iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** XI **Month of publication:** November 2025

DOI: https://doi.org/10.22214/ijraset.2025.74981

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue XI Nov 2025- Available at www.ijraset.com

Reflecting the Double Slit Pattern

Himansh Bainsla

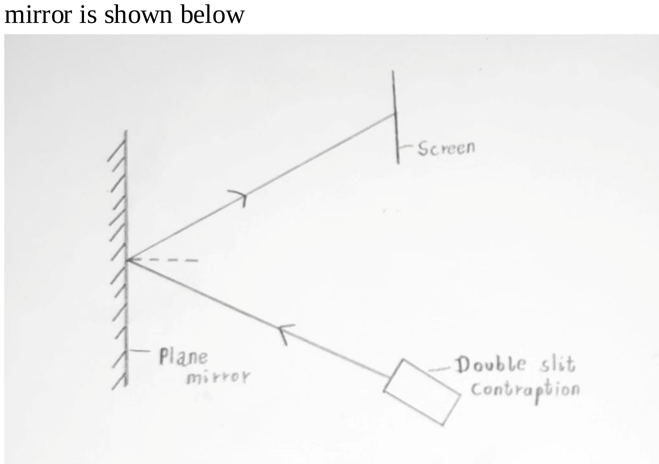
Abstract: This research was conducted to note the changes in the interference patterns, by different means of reflection. For this, we have used a double slit, different mirrors, and a screen to obtain the image. The hypothesis behind this was that double slit produces a fringe patten on a screen when a coherent light source is passed through it, but what if we put a mirror after the slits and obtain an image on a screen. Not just that, what if we put different kinds of mirrors in between the slit and the screen. We conducted this research in an environment with negligible sources of light except the non-coherent light source, and with negligible vibrations which could affect the image obtained. When this research was conducted with a flat mirror, fringes were roughly the same as predicted by mathematical calculations. But when this research was conducted by a convex mirror, the fringes seemed to be virtual . When this same study was conducted with a concave mirror, the fringes seemed to be either concentrated at a single point, or they seemed to be have enlarged with a virtual image however the ratio of magnified image to the actual image that have been obtained if there was no mirror, remained the same. Whereas in the case of a convex mirror, the image was smaller. This property is useful as it can be used to observe the pattern more precisely by magnifying it and the actual numbers, i.e.- when mirror would not have been used can also be calculated because the magnification is the same.

AUTHOR SUMMARY

To understand this study, we need to figure out what light is in the first place, is it a particle? Is it a wave? Well, it's both. Let us imagine light as a wave for basic comprehension, imagine a bucket full of water, and make disturbance in it. We will observe waves in the bucket. Now imagine light travelling like that wave and imagine a narrow obstruction comes in its way, the wave splits into two waves and when those light waves interact, sometimes they cancel each other out and sometimes they don't, which gives us an alternating pattern of dark and light fringes, this is called double slit experiment. Now what if we put a concave mirror in place of screen, we will observe a magnified image is formed at a specific distance. The ratio of the image formed with the pattern we would have got without a mirror remained the same.

I. INTRODUCTION

The famous Youngs double slit experiment (YDSE) is taught in many high schools around the globe for its easy comprehension of dual nature of light. The experiment is conducted by taking two narrow slits separated by a narrow gap when light is passed through the slits. Two different light ways emerge which interfere constructively and destructively forming interference patterns. However, it is very difficult to see those patterns with high precision, and even if high precision is achieved the methods are quite expensive. For this we have researched with different types of mirrors placed at the position of screen and a screen is placed in the path of the reflected ray. In a special case of a concave mirror, when the object is kept between pole and focus the image is magnified and obtained on a screen where we can also measure the fringe parameters quantitatively. and the ratio of the image formed with a mirror to the object which would've been formed if there was no mirror is the same provided wavelength and slit separation is the same. Basic contraption with plane mirror is shown below



ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue XI Nov 2025- Available at www.ijraset.com

II. MATERIALS AND METHODS

To replicate this study we need:

