NEW VIEWS ON OLD SCIENCE RELATIVE TO SMALL τ WITH THE LORENTZ FACTOR

Revision 1.0.1
August 9, 2026

The following conclusions are only opinions of the author.

Abstract: Any presumption that relativistic effects apply only to high velocity situations is contradicted by reviewing situations where velocities near zero affect everything around us. Effects of the Lorentz factor time dilation on observer time with small υ are shown to have implications important to classical physics motions of objects, thermal vibrations, heat, entropy, and the Heisenberg Uncertainty Principle.

In the real universe, there is no "stationary observer" body. Everything is moving in more than one orbit at the same time with all bodies being mutually affected by the forces of gravity and electromagnetism. For over 120 years knowledge of motion affecting the progression of time per the Lorenz factor[1][2][3] has been a mainstay of modern physics. As a result of motion the observed clock time, the "Observertime" τ of each body in the universe, varies when the body moves. Here the definition of "body" is a mass of any size, from fundamental particle to a massive star. The following discussions apply only to low velocity relativistic effects on time progression relative to a body, leaving out any discussion of gravitational time dilation and most other details of cosmology that obscure the following discussions[4]. It is common to discuss, teach, and evaluate the effects of the Lorenz factor with large υ and accompanying relativistic effects. But υ is not confined to be a large value. It now interesting and worthwhile consider those low velocity effects.

For motions of most moving bodies υ is so low that proper time τ of any object would be infinitesimally close to our coordinate time progression t. For these cases calculation of the Lorentz factor would involve computing extremely small deviations from unity with attention paid to numerical details of extremely lengthy mantissas[5]. However, for space vehicle navigation similar computations are routinely repeated.[6][7]. But space vehicle velocities are much larger than everyday human activities require. But no matter how small υ is, for υ> 0, a difference of τ from t continues to exist because the Lorentz factor is smooth and unquantized, i.e. "analog". Discussion of very low υ time effects should have some research value. We suggest here some interesting examples of those effects without delving into significant numerical details.

I NEWTON'S LAWS OF MOTION

Newton's Laws of Motion can be restated in view of the definition of τ [8][9].

First Law

A body remains at rest, or in motion at a constant speed in a straight line, unless acted upon by a force.
Corollary: The body's observed time τ progresses at a constant rate in these cases.

Comment: All bodies are involved in gravitational and electromagnetic forces and accelerations, however slight. All bodies exist in the universe in some orbit. Bodies on earth are also involved with earth's rotation. These motions even affect particles floating in a cold evacuated chamber. Therefore, all bodies have at least an infinitesimal non-zero angular velocity. No real body ever completely satisfies Newton's First Law.

Second Law

When a body is acted upon by a net force, the body's acceleration multiplied by its mass is equal to the net force.

Corollary: The body's observed time τ will vary in relation to the change in υ no matter how slight.

Comment: For each of the three dimensions of rotation, the internal particles of a physical body will have different observer time progression rates at every radius from the center of rotation. For example, ignoring the effects of gravitational time dilation, the progression of observer time for the top of the Leaning Tower of Pisa would be less than that for the base of the monument as the earth rotates. Among other reasons, the wheel of a moving vehicle exhibits different values of τ at every radius.

Third Law

If two bodies exert forces on each other, these forces have the same magnitude but opposite directions.

Conjecture 1: Because of mutual gravitational and electromagnetic field effects between any two bodies in the universe not in contact causing continuous changes in their relative motion, the observer time progression of any body is always changing. Because the motion of each body will exhibit different orbital effects of different amounts, all relative to the Universe, it is impossible in practice to express the net effects of changes in υ for each body. Therefore, the relative changes in observer time between any two bodies in reality will not be equal and opposite due to the radical in the Lorenz Factor.

II HEAT

A black body at some temperature greater than absolute zero has internal atomic thermal vibrations such that every atom inside the body is moving at a velocity different from the observed bulk velocity of the object. Therefore, observer time progression of the bulk body in almost all cases will not equal the observer time progression of any particle inside the body. Instead, the observed bulk body will exhibit a statistical spread of observer time progression for the particles in the body, all of which are less than or equal to the mean observer time progression of the moving body when the temperature of the body is above absolute zero. As a body's temperature increases, the statistical spread of observer time progressions will widen out. Several interesting conjectures may result.

Comment: An interesting dichotomy results. All the particles in a body warmer than absolute zero are moving around and have different observer time progressions than the center of gravity of the body. It is as if the apparent body and its observer time statistics match none of the particles inside. The timing of the apparent body motion seems to exist only as a figment of our vision. Equations of classical mechanics only apply to the apparent body motion.

Comment: Energy can be moved around but doing so requires expending energy.

Simplification: "It takes heat to move heat around".

The above statement even includes energy transferred by photons emitted by energetic processes in atoms. Whenever energy is transferred, motion changes occur somewhere. Any motion changes involve velocity changes and changes in τ. Energy changes and changes in τ are thus tightly linked everywhere and forever. Dramatic examples of reduction in τ occur in violent interactions such as explosions, lightning, and plasma flows in stars. You can observe violent events but you might forget that changes in τ have happened also. A star that is so hot that it radiates substantial energy in x-rays also has varying slow observer time rates in its photosphere and corona.

Conjecture 1: Therefore, in addition to other commonly described reasons, it is impossible to cool a body to absolute zero temperature because that implies zero particle motion. But observer time progression cannot ultimately be held constant in the real universe with everything moving in orbits.

