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The Doppler Effect at Photon Emission

Ph.M. Kanarev kanphil@mail.kuban.ru

The Kuban State Agrarian University, Department of Theoretical Mechanics
13, Kalinin St., 350044 Krasnodar, Russia

Abstract: It is shown that the Doppler Effect calculation at photon emission is possible only with the help of classical mathematical models.

Keywords: The Lorentz transformations, the Doppler Effect, infrared and ultraviolet shift of the spectra, velocity of light, velocity of source.

Introduction

The results of our investigations confirm Albert Einstein's correctness in his dispute with Niels Bohr.[1-3] Einstein's answer to the venerators of his talent has proved to be a prophetic one: "It seems to them that I look at the results of my life with a halcyon satisfaction. But everything is to the contrary if examined closely. There exists no concept, in relation to which I am sure that it will remain inviolable, and I am not convinced that I am on the right track." (Ref. [4], page 16). The following facts confirm equity of these words. There are two interpretations of this effect: the relativistic interpretation and the classical one.[3],[5-7]

The Relativistic Interpretation of the Doppler Effect

The relativistic interpretation is based on the second of Einstein's postulate [8]: *Any ray of light moves in the stationary system of co-ordinates with the determined velocity, whether the ray be emitted by a stationary or a moving body.* The Lorentz transformations originate from this wording of the postulate [2-3] as

$$x' = \frac{x - Vt}{\sqrt{1 - V^2 / C^2}} ; \quad (1)$$

$$t' = \frac{t - Vx / C^2}{\sqrt{1 - V^2 / C^2}} , \quad (2)$$

where x' and x are spatial intervals measured in moving $X'O'Y'$ and stationary XOY reference systems, respectively (Figure 1), t' and t is time measured in moving and stationary reference systems, respectively, V is the traverse speed of moving reference system, and C is velocity of light.

Table 1. Relativistic results of calculation of the Doppler Effect

$\beta = V / C$	ν' / ν (5)	ν / ν' (6)
0.000001	1.0000009	0.9999989
0.00001	1.0000099	0.9999899
0.0001	1.0000999	0.9998999
0.001	1.0010004	0.9990004
0.01	1.0100504	0.9900494
0.1	1.1055415	0.9045340

The results of Table 1 show unambiguously that frequency ν' of the emitted photon is increased with the increase of velocity V of movement of the reference system (for example, of a star). It means that an ultraviolet shift of the spectral lines is increased. Physical sense being present in mathematical symbols ν', ν and β deprives us of the right to give another interpretation of the mathematical models (5) and (6).

Thus, we have got an unambiguous answer: the relativistic mathematical models (5) and (6) describe only ultraviolet shift of the spectra, and they are not connected with their infrared shift [5].

In science, the Lorentz transformations (1) and (2) have been used for the calculation of the so called relativistic effects for about a hundred years. Now we get to know that they give the possibility to calculate the relativistic effects only for the ultraviolet shift of the spectra and provide no information concerning the relativistic effects by the infrared shift of the spectra. It means that the Lorentz transformations misrepresent the reality. Now we can check this fact using the axiom of space-matter-time unity [2], [3].

Let us pay attention to the fact that formula (1) has coordinate x' , which is fixed in the moving reference system (Fig. 1), and formula (2) has time t' , which flows in the same reference system. Thus, in mathematical formulas (1) and (2) an oscillating quantity of the spatial interval x' in the moving reference system is separated from time t' , which flows in this reference system. As in reality it is impossible to separate space from time, it is impossible to analyze these equations separately. This is a set of equations, and it is necessary to analyze them together. This analysis alone will correspond to the axiom of space-matter-time unity, and the results of such analysis alone will reflect reality.

It results from equation (1) implicitly that by $V \rightarrow C$ the spatial interval value x' is reduced. Thereof modern physicists make a conclusion that the spatial interval value x' is reduced with the increase of velocity V of movement of the moving reference system. Then, they take one equation (2) for the analysis¹. It appears from this implicitly that by $V \rightarrow C$ the spatial interval value t' is reduced. Thereof they make a conclusion that if traverse velocity of the moving reference system is increased, flow rate of time t' in it is reduced.

Let us correct erroneous interpretation. As in reality it is impossible to separate space from time, let us analyze equations (1) and (2) together; for this purpose, let us divide the first one by the second one; as a result, we'll have

$$\frac{x'}{t'} = \frac{x - Vt}{t - Vx / C^2}. \quad (7)$$

Now mathematical formula (7) reflects dependence of coordinate x' on time t' . It appears from this that formula (7) operates within the framework of the axiom of space-matter-time unity, i.e. within the framework of reality.