1) Convex, concave and plane mirrors
2) Coherent light source, the original experiment used a 632nm laser with a diameter is 2mm
3) Flat screen, a white sheet held without wrinkles or deformations was used
4) Measuring instrument,
5) Double slit contraption with slit distance of 80micrometer

This study was done in an environment with negligible vibrations and light source except the laser. A regular double slit contraption was first prepared and kept fixed at a point, and a plane mirror for the first prototype for the sake of convenience, pointing at a screen. Note- keep the light source as much far from edges of mirror as you can because diffraction by the edges may alter the results. Foam pieces were also used to minimise the vibrations in the surroundings. For formulating mathematical predictions fringe spacing formula was used

$$\beta = \lambda D/d$$

Where beta is the fringe spacing, lambda is wavelength that is 632nm and D is distance of slit to screen and d is distance of slits that is 80 micrometers. The recording of the result was also done twice and average of them was taken.

III. RESULT

This study found that with a plane mirror a image of same size is formed, and as for a concave mirror the image formation depends upon the distance of slit contraption to the mirror and also the distance of the slits from each other. The mirrors used are of 20cm focal length. When the object is kept at a range of 0.20cm from the pole for a concave mirror, the image formed is virtual and magnified an as the image and as the image comes closer to the focal point the magnification increases, until it reaches its limit at 20cm where the pattern starts to get blurry. For a plane mirror a virtual image with no magnification if formed, it is important to note not to direct the rays near the edges of any mirror as it would result in defraction and alter the results.

Mirror Type	Object–Mirror Distance (cm)	Image Nature	Apparent Magnification (M)	Average Fringe Spacing (mm)	Deviation from Baseline (%)
Plane Mirror	15	Virtual, same size	1.0	0.50	0
Concave Mirror	10 (between F and P)	Virtual, erect, magnified	1.3	0.65	+30 %
Concave Mirror	15	Virtual, erect, less magnified	1.15	0.57	+14 %
Concave Mirror	20 (≈ F)	Nearly infinite magnification	–	Pattern blurred	–
Convex Mirror	10	Virtual, diminished	0.8	0.40	–20 %
Convex Mirror	15	Virtual, diminished	0.6	0.32	–36 %

