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Thermodynamics, Wave Motion and Optics (PHYS201)
Participation 3

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1. Suppose you are given two mirrors paced at 90° to each other as shown the in figure. Use the ray methodology to find out the images formed of the red arrow due to this mirror system. Note: the images formed does not depend on the place of the observer.

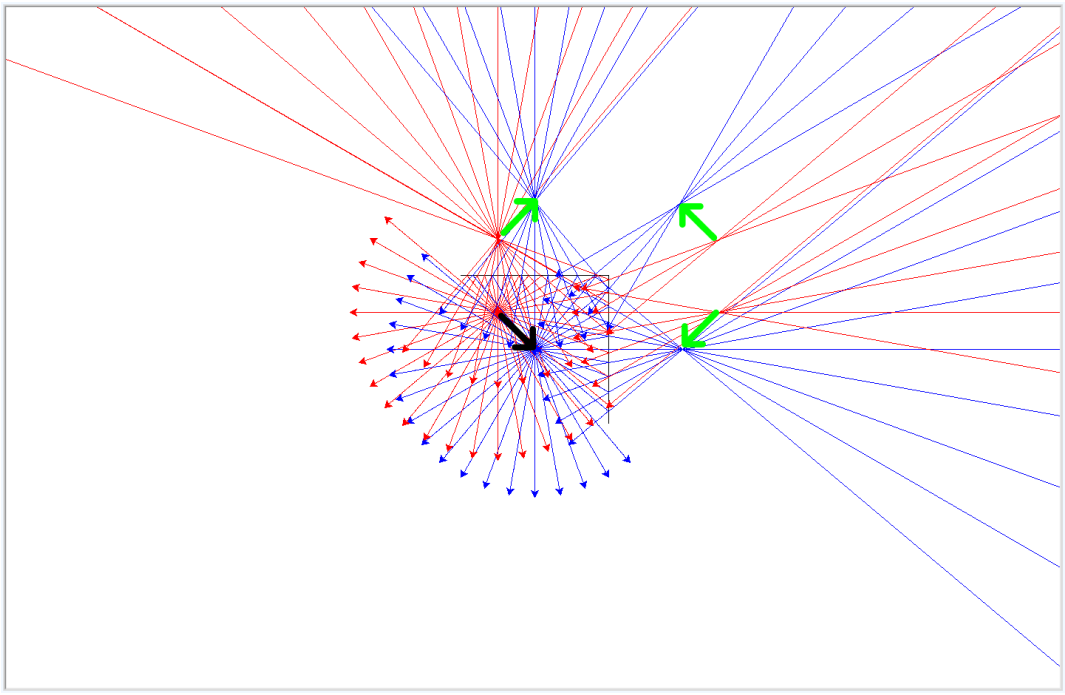
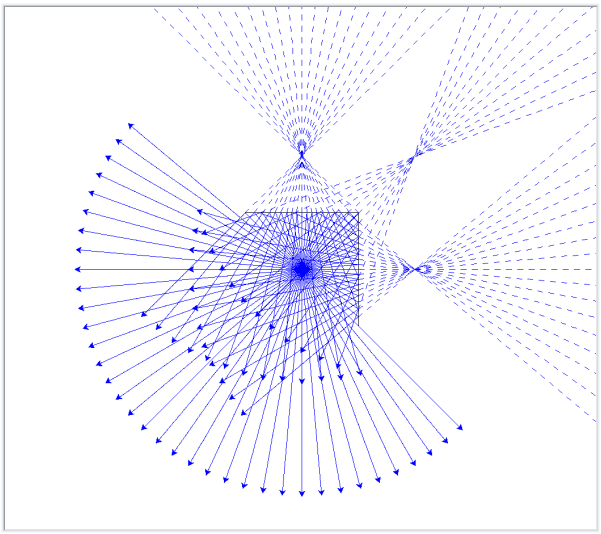
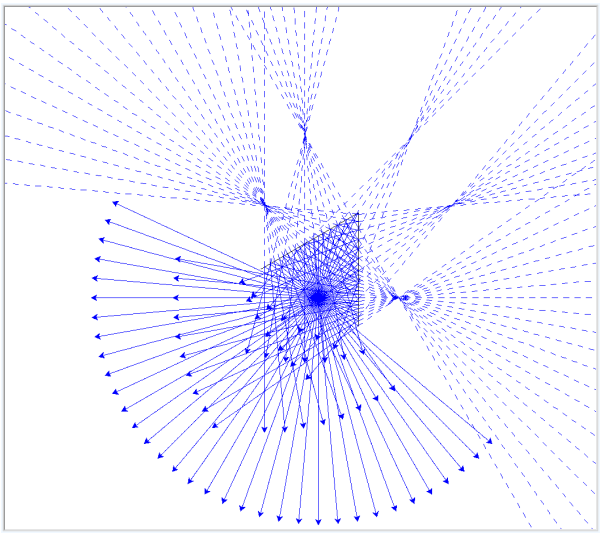


Figure 1: Light reflection.

