The Relativistic Doppler Effect

S. Smith February 1st 2010

Abstract

Since the publication of Einstein's paper in 1905 "On the Electrodynamics of moving bodies" it has been generally accepted that a relative shortening occurs to any object that is moving at or around the velocity of light. This effect also influences electrodynamic radiation, whereby the wavelength of an electromagnetic ray is shortened resulting in a shifting of the emitted radiation towards the blue end of the spectrum. This theoretical effect has been termed and is commonly known to researchers in the field as the Relativistic Doppler Effect. Taking into consideration that the existence of this effect if observed would offer definitive validation of Einstein's theory of Special Relativity, up to this point in time the effect has not been observed and is largely theoretical. The definitive experimental proof of the existence of the Relativistic Doppler Effect would explicitly demand by inference that the existence of length contraction as tacitly suggested by Einstein must occur. In the event that the effect is not observed this would explicitly infer that length contraction does not occur and subsequently Einstein's prediction is in error. Contained herein is a simple experiment that has been performed repeatedly the consistent results of which tend to suggest that the effect if it actually exists, values could fall within the realms of experimental error.

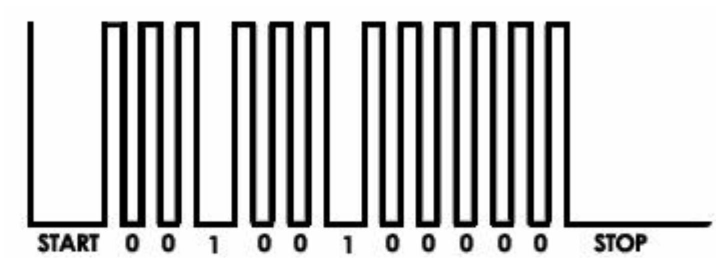
Introduction

When an electromagnetic beam of radiation is transmitted from an emitter and received by a detector should length contraction occur the infra red beam itself would also be shortened resulting in a wavelength change. If the wavelength of the beam falls outside of the narrow operating parameters the beam itself will not be recognized by the detector yielding a negative result. If however the transmitted wavelength of the electromagnetic beam falls within the initial parameters of the devices the beam will be received by the detector which will trigger a positive result displayed on a computer. This exact principle is most commonly used in infra red remote controls for domestic devices such as televisions and audio systems.

In order for this to be achieved the electromagnetic beam travelling close to the speed of light must be modulated with a digital signal to act as a trigger to enable detection of the beam itself by the receiver and provide the result of any interaction on a computer screen. To conduct the experiment in the laboratory an electronic device or emitter of a focused source of infra red radiation is chosen of a fixed and definitive wavelength. The wavelength of the chosen discreet electronic emitter falls within a bandwidth of .8 and 1 micrometer typically 980 nanometers. A matching electronic device, a detector is required which also falls within the identical range of values. This electronic detector is connected to a computer enabling the reception and analysis of the infra red beam sent by the emitter. Further the transmitted beam is caused to be modulated by a digital signal at 36 khz which acts a trigger which will be received by the detector and translated by the computer showing the result of any operation. Caution was exercised in the use of the emitter to ensure that beam scattering does not occur which would influence the results of the experiment.

METHOD

The encoding method used for the trigger signal is space modulated the signal consists of 1 start pulse followed by seven pulses indicating the command a further four pulses indicating the device id and ending with one stop pulse.



In the interests of accuracy the experiment was performed in two parts;

1) The infrared transmitter is placed at the origin of a system of coordinates which shall be referred to as point "A". One centimeter from the transmitter an infrared detector is positioned at point "B" to receive the infra red beam. Upon causing the transmission of an infra red beam containing a modulated signal to be emitted by the transmitter, the resultant beam and trigger signal will be received by the detector with the results displayed being on the screen of the computer connected to the detector.
2) The second stage of the experiment involves the placement of a reflective surface at point "B" to deflect the beam at an angle of forty five degrees to the emitter and the detector being now positioned at point "C" in the same plane as the emitter also at a forty five degree angle to the reflecting surface and ninety degrees to the emitter.
3) The experiment was conducted several more times with the transmitter being at different distances from the mirror and the detector from 1 centimeter up to 1 meter.

Upon performing the experiment it was found that upon transmission of an infra red beam with a corresponding trigger signal it was unimportant whether the beam was reflected or not the trigger signal was always received by the detector and relayed to the computer one hundred percent of the time. Calculation of the shift predicted by Einstein, as often happens, will approach infinity the closer the velocity of the infra red carrier wave to the speed of light;

$$v_{source} = 36 * 10^3 \text{Hz}$$

$$v_{observed} = v_{source} \sqrt{\frac{1-v/c}{1+v/c}} = \text{to } \infty$$

$$\frac{\Delta v}{v_{source}} = \frac{v_0 - v_s}{v_s} = \text{to } \infty$$

$$\Delta v = \text{to } \infty$$

$$\text{for } \lambda_{\text{source}} = \text{to } \infty$$

$$\lambda_{\text{observed}} = \lambda_{\text{source}} \sqrt{\frac{1-v/c}{1+v/c}} = \text{to } \infty$$

$$\Delta\lambda = \text{to } \infty$$

$$z = \frac{\Delta\lambda}{\lambda_{\text{source}}} = -1 \text{ to } 1$$

The result of the frequency change of the trigger pulse according to Einstein's calculations will vary wildly up to infinity which would mean the detector would fail to read the transmitted pulse. Not only will the pulse frequency change but also the carrier wavelength and frequency.

Similarly is applying the same calculations the frequency of the carrier wave will again vary up to infinity depending again upon the velocity of the infra red beam.

RESULTS

It is apparent from the results that should length contraction occur it could only be between the narrow tolerances of the discreet components known to be 20 nanometers. Should the deviation of the wavelength of the infra red beam fall outside 20 nanometers the detector would not be triggered which has been seen not to be the case. The length contraction will also reduce the frequency of the modulated trigger pulse by infinity this frequency change will cause a significant corruption of the trigger signal. It is indeed impossible to imagine that both the frequency and wavelength of the carrier and trigger and the velocity of infra red radiation coincidentally fall within the exact operating parameters 100% of the time as such the theory of length contraction must be considered untenable.

DISCUSSION

It must be considered that this experiment establishes an upper limit on the magnitude of the Relativistic Doppler Effect of 20 nanometers which falls well outside of the predictions of Einstein and does not support Einstein's hypothesis of length contraction. Rather it tends to suggest that the values could actually fall within the realms of experimental error and that Relativistic Doppler Effect does not actually occur.

REFERENCES

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