

Fiber Optic Speed of Light Kit

Lab Project

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Outline

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Purpose and Hypothesis

- Purpose: Examine the relationship between wavelength (λ) and speed of light in a vacuum (c)
- Hypothesis: The speed of light is independent of wavelength



- Speed of Light Apparatus
- Short and long fiber optic cables
- Dual-channel oscilloscope
- Red, green, blue, and infrared LEDs
- Soldering iron and solder sucker



Procedures

- 1 Polish ends of fiber optic cables
- 2 Desolder pins connecting LED to the kit
- 3 Measure short cable length
- 4 Measure mass of both cables
- 5 Connect speed of light kit and oscilloscope together
- 6 Calibrate kit using the short cable
- 7 Measure time for light to travel through long cable
- 8 Repeat for different colored LEDs



Equations

Light slows down in the cable

$$c = nv \quad (1)$$

Long cable length can be determined with linear density

$$L = \frac{M}{\mu} = \frac{Ml}{m} \quad (2)$$

Speed is distance traveled divided by time

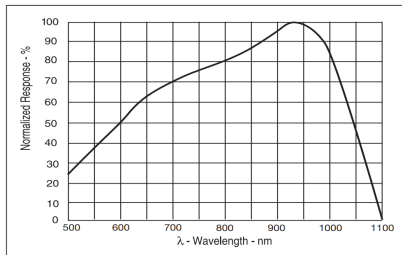
$$v = \frac{L}{t} \quad (3)$$

Combining these equations together

$$c = \frac{nMl}{tm} \quad (4)$$

Results

- Red light worked fine ($c = (2.93 \pm 0.07) \times 10^8$ m/s)
- Blue and green light not detected through short cable (photodetector less sensitive to lower visible wavelengths)
- Infrared light not detected through long cable (dissipating earlier)
- Infrared light not detected clearly through shortened cables (switching time not fast enough)



Conclusions

- Not enough data to support or reject hypothesis
- Speed of Light Kit is a one-trick pony

