Revisited Pound-Rebka experiment shows Einstein's relativity is just an inaccurate approximation to reality

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The Pound-Rebka experiment is a famous experiment to test the theory of general relativity and is taken as paradigm for probing that Einstein's relativity is true. In this experiment there are two Doppler effects involved, namely the gravitational Doppler effect predicted by GR (General Relativity) and the inertial Doppler effect predicted by SR (Special Relativity). Each kind of effect is modelled by its own equations. In this experiment, the aim was to balance both effects in order to attain a null effective Doopler effect, so electromagnetic frequency resulted to yield the same measured value as the original emitted frequency. That implied that if photons were emitted from the top of the tower towards the ground detector, the gravitational Doppler effect would be a Doppler blue shitf, it is to say, a frequency increase. But, if those photons were emitted fron the ground towards the top of the tower, the detector sited in that top would measure a lower frequency for the same gravitacional Doppler effect. In order to achieve the relative inertial movement required by SR, the emission source of photons was placed in the center of a loudspeaker cone, so by vibrating the speaker cone the source moved with varying speed, thus creating varying Doppler shifts.

I. INTRODUCTION: GALILEAN RELATIVITY PREDICTION

The distance photons had to travel was $h = 22.6$ meters. The fractional change in energy is given by $\delta E/E = gh/c^2 = 2.5\times10^{-15}$. From the Galilean Relativity it is very easy to set the theoretical formalisms that can model the balance of those two Doopler effects. The difference of gravitational potential that a photon has to hop is $\Delta\phi = gh$, therefore, the gravitational Doppler effect is modelled in this way:

$$f = f_0 \exp\left(-\frac{\Delta\phi}{c^2}\right) \tag{1}$$

where obviously f isthe measured frequency and f_0 is the original emitted frequency. At the same time, and as we already know, the inertial Doppler effect es modelled in Galilean Relaivity in this way:

$$f = f_0 \exp\left(\frac{v}{c}\right) \tag{2}$$

Since the aim of the Pound-Rebka experiment is to balance both kinds of effects, so the observed frequency matched the original one, we must compose both frequencies as:

$$f = f_0 \exp\left(\frac{v}{c}\right) \exp\left(-\frac{\Delta\phi}{c^2}\right) \tag{3}$$

and the observed frequency must match the original frequency , $f = f_0$, so we must verify that

$$\exp\left(\frac{v}{c}\right) \exp\left(-\frac{\Delta\phi}{c^2}\right) = 1 \tag{4}$$

and after some easy algebraic steps:

$$\exp\left(\frac{v}{c} - \frac{\Delta\phi}{c^2}\right) = 1 \tag{5}$$

$$\frac{v}{c} - \frac{\Delta\phi}{c^2} = 0 \tag{6}$$

$$v = \frac{\Delta\phi}{c} \tag{7}$$

we arrive to this simple estimation:

$$v = \frac{gh}{c} \approx 7.5 \times 10^{-7} \text{ m/s} \tag{8}$$

that was what experimentally was set as input data, because that was the mean speed to which the loudspeaker cone vibrated. We can probe in which such a simple and natural way both effects are balanced in this model that use exponentials.

II. EINSTEIN'S RELATIVITY PREDICTION

Let"s see now how tricky and awkward Einstein formalisms under SR and GR assumptions can be. For intertial Doppler effect we have under SR:

$$f = f_0 \sqrt{\frac{1+\frac{v}{c}}{1-\frac{v}{c}}} \tag{9}$$

For the gravitational Doppler effect we get an equation derived from GR formalisms as:

$$f = f_0 \sqrt{\frac{1 - \dfrac{2GM}{(R+h)c^2}}{1 - \dfrac{2GM}{Rc^2}}} \tag{10}$$

where M and R are the Earth mass and its radius respectively. So, in order to balance both Doppler effects we have under these assumptions:

$$\sqrt{\left(\frac{1 + \dfrac{v}{c}}{1 - \dfrac{v}{c}}\right)\left(\frac{1 - \dfrac{2GM}{(R+h)c^2}}{1 - \dfrac{2GM}{Rc^2}}\right)} = 1 \tag{11}$$

That eyesore written above shows us the cumbersome formalism used in Einstein's relativity. And that roughness and ugliness in the equations can only show us that there is more truth in the Galilean formalisms presented above than in those of SR and GR.

In this latter and ugly equation we arrive to the experimental result if we asume a height $h \ll R$, that is to say, we arrive, though in a very approximated manner, to the inertial speed

$$v \approx \frac{gh}{c} \approx 7.5 \times 10^{-7} \text{ m/s} \tag{12}$$

By the way, that will never be true if h approaches R, But, in the context of Galilean Relativity, that prediction is always true regardless the value of h with respect to the value of R.

Regards

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