Low-cost experiment to measure the speed of light

Faraz Mehdi[1,2] and Kiran M. Kolwankar[2]

[1] Department of Physics, University of Mumbai, Santa Cruz (E), Mumbai 400 098, India

[2] Department of Physics, Ramniranjan Jhunjhunwala College, Ghatkopar (W), Mumbai 400 086, India

farazmehdi786@gmail.com, Kiran.Kolwankar@gmail.com

Submitted 15-11-2020

Abstract

In this paper, we demonstrate a low-cost method to measure the speed of light. It uses instruments which are readily available in any undergraduate laboratory in a developing country and some components which are inexpensive. The method is direct as it measures the time of flight of the LASER beam and easy to implement. It will allow students to verify the finite value of the speed of light first hand. It can be part of the undergraduate syllabus as a regular experiment or a demonstration experiment.

1 Introduction

Light travels exceedingly fast. This lead to the belief among the earlier researchers that it travels with infinite speed. To fathom the fact that it travels with finite speed, though very large as compared to the everyday objects, was difficult at those times and, even now, it poses a barrier among the young students studying science. As a result, it would be of interest to have an experiment in which the students can themselves measure the speed of light directly and verify that it is finite.

There are different ways to estimate the speed of light but most of them are either hard to perform in the given time, e.g., the experiments consisting of a rotating mirror based on the principle proposed by Fizeau and Foucault, or they are too expensive e.g., the use of pulsed LASER to measure the speed of light. There are commercially available set-ups for undergraduate laboratories but they cost usually in several lakhs of rupees. We present here an experiment which measures the time of flight of a modulated laser beam over a distance. Given the instruments like an oscilloscope (or a DSO), power supplies and a signal generator, which are readily available in any undergraduate lab-