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Double-slit interference with a caliper

Natália Carolina Schvan Wendt[1], **Rodrigo Sanas Zamboni**[1], **Marcia Muller**[1,2] and **José Luís Fabris**[1,2]

[1] Department of Physics, Universidade Tecnológica Federal do Paraná, Curitiba, Brazil
[2] Graduate Program in Electrical and Computer Engineering, Universidade Tecnológica Federal do Paraná, Curitiba, Brazil

E-mail: fabris@utfpr.edu.br

Abstract

The implementation of a simple double-slit for light interference experiments by using just three off-the-shelf, non-optical components is described. Thanks to the simplicity of the assemblage, the distance between the slits and slit width can be easily modified. The device can be used in teaching laboratories for quantitative experiments, as well as in demonstration classes.

Keywords: light interference, double-slit, single-slit

1. Introduction

In the early 1800s, Thomas Young performed a memorable experiment that contributed to the establishment of the wave nature of light. He divided a partially spatially coherent beam of sunlight emerging from a small aperture, and combined the two obtained coherent beams onto a screen. The resulting pattern showing alternate bright and dark fringes could only be explained by admitting that the two beams behaved as light waves, interfering when superimposed. Owing to the historic and scientific meaning of the experiment, it is well discussed in most physics textbooks [1].

When light interference phenomena are explored nowadays in teaching laboratories, they normally rely on the use of commercial double-slits under laser incidence, plus a projection screen placed at the focal distance of a converging lens positioned right after the slits. However, fringes are difficult to distinguish at short distance, and moving the screen away makes the intensity of the pattern fade. Attempts have been made to work out the issues using, e.g. optical components not always readily available [2], microscope glass slide blackened with some sort of ink and scratched to form two close slits commonly irregular and inaccurately apart from each other [3], graphic art films to produce double-slits requiring several steps from project to production, as well as the use of a high resolution image setter [4].

In this work, a double-slit was built with a caliper and a pencil lead wrapped in printer paper. The resulting interference-diffraction pattern was used to experimentally determine the diameter of the lead and the thickness of the paper which compose the double-slit.

