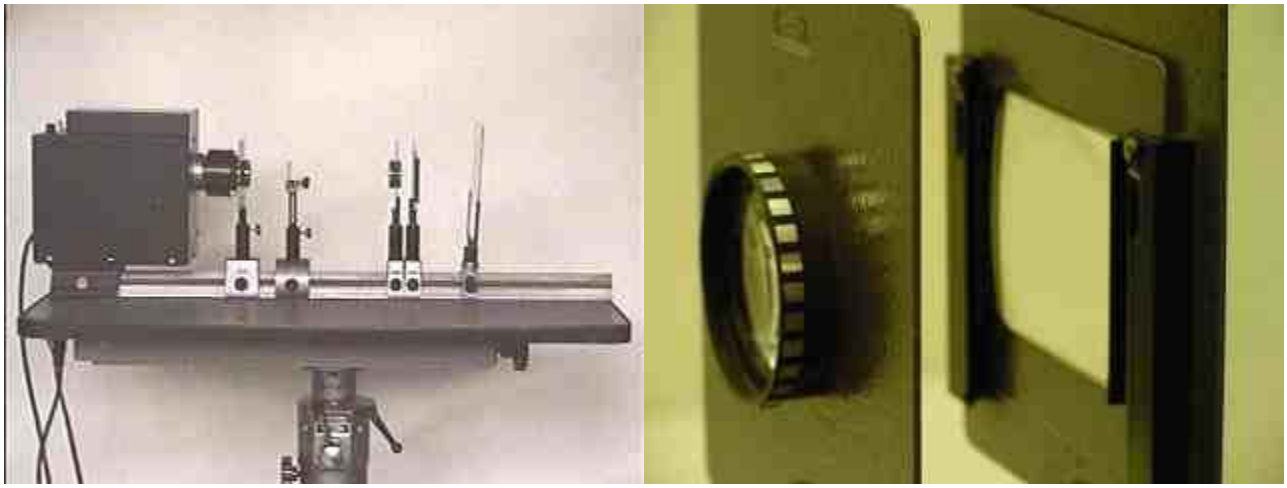
Question #232

Shown in the photograph below is an optical system that creates on-axis astigmatism in which the vertical focusing is greater than the horizontal focusing. This is achieved by using a pair of lenses, one spherical focusing lens and one cylindrical focusing lens with its focus in the vertical direction. Astigmatism in the eye is generally of this type; it occurs when the curvature of the cornea is greater in one direction than the perpendicular direction. Here the effective curvature of in the vertical direction would be greater than that in the horizontal direction. In the photograph a ground glass screen is at the right and the "astigmatic" lens is next to the screen. The original object is a small circular hole.

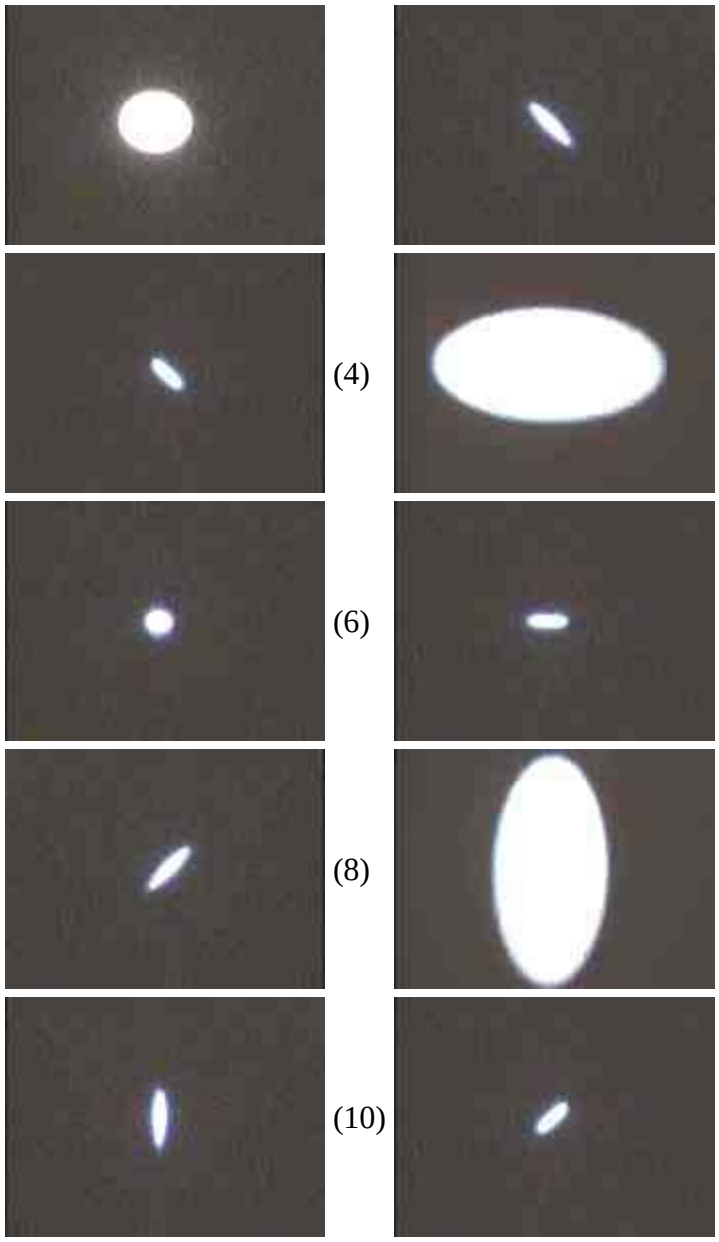
The optical system, seen in the photograph at the left below, consists of the bright point white light source with a collimator lens, a 10cm focal length convex lens, a metal plate with a small circular hole acting as the source image source, the lens pair acting as the astigmatic lens (seen close up at the right below), and a ground glass screen that can be moved along the optical rail.



If you view the image from the right, looking back toward the light source, the light passing through the astigmatic lens and hitting the screen in its close position is seen in the photograph below.

If you now move the screen to the right, away from the astigmatic lens, the light spot on the screen will change. You are to select from the ten possible shapes below (including the first as seen above) which are possible ways that the light may look on the screen as the screen is withdrawn. Identify which shapes are possible and the order in which they will occur as the screen is withdrawn.

(1) (2)



List the images in the order in which they appear as the screen is moved outward from its initial position adjacent to the lenses. Leave out any that do not actually appear as the screen is withdrawn.

- image (1)
- image (2)
- image (3)
- image (4)
- image (5)
- image (6)
- image (7)
- image (8)
- image (9)
- image (10)

Click here for Answer #232 after November 21, 2005.

Question of the Week

Outreach Index Page

Lecture-Demonstration Home Page

For questions and comments regarding the *Question of the Week* contact Dr. Richard E. Berg by e-mail or using phone number or regular mail address given on the Lecture-Demonstration Home Page.