Construct, Conduct & Comprehend Physics Experiments

LEOK-3-13 Studying on Interference of Fresnel's Biprism

- *Complete set*
- *Cost effective solution*
- *Detailed instructional manual*
- *Easy alignment*

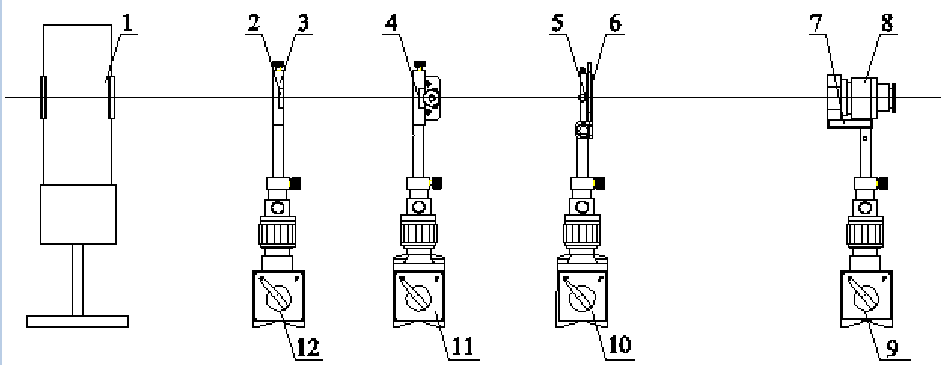

Figure 13-1 Schematic of experiment setup

1: Sodium Lamp (LLE-2 w/small hole)
2: Lens L_1 (f'= 50 mm)
3: Lens Holder (SZ-08)
4: Adjustable Slit (SZ-27)
5: Biprism Holder (SZ-41)
6: Bi-prism
7: Microscope Holder (SZ-36)
8: Eyepiece of Microscope
9,11,12: Magnetic Base (SZ-04)
10: Two-Axis Stage (SZ-02)
Others: Lens L_2 (f'= 70 mm) with holder and magnetic base (SZ-04).

Theory

Fresnel's biprism consists of two equal prisms of small refracting angle, placed together as shown in Figure 13-2. A ray of light from a point source S is divided by refraction into two overlapping rays. The prisms form two virtual images, S_1 and S_2 of light source S. They take the same effect as the two slits in previous Young's experiment.

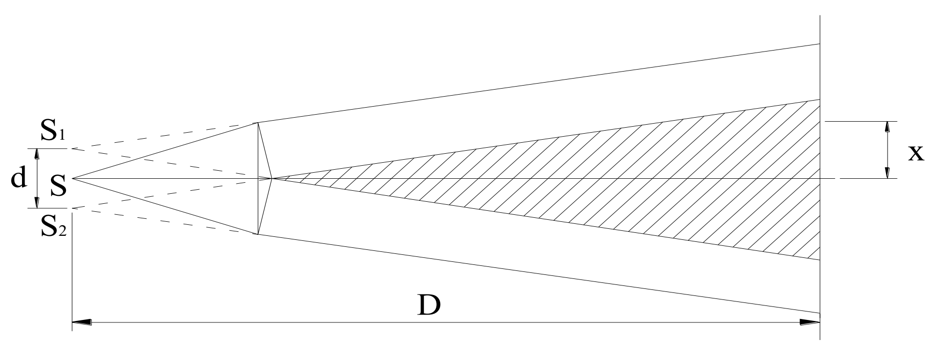

Figure 13-2 Schematic of Fresnel's biprism interference

So we have the formulae as follows:

$$d\frac{x}{D} = \pm(2k+1)\frac{\lambda}{2}$$ (Dark interference fringes). (13-1)

$$d\frac{x}{D} = \pm k\lambda$$ (Bright interference fringes). (13-2)

$$\Delta x = \frac{D}{d}\lambda \quad , \tag{13-3}$$

where D is the distance between the point source and the viewing screen, x is the vertical distance between the point source and viewing location on the screen, Δx is the distance between two adjacent dark fringes (or bright fringes), d is the distance between the two virtual images S_1 and S_2. d cannot be measured directly. But if we put a lens behind the biprism and measure the distance between the images of S_1 and S_2 with the eyepiece of a DMM, then d can be calculated.

Experiment Procedures

1. Refer to Figure 13-1, align all components in same height along a straight line;
2. Focus the aperture of the light source onto the single slit by lens L_1. The key to the success of this experiment is to align the directions of single slit and the ridge of the biprism in parallel;
3. Use the eyepiece of the direct measurement microscope to observe biprism interference pattern, hence, equal-interval bright/dark fringe pairs will be observed;
4. Measure the fringe interval D*x* between two adjacent fringes using the eyepiece, and measure the distance D between the single slit plate and the eyepiece (on the reticle plane);
5. To obtain the interval d between the two virtual images generated by the Fresnel's biprism, put a lens L_2 (f'=70 mm) behind the biprism to image the two virtual images into real images. Move the direct measurement microscope to the real images plane and measure the distance between the two real images as d', by the use of object-image relationship of lens imaging (lens equation) to obtain d;
6. Use d, *Dx*, D and equation (13-3), to calculate the wavelength *l* of the illumination light.

Setup for measuring distance between two virtual images (Step 5)

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