RELATIVISTIC SCALING OF PHYSICAL PROPERTIES: RECIPROCAL RELATIONSHIP BETWEEN CONVERSION FACTORS

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ABSTRACT

It is well established experimentally that clock rates increase with gravitational potential. This effect was predicted by Einstein in 1907 and verified in the experiments of Pound and Snider in 1965. In the present work it will be argued that the above results can be conveniently described in terms of a uniform scaling of physical properties. One only needs a conversion factor between the two sets of units in different gravitational potentials to accurately predict the result of a measurement at one altitude based on the corresponding value obtained at another. For the case of the unit of energy, Einstein showed that the appropriate conversion factor is $S = 1+ghc^{-2}$, where $c=2.99792458$ ms-1 is the speed of light in free space, g is the local acceleration of gravity and h is the difference in altitudes between the two rest frames. The corresponding factors for light speed and frequency are both also equal to S. As with conventional measurements, the corresponding conversion factor in the reverse direction is always the reciprocal of the other. For example, the reverse factors for energy, light speed and frequency are each equal to $S^{-1}= 1-ghc^{-2}$. Attempts to develop a corresponding set of conversion factors for different inertial rest frames have heretofore been hampered by the fact that the Special Theory of Relativity (STR) predicts unambiguously that time dilation is symmetric, i.e. that a moving clock is always found to have a slower rate than one that is stationary in the observer's rest frame. On this basis, it is impossible to define a unique conversion factor between measured values of the same frequency obtained in two different rest frames. The present work shows that experimental tests of the symmetry of time dilation do not agree with the above prediction of STR. As a result, it becomes possible to also define conversion factors between measured values in different inertial systems.

KEYWORDS: *Einstein's Symmetry Principle (ESP), Asymmetric Time Dilation, Clock-Rate Proportionality, Universal Time-Dilation Law (UTDL), Lorentz Transformation (LT), Relativistic Velocity Transformation (RVT), Alternative Global Positioning System-Lorentz Transformation (GPS-LT), Absolute Remote Simultaneity, Isotropic Length Expansion, Uniform Scaling of Physical Properties, Amended Version of the Relativity Principle (RP)*