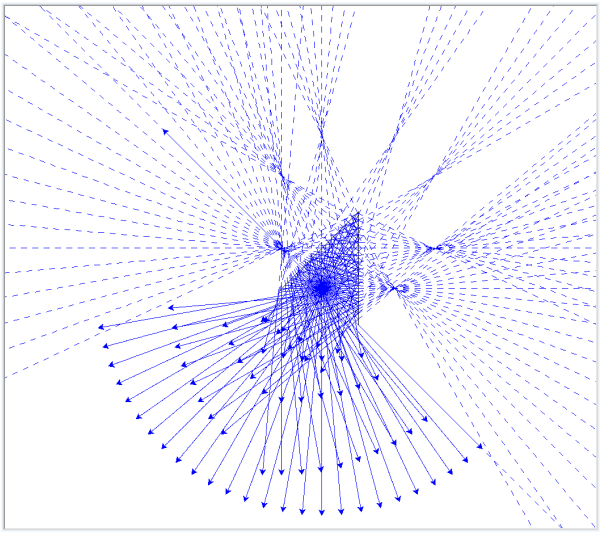
2. For the case of the phenomena of multiple reflections and images formed in a system of two plane mirrors, Derive a formula for the number of images formed as a function of the angle between the two mirrors. You may make use of the experimental data provided in the lecture for the number of images formed at different angles.



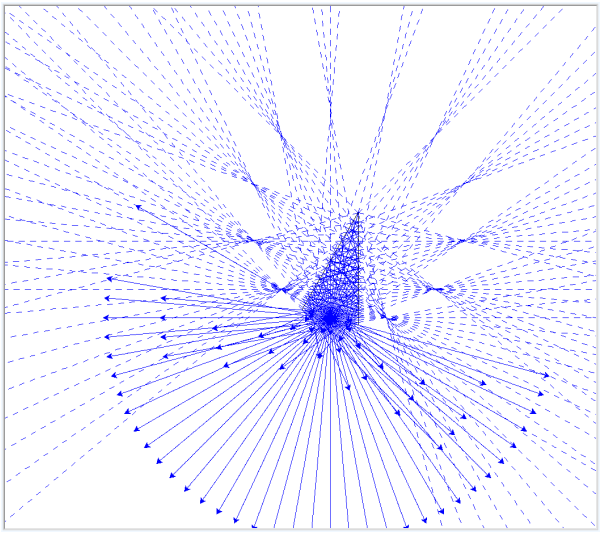
(a) $\theta = 90°$



(b) $\theta = 60°$



(c) $\theta = 45°$



(d) $\theta = 30°$

Figure 2: Images formed at different angles.

θ	#
90°	3
60°	5
45°	7
30°	11

Table 1: Number of images formed at different angles.

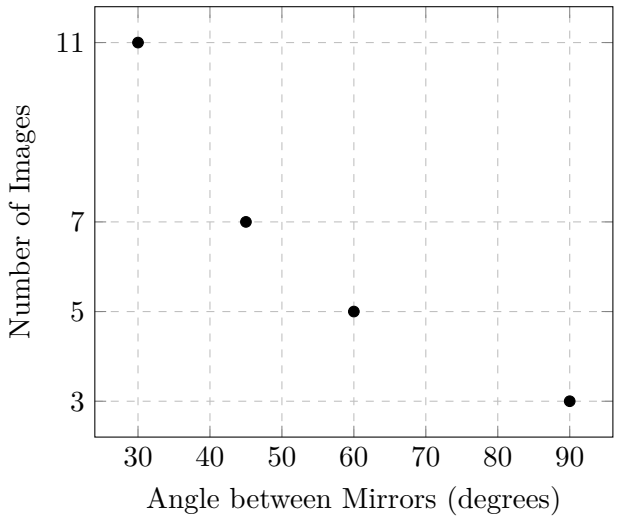


Figure 3: Plot of Table 1.

From Figure 3 and Table 1:

$$\# \propto \frac{1}{\theta} \tag{1}$$

$$\# = \frac{m}{\theta} + c. \tag{2}$$

Using linear regression:

$$m = \frac{\Sigma y \Sigma x^2 - \Sigma y \Sigma xy}{n\left(\Sigma x^2\right) - \left(\Sigma x\right)^2} \quad c = \frac{n\left(\Sigma xy\right) - \Sigma x \Sigma y}{n\left(\Sigma x^2\right) - \Sigma x^2} \tag{3}$$

$$m = 360 \quad c = -1. \tag{4}$$

$$\# = \frac{360}{\theta} - 1. \tag{5}$$

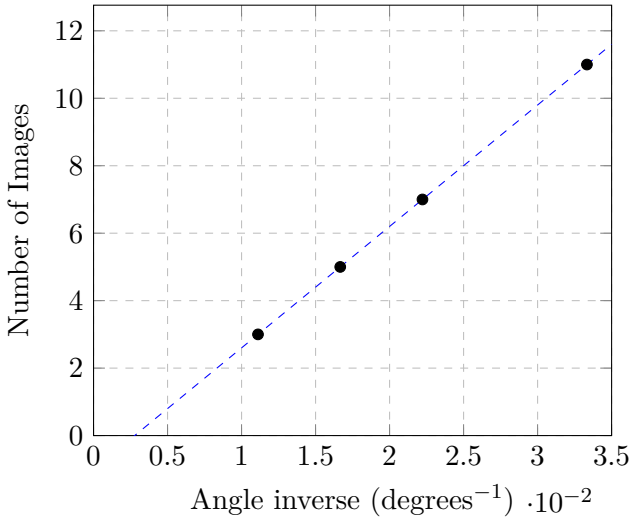


Figure 4: Plot of Table 1 with Equation 5.