Jurnal Penelitian dan Pembelajaran Fisika Indonesia

Original Research Paper

Effect of Gap Width on the Distance between Bright Patterns in Yellow

Amalia Darozatun Rahmawati[1], Dilla Ayu Febrianti[2], Faturahman[3], Adam Malik[4]

[1,2,3,4]Physics Education, FTK, UIN Sunan Gunung Djati, Bandung, Indonesia

Article history
Received: December 18th, 2023
Revised: December 27th, 2023
Accepted: December 30th, 2023

*Corresponding Author:
Amalia Darozatun Rahmawati, Physics Education, FTK, UIN Sunan Gunung Djati, Bandung, Indonesia
Email: 1212070008@student.uinsgd.ac.id

Abstract: This research aims to determine the effect of gap width on the distance between bright patterns in the yellow color experiment. This research was carried out in a virtual laboratory, with the method used is a quantitative method with an experimental method, namely the method used to determine the effect of the independent variable on the dependent variable. Data collection was taken during the practicum using the PhET website in the Wave Interference – Slits section, with yellow light which has a wavelength of around 670-690 nm. The distance between two slits is 1500 nm and three different slit widths are used, namely 500 nm, 600 nm, and 700 nm. This research shows that the smaller the value of the gap width, the greater the value of the dark light pattern. Where, the wider the gap, the denser the light-dark pattern on the screen, and the smaller the gap width, the more sparse the light-dark pattern on the screen.

Keywords: Gap Width; PhET; Dark Light Pattern

Introduction

Physics is a science that underlies other sciences, therefore the concepts of physics are widely applied in other sciences. Physics itself is an experimental method used to determine principles and patterns related to phenomena that often occur in everyday life (Giancoli, 2001).

In studying physics there are always laboratory or practical activities which aim to increase understanding of studying physics concepts. Apart from that, students can also practice abilities and skills in solving problems as well as skills to measure, retrieve, analyze and process data and be able to present experimental results properly and correctly.

Practicum in physics is a learning that can improve students' skills in using practical tools and increase students' understanding of physics concepts (Kholifudin, 2017). Apart from that, practicum can also develop students' scientific performance, and train skills in a process, so that they can achieve the goals of learning (Mubarrok, 2014).

The practical scientific attitude required in basic physics practicum includes knowledge skills and abilities. What is meant by scientific attitude here is that students must have an honest attitude, be able to think critically, be able to solve a problem, and be able to work together with a team. By having all these attitudes, students will be able to participate in practical activities well (Siyoto & Sodik, 2015).

Practicums can be carried out in real or virtual laboratories. With the virtual laboratory, students have the opportunity to carry out practicums using the internet anytime and anywhere. This is very effective because with a web-based format display, students can carry out practical work independently (Jaya, 2012). PhET, a website that allows students to perform physics, chemistry, and biology simulations for learning purposes, is one of the easiest-to-use virtual laboratories (Prihatiningtyas et al., 2013). Because of PhET's ability to carry out simulations ideally, this simulation can help in carrying out real practical activities that cannot be done with actual or real tools (Bhakti et al., 2019; Fithriani et al., 2016).

One of the physical materials that is interesting to practice in the virtual laboratory is light

DOI: 10.29303/jppfi.v5i2.249

interference because light that passes through a gap at a certain distance will experience interference which will give rise to light with dark or light patterns which can increase the concept of understanding for students (Jehadu et al., 2020). Interference is a combination of two or more waves into one new wave that can strengthen or weaken each other (Tsalatsin, 2014). Strengthening waves are waves that have the same phase (Sudiro, 2020), such as peaks and peaks, or valleys and valleys, with the resultant wave having a maximum amplitude. Meanwhile, waves that attenuate each other are waves that have different phases (Faruq et al., 2014), such as peaks and valleys, or valleys and peaks, with the resultant wave having zero amplitude.

Light can experience interference if the light is coherent (Susilayati, 2016), with light having a wavelength (λ) that passes through a narrow gap (d) at a certain separation distance. The equation that fills the light with a bright pattern is.

$$\frac{dp}{L} = m\lambda$$

Light that passes through two slits at a certain distance will be interfered with because the waves have the same frequency. This interference will create dark and light patterns on the screen (Jehadu et al., 2020). The interference principle states that the energy produced cannot be distributed evenly when two waves propagate in almost the same direction with a constant phase difference. However, sometimes it can reach maximum and minimum (Handayani, 2014). So, the aim of this lab is to determine the effect of gap width on the distance between light patterns in the yellow color experiment.

