Young's double slit experiment

Science, Physics

Young’s double slits Formal Lab Florencia Shi Purpose: The double slits experiment was conducted to observe the interference of light waves, to explore how interference pattern would be affected by different colours, and to determine whether interference would change if the angle of slits was changed horizontally or vertically. Hypothesis: Dark and light bands would be seen, and red light causes wider nodal spacing, while blue light causes shorter nodal spacing. Materials: In this experiment, a lamp base assembly, a piece of blue filter, a piece of red filter, a slit plate, a laser pointer, a meter scale, and a 40 W lamp were used.

Procedures: 1. A 40 W lamp was assembled in a lamp base assembly, and the assembly was settled on the edge of a desk top. 2. The lamp was turned on. And the filament of the lamp was seen, from a distance, by a person through the double slits on the slit plate. The shape of the interference was recorded. 3. A piece of red filter was placed in front of the lamp, and the lamp was seen, from a distance through the same double slits. The change of the interference pattern was recorded. 4.

The filament of the lamp was seen by a student standing a certain distance away through the same double slits with a piece of blue filter placed in front of the lamp. The change of interference pattern was observed. 5. The slit plate was rotated vertically and horizontally, while other factors were kept constant. The change of interference pattern was observed. 6. The laser light conducted by the laser pen was directed through the double slits onto a piece of paper located 3m away. The interference pattern was observed through the slits. 7. The nodal spacing on that piece of paper was measured. 8.

Step 6 and step 7 were repeated at a distance of 2m away. Observations: 1. The patterns of lamp light interference were dark and light bands, while the patterns of laser interference were dark and light spots. 2. After the red filter was placed in front of the lamp, the nodal spacing increased. After the blue filter was placed in front of the lamp, the nodal spacing decreased. 3. After the slit plate was rotated vertically, the light and dark bands were not parallel to each other any more, because after the slit plate was rotated vertically, the top and bottom of the double slits were not in the same vertical straight line.

After the slit plate was rotated horizontally, the nodal spacing increased, because the distance between two slits (d) decreased. | Distance |? x1/2 |? x2 |? x3 |? x4 |? x5/2 |? xav | |(m) | | | | | | | | 3m | 0. 0022 | 0. 0051 | 0. 0049 | 0. 0042 | 0. 0025 | 0. 0047 | | 2m | 0. 020 | 0. 0048 | 0. 0042 | 0. 0039 | 0. 0021 | 0. 0043 | Discussion: 1. Dark and light bands were seen through the double slits. These were seen because the two lights came from the same source and had the same frequency. Therefore interference of light waves occurred. The light band was where two crests or two troughs intersected (antinodes), and the dark band was where a crest and a trough intersected (nodes). 2. A wider nodal space occurred in the interference pattern.

Since when the lamp was blocked by the red filter, only red light could go through it, and the dark band occurs when the difference between the travelling distances of the two light waves is half of the wavelength. Since the red light has a longer wavelength, half of the wavelength increases accordingly, which means the dark bands will be more away from the central bright band. 3. The nodal space of the interference pattern decreased, since blue light has a shorter wavelength. 4. Blue has the shorter wavelength, and it was proved when the nodal spacing of the interference pattern became shorter. 5.

After the slit plate was rotated vertically, the light and dark bands were not parallel to each other any more, because after the slit plate was rotated vertically, the top and bottom of the double slits were not in the same vertical straight line. After the slit plate was rotated horizontally, the nodal spacing increased, because the distance between two slits (d) decreased. 7. The pattern of laser interference consisted of light and dark spots, while the pattern of lamp light interference consisted of dark and light bands, because the light of the lamp could diffuse into a wider range of direction, while laser was ollimated, and was directed into a much narrower direction. 8. | Distance |? x1/2 |? x2 |? x3 |? x4 |? x5/2 |? xav | |(m) | | | | | | | | 3m | 0. 0022 | 0. 0051 | 0. 0049 | 0. 0042 | 0. 0025 | 0. 0047 | | 2m | 0. 0020 | 0. 0048 | 0. 0042 | 0. 0039 | 0. 0021 | 0. 0043 | 9. 1. Conclusion: Based on observations gathered during the experiment, the interference pattern of the 40 W lamp consisted of dark and light bands. When red filter was used, the nodal spacing of the pattern increased, and when blue filter was used, the nodal spacing of the pattern decreased. After the slit plate was rotated vertically, the light and dark bands were not parallel to each other any more. After the slit plate was rotated horizontally, the nodal spacing increased. The interference pattern changed into dark and light spots, after laser pointer replaced the lamp as a light source.

The wavelength of the laser was predicted to be And the percentage of error calculated was Experimental Uncertainties: 1. The value of nodal spacing (?

x) measured was not precise because the scale of a meter scale is only accurate to millimetres. 2. The slit plate was not exactly parallel to the screen that interference pattern was shown. 3. The measured nodal spacing (? x) was not precise due to the width of the slit. The d was only the distance between two slits, without including the width of the slit.