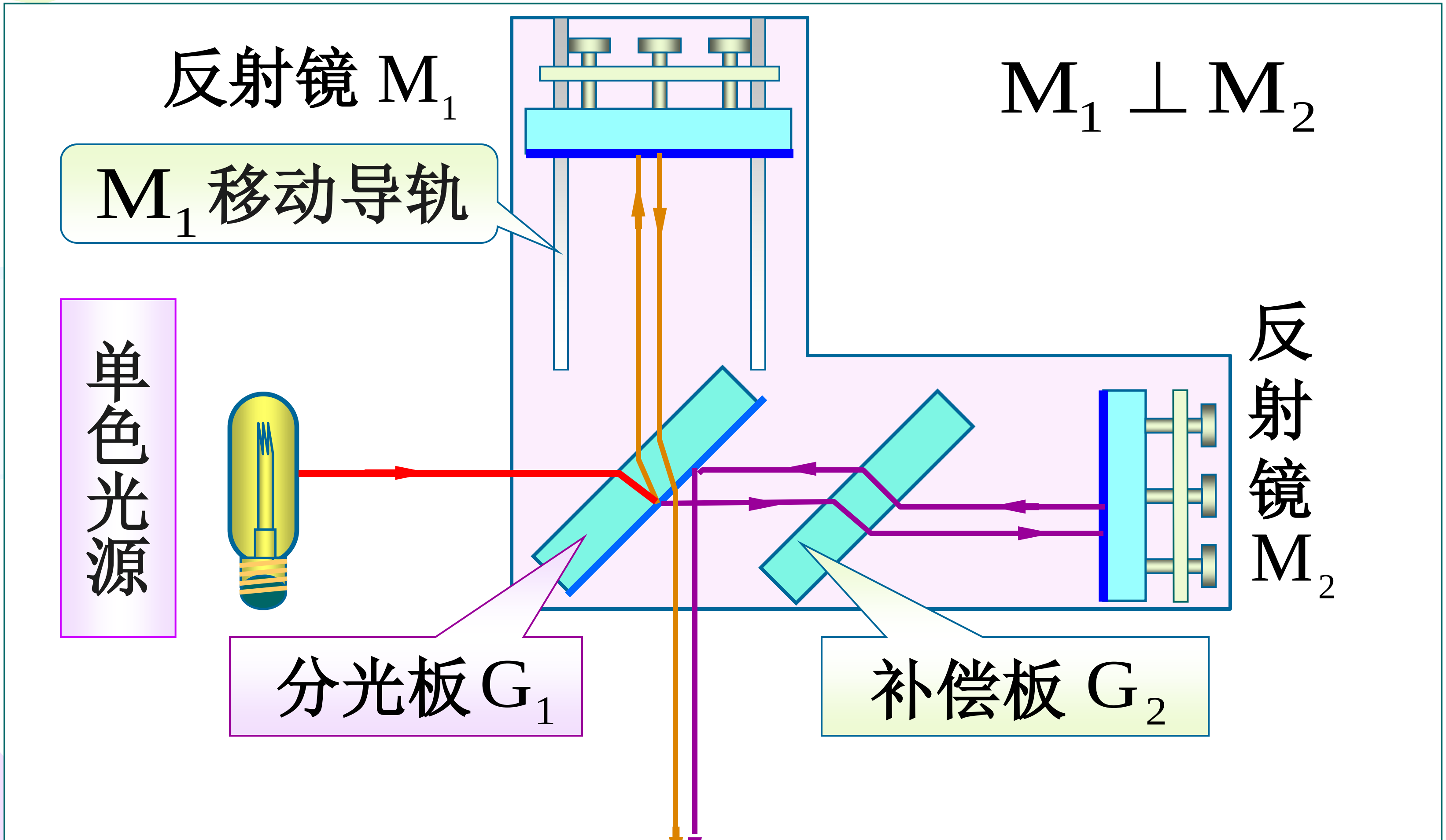
Albert A.Michelson

美国物理学家

1907年获诺贝尔物理学奖

薄膜干涉的应用

结构图和光路



$G_1 // G_2$ 与 M_1, M_2 成 45^0角

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