Method

This practicum is carried out in a virtual laboratory or virtual laboratory using the PhET virtual laboratory simulation website where learning is carried out anywhere to understand the concepts, principles, or facts being studied (Hartina et al., 2019). The method used in this research is a quantitative experimental approach to determine the influence of independent variables on the dependent variable and find correlations between changes in the social facts being measured.

Data collection was taken during the practicum using the PhET website in the Wave Interference – Slits section, with yellow light which has a wavelength of around 670-690 nm. The distance between two slits is 1500 nm and three different slit widths are used, namely 500 nm, 600 nm, and 700 nm. For each distance and grid, 5 repeated data are obtained which will be processed, analyzed, and tested for normality of the data..

Result and Discussion

This research discusses the effect of gap width on the distance between bright patterns in yellow color experiments using the PhET virtual laboratory.

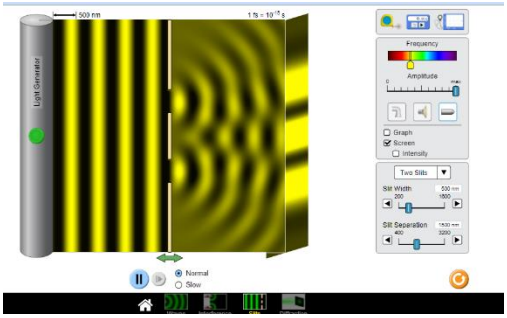

Figure 1. Practical Simulation of Interference With the PHET Virtual Laboratory

The experiment was carried out using the color yellow by taking several number samples on the slit width to determine its effect on the light-dark pattern on the screen (p). The data obtained from observations were then processed, the results obtained are in Table 1.

Table 1. Analysis of the Influence of Gap Width on Light-Dark Patterns

Gap width (nm)	Light Dark Pattern
500	1525.2
600	1225.0
700	1149.2

Table 1 shows that the dark light pattern is influenced by the width of the gap, where the smaller the value of the gap width, the greater the dark light pattern value. Vice versa, the greater the gap width value, the smaller the light-dark pattern value will be.

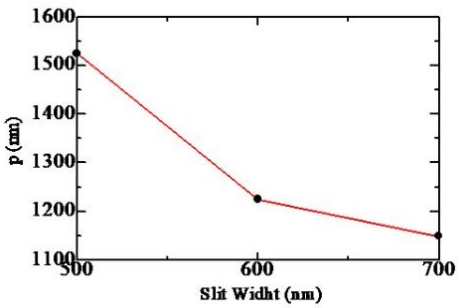

Figure 2. Graph of the Relationship Between Gap Width and Light-Dark Pattern

The shape of the graph as shown in Figure 2 above shows that the width of the gap has an influence on the light-dark pattern produced. Based on this graph, the longer the width of the gap, the denser the light-dark pattern on the screen. Meanwhile, the smaller the gap width, the more sparse the light-dark pattern on the screen. This is similar to the practicum carried out by (Agustina et al., 2022) which states that there are differences in parts of the screen which cause the light-dark pattern to become denser because the double slits in the light reinforce each other or what can be called maximum interference.

Conclusion

The conclusion of the experiment was carried out using the color yellow by taking several number samples on the width of the gap to determine its effect on the light-dark pattern on the screen (p). The results show that the smaller the value of the gap width, the greater the value of the dark light pattern. Conversely, the greater the value of the gap width, the smaller the light-dark pattern value will be. The wider the gap, the denser the light-dark pattern on the screen, the smaller the gap width, the more sparse the light-dark pattern on the screen.

References

Agustina, R. D., Cesariyanti, Y., Putra, R. P., Putri, A., & Dermawan, M. D. S. (2022). Penggunaan PHET Virtual Lab dalam Uji Jarak Pola Gelap Terang pada Interferensi. *WaPFi (Wahana Pendidikan Fisika)*, 7(1), 52–58. Doi: https://doi.org/10.17509/wapfi.v7i2.42974

Faruq, F.A., Lanto, M.S., & Hernawati, H., (2014). Simulasi Gelombang Berjalan Dengan Menggunakan Software Matlab Versi 7.14. *JFT: Jurnal Fisika dan Terapannya*, 18-27. 1(1) Doi: https://doi.org/10.24252/jft.v1i1.15738