Conjecture 2: In any aggregate of matter, common equations of physics and chemistry, such as gas laws, diffusion, black body radiation, momentum, and so forth will imply the existence of underlying and heretofore unstated equations for the progression of observer time of the contained atoms or bodies.

Conjecture 3: Accordingly, mathematical studies of the statistical differences in $\Delta\tau$ for underlying common equations in classical mechanics might yield new equations for the motions of particles and larger aggregates of matter moving under influence of temperature changes.

Conjecture 4: Gravitational fields exist to attempt to reduce the difference $\Delta\tau$-Δt between any two massive particles to zero by combining the objects into one moving mass with a new proper time.

III THERMODYNAMICS

The zeroth law of thermodynamics defines thermal equilibrium and forms a basis for the definition of temperature: If two systems are each in thermal equilibrium with a third system, then they are in thermal equilibrium with each other.[10]

Conjecture 5: Systems in thermal equilibrium might have identical observer time progression statistics. However, proving that the observer time progression statistics of bodies are completely identical is impossible due to noise in the statistics and the impossibility of documenting the motion of all the atoms in the bodies due to the Heisenberg Uncertainty Principle (below).

The first law of thermodynamics states that, when energy passes into or out of a system (as work, heat, or matter), the system's internal energy changes in accordance with the law of conservation of energy.

Conjecture 6: The observer time statistics of a system’s bodies and atoms must change with the energy transfers if any velocity changes occur. However, it is not likely that the observer time statistics will balance.

The second law of thermodynamics states that in a natural thermodynamic process, the sum of the entropies of the interacting thermodynamic systems never decreases. A common corollary of the statement is that heat does not spontaneously pass from a colder body to a warmer body.

Comment: The atoms in a cooler body being warmed will exhibit decreasing observer time progression statistics and as the warmer body cools the associated atoms exhibit increasing observer time progression statistics. A simple example is when a cold spoon is used to stir hot tea. The observer time in the particles of the tea will increase on the average and the observer time in the atoms in the spoon will decrease, on the average.

Comment: As for entropy, any discussion about randomness and energy levels is also relative to velocity variations of bodies. Velocity variations also lead to changes in individual progression of observer time τ. That is, as entropy increases relative to energy, so does "entropy" of observer time τ.

The third law of thermodynamics states that a system's entropy approaches a constant value as the temperature approaches absolute zero. With the exception of non-crystalline solids (glasses), the entropy of a system at absolute zero is typically close to zero.

See Conjecture 1.

IV HEISENBERG UNCERTAINTY PRINCIPLE

The Heisenberg Uncertainty Principle is well known.[11] But the Principle can be restated as follows. "We cannot know both the position and observer time τ of a particle, such as a photon or electron, with perfect accuracy."

V CONSERVATION OF ENERGY AND MOMENTUM

During interactions of observed bodies principles of energy and momentum conservation do not yield similar conservation of observer times due to the radical in the Lorentz factor.

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[1] Observertime, here denoted by τ, as defined in https://byjus.com/physics/time-dilation/

[2] The Lorenz factor: $\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$

[3]Landau, L. D.; Lifshitz, E. M. (1975). *The classical theory of fields*. Course of theoretical physics. Vol. 2 (4th ed.). pp. 7-8, Oxford: Butterworth – Heinemann. ISBN 0-7506-2768-9.
Proper time. (23 May 2026), In Wikipedia https://en.wikipedia.org/wiki/Proper_time

[4] These discussions purposely neglect the strong and weak forces. Gravitational time dilation often overwhelms the small effects discussed in this paper.

[5] Digital computations taking into account very long mantissas can be assisted by software tools such as BIGNUM.c and similar codes operating in modern computers.

[6] https://www.congress.gov/119/bills/hr2313/BILLS-119hr2313ih.pdf

[7] https://www.livescience.com/space/mars/einstein-was-right-time-ticks-faster-on-mars-posing-new-challenges-for-future-missions

[8] Thornton, Stephen T.; Marion, Jerry B. (2004). *Classical Dynamics of Particles and Systems* (5th ed.). Brooke Cole. p. 49. ISBN 0-534-40896-6.
Newtons Laws of Motion. (11 May 2026), In Wikipedia® as https://en.wikipedia.org/wiki/Newton%27s_laws_of_motion only to avoid misquoting

[9]. L. D. Landau and E. M. Lifshitz, *The Classical Theory of Fields*, Fourth Revised English Edition, Courses of Theoretical Physics, Volume 2, (1951), Pergamon Press, Oxford; ISBN 0-08-025072-6.
[10]Kittel, C. Kroemer, H. (1980). *Thermal Physics*, second edition, W.H. Freeman, San Francisco, ISBN 0-7167-1088-9. Laws of Thermodynamics. (11 June 2026) In Wikipedia, https://en.wikipedia.org/wiki/Laws_of_thermodynamics
[11] In the Heisenberg Uncertainty Principle "we cannot know both the position and speed of a particle, such as a photon or electron, with perfect accuracy " per https://scienceexchange.caltech.edu/topics/quantum-science-explained/uncertainty-principle

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NOTE: This paper completely composed without any usage of Artificial Intelligence.

Author:
G. L. Williams
af8c@alumni.caltech.edu

Revision History
Revision 1.0
July 15, 2026
Revision 1.0.1
August 9, 2026
Added note about Artificial Intelligence