Report on the Evaluation of Chapter 31 Relativity in "The Grand Unified Theory of Classical Physics" by Dr. Randell L. Mills

Prepared by

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Executive Summary

In my analysis, I verified calculations and equations involving the theory of Relativity found in Chapter 31 of the book "The Grand Unified Theory of Classical Physics" (January 2020 edition) by Dr. Randell L. Mills. I verified equations and calculations to a high degree of accuracy that are associated with this process. There is a remarkable agreement between the GUTCP calculated equations and the equations I get from my calculations. I verified all the equations from 31.1 through 31.28.

Purpose

Chapter 31 starts with a discussion of inertial reference frames. Frames of reference are very important in Physics since all measurements and all motion are measured relative to a given frame of reference. In fact, the law of propagation of a wavefront is measured with respect to an inertial frame of reference.

The Theory of Special Relativity is based on two postulates – 1) the principle of relativity and 2) the postulate that the velocity of light is independent of the velocity of its source. The Theory of Special Relativity is based on inertial frames. The second postulate also leads to the general postulate that there exists a maximum speed for the propagation of any phenomena, notably, the speed of light in free space. Even gravity interactions propagate at the speed of light – the universal speed limit of the universe.

Now let there be two inertial reference frames, one moving with respect to the other. The set of transformation equations relating measurements made in one reference frame (x,y,z,t) to measurements made in the other frame (x',y',z',t') are known as the Galileo transformations. Here, t=t' and time is considered absolute – all observers measure the same time no matter what reference frame they are in. Also 3-dimensional lengths in one reference frame equal 3-dimensional lengths in the other frame – so 3-dimensional lengths are preserved.

Galileo transformations work for Newtonian laws of mechanics (accelerations equal each other in the two reference frames, whereas coordinates and velocities do not agree). But Galileo transformations do not work when the propagation of light is considered. The Galileo transformations are not consistent with the second postulate of relativity and are not consistent with Maxwell's Equations. Historically, to make the Galileo transformations work with light, a medium that light moved in was invented in the 1800's (called the "Ether"). In 1887 the Michelson-Morley experiment showed persuasively that the Ether was not there, since no effect of the motion of the Earth through the Ether could be seen on the speed of Light. Without an Ether, the Galileo transformations were no longer valid for light and Maxwell's Equations. So a new set of transformations were found that would be consistent with the relativity second postulate and would transform Maxwell's Equations correctly.

The new transformations are known as the Lorentz Transformations. One of the effects predicted by them is time dilation. Now $t \neq t'$ and time passage depends on the speed of a clock measuring the time interval. Time dilation is derived in Chapter 31 using two parallel, horizontal mirrors and a light pulse travelling vertically between them. What we find is that time measured on a moving clock runs slower than time measured on a clock that's stationary with respect to us. This is exactly the time dilation described by Special Relativity.

There are two kinds of spaces in Relativity: 1) flat, Galilean space, and 2) non-uniform, curved, Riemannian space. The differences in these two kinds of spaces are discussed at the end of Chapter 31. Flat, Galilean space is described by the Lorentz Transformation and forms the basis of Special Relativity. On the other hand, curved, Riemannian space is used in General Relativity. In General Relativity matter curves spacetime, and the curvature of spacetime controls how masses move in it. These gravitational interactions propagate at the speed of light. A metric tensor and covariant quantities $g_{\mu\nu}(x)$ describe the interactions in General Relativity. The covariance requirement can be justified independently of the general principle of relativity. The metric of General Relativity is the Schwarzschild metric.

Calculations

I have verified that Equations 31.1-31.9 are true and correct.

I have also verified that Equations 31.10-31.16 are also correct.

I have verified that Equations 31.17-31.22 are correct.

And I have verified that Equations 31.23-31.28 are correct as seen in the book.

Conclusion

I was able to verify the GUTCP results of Chapter 31 in excellent agreement with my own calculations and derivations of equations. I successfully reproduced all of the equations and derivations found in Chapter 31. This chapter demonstrates that the GUTCP theory is successful at describing Relativity to a high degree of accuracy.

I find my results and calculations to be confirmation that the derivations and equations of Chapter 31 are indeed valid, reproducible, and accurate.