We also conclude that

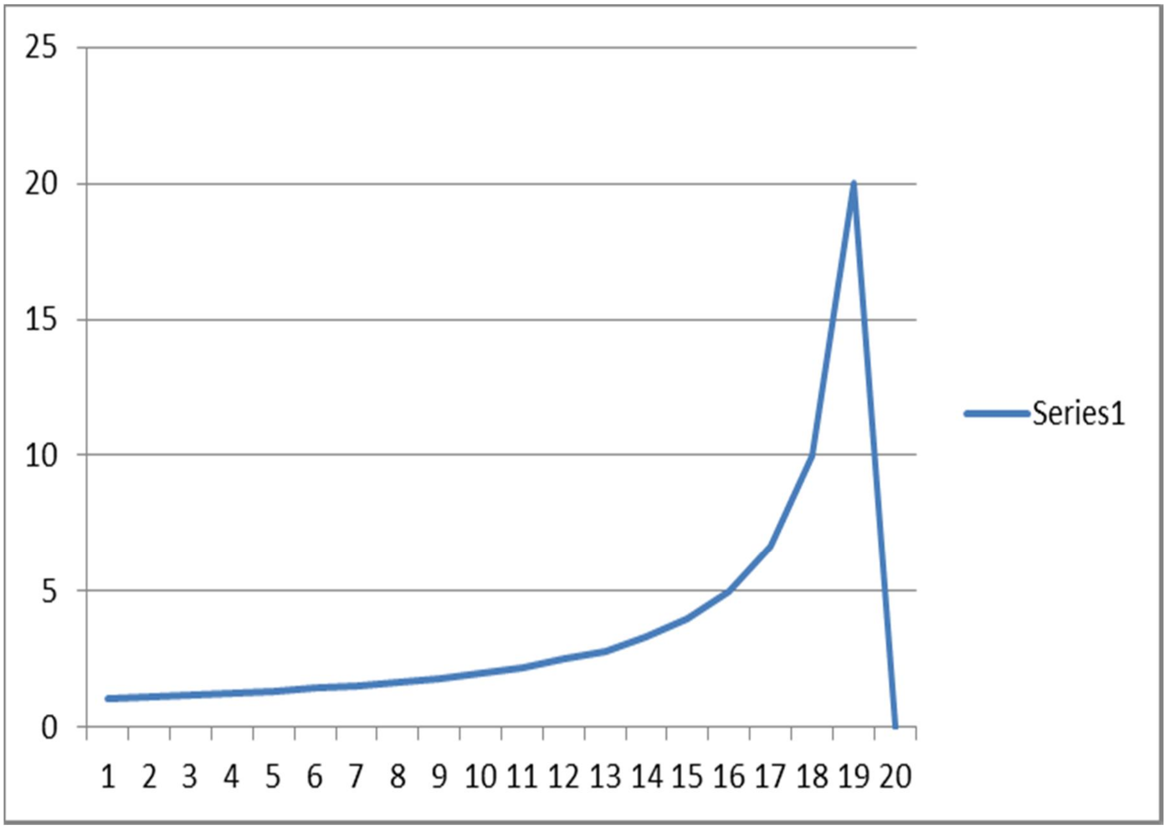
$$\beta' = M \times \beta$$

Where β′ is the image size, M is magnification and β is the length of interence pattern obtained without mirrors

It is observed that there is an increase in the magnification of the interference pattern as it is brought close to the focal point, until it reaches the focal point where the image is blurry and magnification and other measurements are hard to figure.

The y axis in the graph shows the magnification whereas the x axis shows its distance from the pole

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue XI Nov 2025- Available at www.ijraset.com



IV. DISCUSSION

The purpose of the experiment was to investigate how a concave mirror influences the interference fringe pattern's magnification when the object (double slit) is positioned between the mirror's pole and focal length. The findings unequivocally show that as the source is enlarged by the virtual image created by the concave mirror, the fringe spacing rises. This occurs because the concave mirror creates a virtual, erect, and magnified image behind it when the object is positioned between the pole and focus. The observed increase in fringe separation is caused by the virtual image of the slits acting as an efficient secondary source for the interference pattern.

The mirror formula states that

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

When the item is positioned between the pole and the focus, the magnification M is greater than 1. This theoretical relationship is consistent with the experimental trend: both magnification and fringe spacing increase when the slit-to-mirror distance decreases.

Conversely, the convex mirror caused the interference fringes to shrink slightly. Since it forms a virtual, erect, and diminished image of the slits, the effective slit separation increased, leading to smaller fringe spacing. The decrease in fringe size was consistent with theoretical expectations, showing that convex mirrors reduce the apparent angular width of the interference source.

It is confirmed that the mirror only alters spatial geometry and not coherence or phase relationship because the image's nature remains virtual and erect throughout the observations and the fringe visibility remains roughly constant. Small variations in fringe spacing are probably caused by hand measuring mistakes, faulty mirror curvature, or misalignment.