¹ (i.e. they separate time t' from spatial interval x')

It is clear from figure 1 that $x = C \cdot t$ is the coordinate of position of a light signal in the stationary reference system. If we insert $x = C \cdot t$ in the given formula (7), we'll get coordinate $x' = C \cdot t'$, which positions the light signal in the moving reference system. Where is this signal situated? As we change coordinates x and x' , in time t and t' it is situated on coinciding axes OX and $O'X'$, i.e. in point K (Fig. 1). Geometrical sense of the Lorentz transformations is very simple. Coordinate x' of point K in the moving reference system and its coordinate x in the stationary reference system are positioned in them. It is a crossing point of a light sphere with axes OX and $O'X'$ (figure 1). **This is the essence of the Lorentz transformations. There is no other information in these transformations, and they reflect no physical effects** [2],[3].

Classical Interpretation of the Doppler Effect at Photon Emission

We have already shown that total energy of the photon is equal to the sum of energies of its translational motion $mC^2/2$ and rotational motion $h\nu/2$ and that this amount depends on the value of speed V and direction of radiation source motion C [1], [2], [3]. If the angle between the direction of velocity vector of source motion V and the direction of velocity vector of the photon being emitted (Fig.2) is equal α , total energy of the emitted photon will be written in the following way [7].

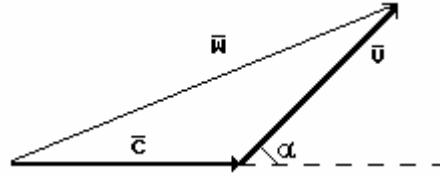


Figure 2. Diagram of addition of velocities of the source and the photon

$$h\nu' = \frac{1}{2}m|\vec{C} + \vec{V}|^2 + \frac{1}{2}h\nu = \frac{1}{2}m(C^2 + V^2 + 2VC \cos \alpha) + \frac{1}{2}h\nu. \quad (8)$$

If we take into account that $m = h\nu/C^2$ and designate $\beta = V/C$, we'll find after conversion of the equation (8)

$$h\nu' = \frac{h\nu}{2}(2 + \beta^2 + 2\beta \cos \alpha). \quad (9)$$

If the directions of the motion of the source and the photon being emitted coincide, it means that $\alpha = 0$ and

$$\frac{\nu'}{\nu} = 1 + \beta + \beta^2/2. \quad (10)$$

When the directions of the motion of the source and the photon being emitted are counter, it means that $\alpha = 180^\circ$ and

$$\frac{\nu'}{\nu} = 1 - \beta + \beta^2/2. \quad (11)$$

In Table 2, the calculation results are given according to the classical formulas (10) and (11) and relativistic formulas (5) and (6). Analysis of this table shows that the classical formula (10)

gives the result, which is close to the result of the relativistic formula (5), and classical formula (11) gives the result, for which there is no relativistic formula,

Relativists use the formula (6) for the calculation of the infrared shift of the spectra having no mathematical right for it. Such right and such accuracy are given by the classical mathematical formula (11) (Table 2).

Table 2. Calculation results of Doppler Effect

$\beta = V / C$	ν' / ν (10)	ν' / ν (11)	ν' / ν (5)	ν / ν' (6)
0.000001	1.0000010	0.9999990	1.0000009	0.9999989
0.00001	1.0000100	0.9999900	1.0000099	0.9999899
0.0001	1.0001000	0.9999000	1.0000999	0.9998999
0.001	1.0010005	0.9990005	1.0010004	0.9990004
0.01	1.0100500	0.9900500	1.0100504	0.9900494
0.1	1.1050000	0.9050000	1.1055415	0.9045340

The results of the simultaneous registration of the usual spectral lines of the hydrogen atom received from the space object SS433 and the spectral lines shifted to the ultraviolet and infrared field of the spectrum can serve as an experimental fact, which confirms equity of mathematical models (10) and (11) [9]. It proves the fact that the main part of the space object SS433 is stationary in relation to space, and two other parts move in relation to space. The part, which generates the ultraviolet shift, moves to the Earth, and the part, which generates the infrared shift at that time, moves from the Earth. Periodicity of the change of values of these shifts is registered [9].

Conclusion

The relativistic mathematical model (6), which originates from the Lorentz transformations, has nothing to do with the Doppler Effect. The ultraviolet and infrared shifts of the spectra describe the classical mathematical models (10) and (11) only.

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