Lab 5: Image Formation with Lenses Part 2

Laboratory Report

Fundamentals of Imaging Science

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Introduction

For this lab, we further discuss image formation using lenses, more specifically telescopes. Although most modern telescopes use mirrors, this lab will be considering lenses instead. There are two main types of lenses used in telescopes, a positive convex lens, and either a concave or convex lens. The lens distance is negative of the lens has a negative focal length.

Methods

To continue the procedures, the focal lengths of the lenses were retrieved from the previous lab. The next data was provided in the forms of 3 digital images. The observed magnification is attained through our own sight while the calculated magnification is attained through the formula $M = -(f_1 / f_2)$.

Lens A: Convex, focal length of 125.326 mm

Lens B: Convex, focal length of 38.132 mm

Lens C: Concave, the focal length of -38.132mm

Results

Observation	Image Orientation	Observed Magnification	Calculated Magnification
Keplerian	Inverted	- 2.5 magnification	-(125.326/38.132) = -3.29
Galilean	The same	2.5 magnification	-(125.326/-38.132) = 3.29

Discussion

1) Both of the telescopes have the same magnification and about the same level of clarity. The main difference between them is that the Keplerian telescope inverts the image. The absolute value of the observed and calculated magnification are identical.

2) Although both of the telescopes have the same absolute value magnification, the Keplerian telescope's ray path crosses the x-axis, inverting the image. The Galilean telescope's ray path remains above the x-axis, which only magnifies the image and the orientation remains the same. Although the f_2 distance remained the same, the point of contact on the convex lens is past the point of intersection of the x-axis. The concave lens's point of contact is far before the point of intersection.