Bhakti, Y. B., Astuti, I. A. D., & Dasmo, D. (2019). Peningkatan Kompetensi Guru melalui Pelatihan PhET Simulation bagi Guru MGMP Fisika Kabupaten Serang. *J-ABDIPAMAS: Jurnal Pengabdian Kepada Masyarakat*, 3(2), 55–62. Doi: http://dx.doi.org/10.30734/j-abdipamas.v3i2.574

Fithriani, S. L., Halim, A., & Khaldun, I. (2016). Penggunaan Media Simulasi PhET dengan Pendekatan Inkuiri Terbimbing untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Pokok Bahasan Kalor di SMA Negeri 12 Banda Aceh. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, 4(2), 45–52. Retrieved From: https://jurnal.usk.ac.id/JPSI/article/view/7578

Giancoli, D. C. (2001). *Fisika Edisi Kelima Jilid 1*. In Jakarta: Erlangga.

Handayani, S. L. (2014). Analisis Pola Interferensi Celah Banyak untuk Menentukan Panjang Gelombang Laser He-Ne dan Laser Dioda. Jurnal Fisika, 4(1), 26-31. Doi: https://doi.org/10.15294/jf.v4i1.3862

Hartina, L., Rosidin, U., & Suyatna, A. (2019). Pengaruh Penerapan Instrumen Performance Assessment pada Pembelajaran IPA Berbasis Laboratorium Real terhadap Hasil Belajar Siswa. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 25-32. Doi: 10.29303/jppipa.v6i1.299

Jaya, H. (2012). Pengembangan Laboratorium Virtual untuk Kegiatan Praktikum dan Memfasilitasi Pendidikan Karakter di SMK. *Jurnal Pendidikan Vokasi*, 2(1), 81-90. Doi: https://doi.org/10.21831/jpv.v2i1.1019

Jehadu, V., Warsito, A., Johannes, A. Z., & Louk, A. C. (2020). Visualisasi Fenomena Kombinasi Difraksi dan Interferensi pada Celah Ganda Memanfaatkan Metode Secant Berbasis Pemrograman Delphi. *Jurnal Fisika*, 5(2), 156–162. Retrieved From: https://ejurnal.undana.ac.id/index.php/FISA/article/view/3540

Kholifudin, M. Y. (2017). Sinar Laser Mainan Sebagai Alternatif Sumbar cahaya Monokromatik Praktikum Kisi Difraksi Cahaya. *Jurnal Penelitian Pembelajaran Fisika*, 8(2), 129–134. Doi: https://doi.org/10.26877/jp2f.v8i2.1641

Mubarrok, M. F. (2014). Penerapan pembelajaran fisika pada materi cahaya dengan media PhET simulations untuk meningkatkan pemahaman konsep siswa di SMP. *Inovasi Pendidikan Fisika*, 3(1), 76-80. Retrieved From: https://ejournal.unesa.ac.id/index.php/inovasi-pendidikan-fisika/article/view/7400/7854

Prihatiningtyas, S., Prastowo, T., & Jatmiko, B. (2013). Imlementasi Simulasi PhET dan KIT Sederhana untuk Mengajarkan Keterampilan Psikomotor Siswa pada Pokok Bahasan Alat Optik. *Jurnal Pendidikan IPA Indonesia*, 2(1). 18-22. Doi: https://doi.org/10.15294/jpii.v2i1.2505

Siyoto, S., & Sodik, M. A. (2015). *Dasar Metodologi Penelitian*. Yokyakarta: Literasi Media Publishing.

Sudiro, S. (2020). *Modul Pembelajaran Fisika SMA Kelas XI: Karakteristik Gelombang Mekanik.* Jakarta: Kementerian Pendidikan dan Kebudayaan Direkrotat Jendral Anak Usia Dini, Pendidikan Dasar dan Menengah Direktorat Sekolah Mengah Atas. Retrieved From: https://repositori.kemdikbud.go.id/22211/1/XI_Fisika_KD-3.8_Final.pdf

Susilayati, M. (2016). Difraksi pada Laser: Tafsir atas "Cahaya di atas Cahaya"? SHAHIH: *Journal of Islamicate Multidisciplinary*, 1(2), 193–205. Doi: https://doi.org/10.22515/shahih.v1i2.332

Tsalatsin, M. N. (2014). Penentuan Panjang Gelombang Sinar Menggunakan Interferensi Celah Ganda Sederhana. *Jurnal Fisika*, 4(2). Doi: https://doi.org/10.15294/jf.v4i2.3828