

# Lab 3: Image Formation with Pinholes

Laboratory Report

Fundamentals of Imaging Science

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## Introduction

For this lab, we explore the geometric laws of image formation with a pinhole system. Like the previous lab, these laws primarily include the sharpness of the shadow. The sharpness of the shadow can be manipulated by many factors, one of which is pinhole usage. Although pinhole usage is limited, it is used often with radioactive materials as the source.

## Methods

To begin, a light source and pinhole cutout were attained. The light source was placed 800mm from the wall. Then a pinhole cutout was placed at varying lengths from the light source. After the pinhole cutout is placed the sharpness of the image is recorded. This process is repeated for three different sizes of pinhole cutouts.

## Results

*Table 1:* Object size  $w_1$ : 30mm      Pinhole diameter: 3mm

Measurement Set	$L_1$ mm	$L_2$ mm	$W_2$ mm	Sharpness	$w_E$ mm	Delta mm
1	200	600	70	0.5	90	-20
1	400	400	30	3	30	0
1	600	200	8	7	20	-12

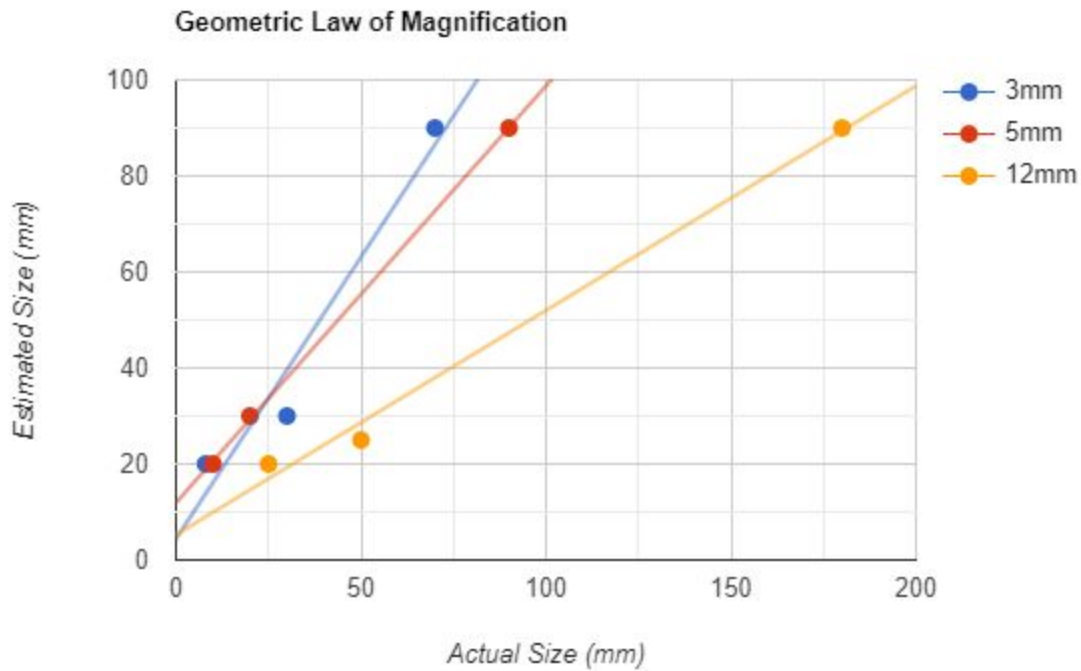
*Table 2:* Object size  $w_1$ : 30mm      Pinhole diameter: 5mm

Measurement Set	$L_1$ mm	$L_2$ mm	$W_2$ mm	Sharpness	$w_E$ mm	Delta mm
2	200	600	90	1	90	0
2	400	400	20	5	30	-10
2	600	200	10	7	20	-10

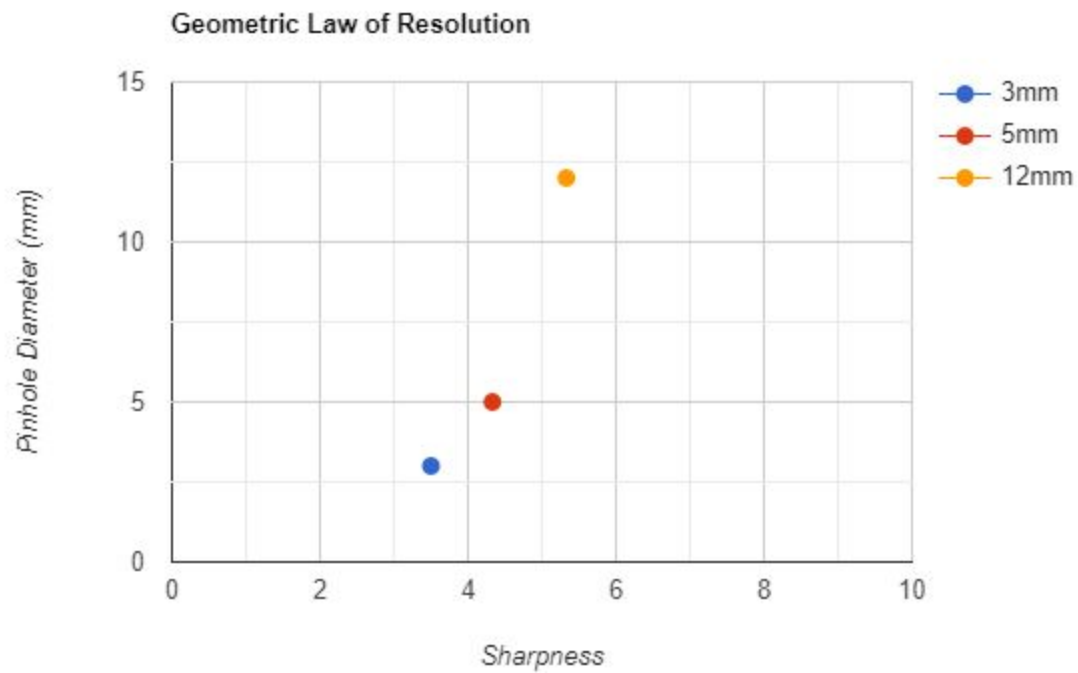
Table 3: Object size w\_1: 30mm Pinhole diameter: 12mm

Measurement Set	L_1 mm	L_2 mm	W_2 mm	Sharpness	w_E mm	Delta mm
3	200	600	180	2	90	110
3	400	400	50	6	30	20
3	600	200	25	8	20	5

## Discussion



Based on the results attained using the methods, the geometric law of magnification is an accurate law to describe pinhole imaging. The best-case scenario is that the y-intercept is 0 and the slope is 1, which is nearly the case in the results. However, delta must also be as close as possible to 0, which was not the case in the recorded results. Regardless, the graph is close enough to the optimal to prove the acceptance of the law of magnification.



Based on the results attained using the methods, the geometric law of resolution is not an accurate law to describe pinhole image sharpness. The law states that the larger the pinhole, the poorer the sharpness, however, the attained data says the opposite. It says that the larger the pinhole, the higher the sharpness of the image. These results disprove this law.