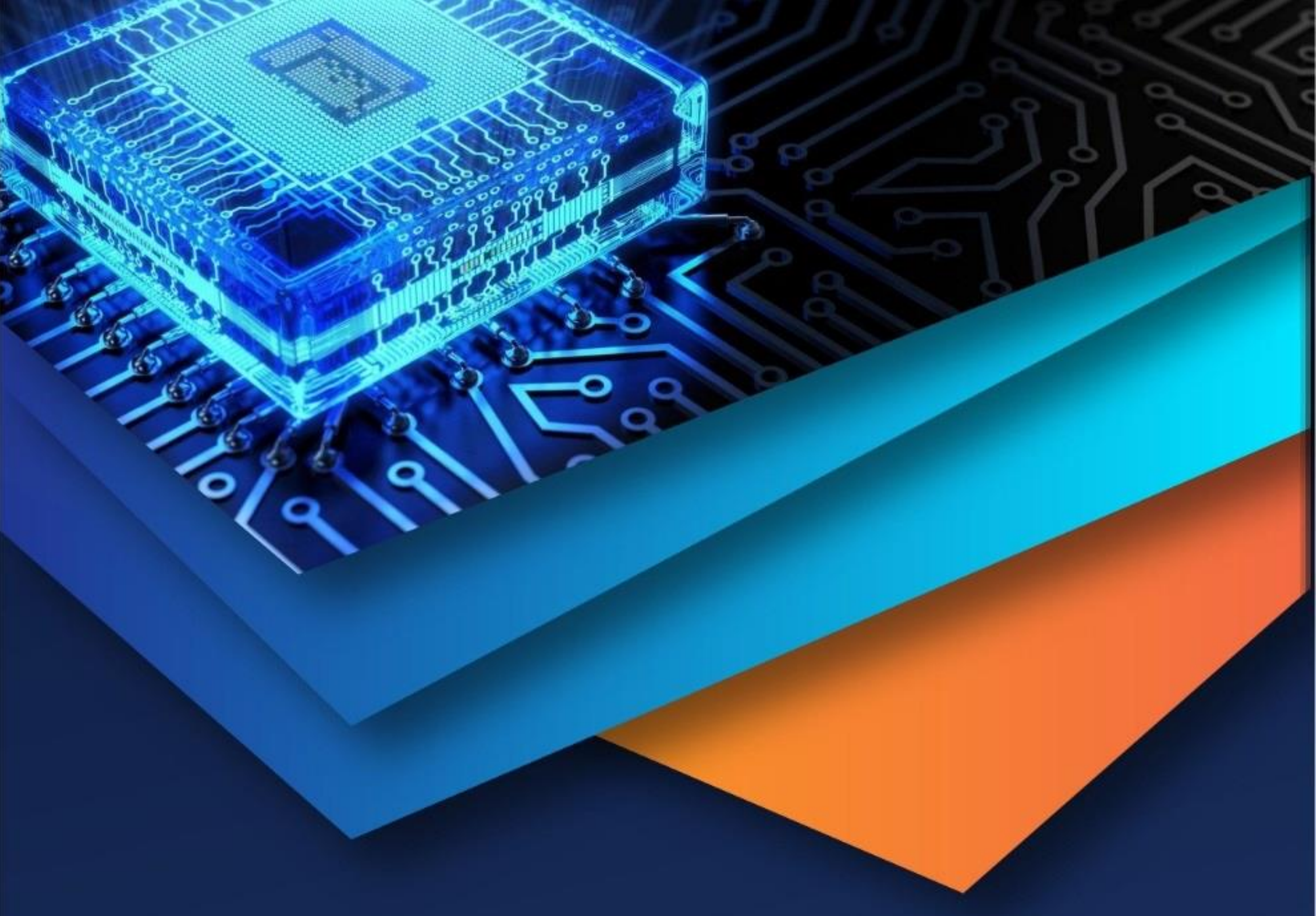
Overall, the experiment effectively shows that an interference pattern may be magnified by a concave mirror without changing the wavelength or fringe order. Mirror magnification directly scales fringe spacing, as confirmed by the observed results, which are in good agreement with theoretical expectations.

V. CONCLUSION

Using a coherent 632 nm laser, the study effectively illustrates how various mirror curvatures affect the magnification of interference fringes in a double-slit arrangement. A concave mirror created an enlarged virtual picture when the object was positioned between its pole and focus, increasing the fringe spacing, whereas a plane mirror maintained the fringe spacing and served merely as a reflective surface. The convex mirror, on the other hand, created a smaller virtual picture, which resulted in a smaller fringe spacing.

These findings demonstrate that, without changing the coherence or wavelength of the light, mirror geometry directly alters the effective slit separation and, thus, the observable interference pattern. The relationship between wave interference and geometrical optics is strengthened by the experimental results, which closely match predictions from the mirror and magnification equations.

Overall, this experiment confirms and evalutes how the mirrors manuplate the interference pattern at different distances



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY