Microwave Resonance and Doppler Effect

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A standing wave can be formed in a microwave resonator if the length of the resonator is equal to one half of the wavelength multiplied by an integer. Two observers moving at the same speed will observe the resonator of the same length. They will also observe the same wavelength as the wavelength is proportional to the length of the resonator. If one observer moves in the opposite direction, they will observe an identical wavelength but two different frequencies due to the Doppler effect. Therefore, the apparent speed of the microwave appears to be different for these two observers.

I. INTRODUCTION

A standing wave can be formed between the wave transmitter and the reflector if one half of the wavelength multiplied by an integer is equal to the distance between the transmitter and the reflector. The standing wave exhibits the first harmonic if the distance is equal to one half of the wavelength. The standing wave exhibits the second harmonic if the distance is equal to the wavelength.

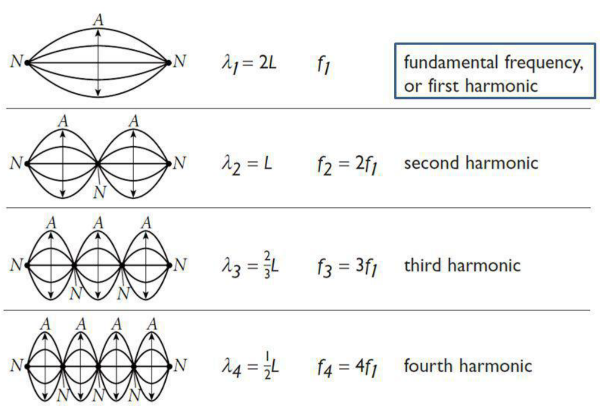

FIG. 1. Standing Wave harmonic

This proportionality between the wavelength and the distance indicates that the length contraction from Lorentz transformation[1] should be applied to both the distance and the wavelength. Such length contraction depends on the speed of the relative motion, not the direction of the motion.

Two observers in motion relative to a stationary standing wave will observe the same wavelength if they move with the same speed but in the opposite direction.

II. PROOF

Consider one dimensional motion.

A. Standing Wave

Let a microwave transmitter and a reflector plate be stationary relative to a reference frame F_0. The microwave is emitted in the positive x direction toward the reflector which is in the y-z plane. Let the wavelength of the coherent microwave be λ. The distance between the transmitter and the reflector is d.

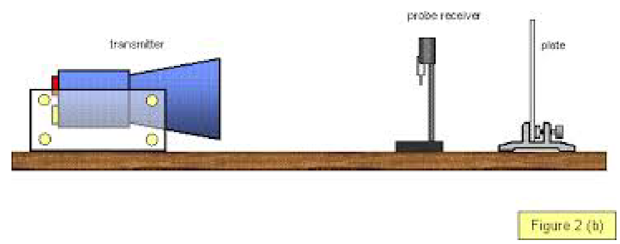

FIG. 2. Microwave Transmitter and Reflector Plate

The condition for the standing wave is

$$n\frac{\lambda}{2} = d \tag{1}$$

n is a positive integer.

B. Length Contraction

The laws of physics are conserved in all inertial frames of reference.

Let another reference frame F_1 moves at a constant velocity of (v,0) relative to F_0. The standing wave in F_1 is represented by

$$n\frac{\lambda_1}{2} = d_1 \tag{2}$$

Let another reference frame F_2 moves at a constant velocity of (-v,0) relative to F_0. The standing wave in F_2 is represented by

$$n\frac{\lambda_2}{2} = d_2 \tag{3}$$

According to Lorentz transformation, length contraction is independent of the direction of the relative motion.

$$d_1 = d_2 \tag{4}$$

From equations (2,3,4),

$$\lambda_1 = \lambda_2 \tag{5}$$

The wavelength is conserved in both F_1 and F_2.

C. Doppler Effect

To a stationary observer in F_1, the transmitter is moving away while emitting the microwave at an apparent frequency f_1. To a stationary observer in F_2, the transmitter is moving closer while emitting the microwave at an apparent frequency f_2.

According to the Doppler effect,

$$f_1 < f_2 \tag{6}$$

The apparent frequency of the microwave decreases in F_1 but increases in F_2.

D. Speed of Microwave

The speed of microwave in F_1 is C_1.

$$C_1 = f_1 * \lambda_1 \tag{7}$$

The speed of microwave in F_2 is C_2.

$$C_2 = f_2 * \lambda_2 \tag{8}$$

From equations (5,6,7,8),

$$C_1 < C_2 \tag{9}$$

The apparent speed of the microwave decreases in F_1 but increases in F_2.

III. CONCLUSION

The apparent speed of microwave is different in a different reference frame. The speed of microwave in the rest frame of the observer depends on the relative motion between the observer and the transmitter.

A stationary standing wave shows that the wavelength of its microwave is conserved for two observers moving at the same speed but in the opposite direction. These observers detect an identical wavelength but two different frequencies. Therefore, they observe two different speeds from the same microwave.

Lorentz transformation is based on the assumption that the speed of light is identical in all inertial reference frames. This is proved to be incorrect by the standing wave from a microwave resonance. Lorentz transformation has contradicted itself with its assumption of length contraction.

Therefore, Lorentz transformation fails to describe physics properly. It is an impractical mathematical description not for the real world. It is not suitable for physics. All theories that are based on Lorentz transformation are proved to be unsuitable for physics.

[1] H. R. Brown (2001), The origin of length contraction: 1. The FitzGeraldLorentz deformation hypothesis, American Journal of Physics 69, 10441054. E-prints: gr-qc/0104032; PITT-PHIL-SCI00000218.

[2] Eric Su: List of Publications, http://vixra.org/author/eric_su