Frequency shift effect of the relativity of complex electromotive time-space

Yingtao Yang
(Toronto, Canada, former employing institution: Xi’an Institute of China Coal Technology and Engineering Group Corp)
Yangyingtao2012@hotmail.com

Abstract: Based on the relativity of complex electromotive time-space, the paper deduced that the frequency of electromagnetic wave is related not only to the relative velocity of the reference system, but also to the potential of the reference system, that is, the effect of frequency shift. The redshift effect of ele3ctric potential and Doppler effect of the special relativity are its special cases. The redshift effect of electric potential is a new redshift, and plays an important role in cosmology.

Keywords: relativity of complex electromotive time-space; effect of frequency shift; complex motion; redshift effect of electric potential; Doppler effect

For a relatively steady observatory A, the frequency ν of electromagnetic wave from a steady radiation source and the frequency ν′ from a moving radiation source are different. We can get the equation of Doppler effect of the relativity [1]:

$$\nu' = \frac{\sqrt{1-\frac{v^2}{{c_0}^2}}}{1-\frac{v}{c_0}\cos\theta}\nu \qquad (1)$$

Where, v is the motion velocity of a radiation source relative to the observer, θ is the included angle between v and the linking lines of the observer and the radiation source.

Now we discuss that the reference system where the radiation source is located is a complex electromotive inertial reference system [2], that is, relative to the observer, it has not only relative motion velocity, but also relative electric potential. Considering the factor of electric potential, applying the method used in the reference [1], conducting again deduction, we can get the formula for frequency shift of the relativity of complex electromotive time-space.

As shown in figure 1, suppose the motion velocity of a satellite is v, relative to the observer, the electric potential of the satellite is ϕ, in the interior there is a set of electromagnetic wave generator, the generator emits pulses in its static system. Two successive pulses are emitted from the positions x_1 *and* x_2, their emission moments are recorded as $t_1$and t_2. The time interval of the two pulses is τ and is equal to $1/\nu$ in the inertial system of the satellite, but in the inertial system of the observer is γ time bigger than $1/\nu$.

Here, γ is the factor of time expansion. And according to the formula of time expansion of the relativity of complex electromotive time-space [2], there is：

$$t_1 - t_2 = \gamma\tau = \gamma/\nu \tag{2}$$

Where， $$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{{c_0}^2}-\frac{\phi^2}{{\phi_0}^2}}} \tag{3}$$

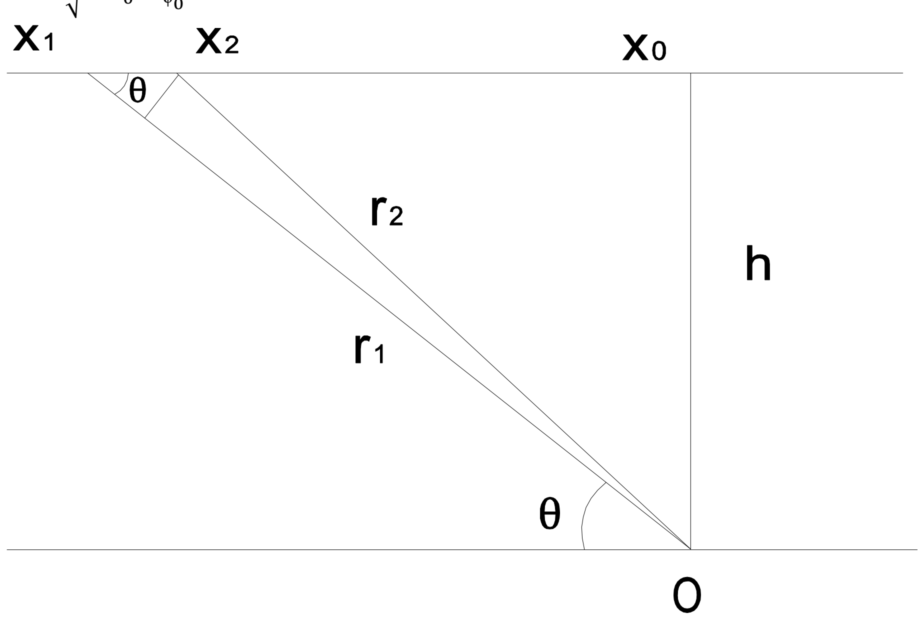

Fig.1

ϕ_0 is the limit electric potential；

V is the motion velocity of the satellite；

The time required for the two pulses to arrive at point o is respectively $\frac{r_1}{c_0}$ and r_2/c_0， therefore, the measured time interval τ' between them is defined by the following equation：

$$\tau' = t_2 + \frac{r_2}{c_0} - t_1 - \frac{r_1}{c_0} = \gamma\tau - \frac{r_1 - r_2}{c_0} \tag{4}$$

When the period of electromagnetic signal is very short, $x_2 - x_1$ is very small， if the distance $x_2 - x_1$ is much smaller than r_1, there is：

$$r_1 - r_2 \approx (x_2 - x_1)\cos\theta = v\gamma\tau\cos\theta \tag{5}$$

Therefore by substituting it into equation(4), we get：

$$\tau' = \gamma\tau\left(1 - \frac{v\cos\theta}{c_0}\right) \tag{6}$$

Because $\nu' = \frac{1}{\tau'}$， $\nu = \frac{1}{\tau}$， so the formula for frequency shift effect of the relativity of complex electromotive time-space is:

$$\nu' = \frac{\sqrt{1-\frac{v^2}{c_0{}^2}-\frac{\phi^2}{\phi_0{}^2}}}{1-\frac{v}{c_0}\cos\theta}\nu \tag{7}$$

When $\phi = 0$， we get the formula for Doppler effect of the special relativity.

When $v = 0$， we get the formula for frequency shift effect of the relativity of electric potential：

$$\nu' = \nu\sqrt{1-\frac{\phi^2}{\phi_0{}^2}} \tag{8}$$

The redshift Z induced by Doppler effect of the relativity of complex electromotive time-space is：

$$z = \frac{\nu-\nu'}{\nu'} = \frac{1-\frac{v}{c_0}\cos\theta}{\sqrt{1-\frac{v^2}{c_0{}^2}-\frac{\phi^2}{\phi_0{}^2}}} - 1 \tag{9}$$

When $v = 0$，we get the formula for redshift Z of electric potential:

$$z = \frac{1}{\sqrt{1-\frac{\phi^2}{\phi_0{}^2}}} - 1 \tag{10}$$

The frequency shift effect of the relativity of electric potential is related to the absolute value of electric potential and not related to the polarity (positive or negative) of electric potential. It is can be seen that$z \geq 0$. Therefore, the frequency shift effect induced by electric potential is only redshift, not blue shift. So it is called redshift effect of electric potential. The effect has important application in cosmology, and will be discussed in other paper.

References:

[1] Special relativity, written by A.P. French, translated by Zhang Dawei, Press of People’s Education, first edition, Jun 1976, P150-P152

[2] Yingtao Yang, The basic effect of the relativity of electromotive time-space, National Library of Science, www.nstl.gov.cn/preprint