Dark Energy or just **Energy**?

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Abstract

This research note hypothesizes new physics without dark energy, dark matter, extra dimensions, and deviation from proven mathematical models. The main idea is that matter expands proportionally with space, and that the proposed discrete step-expansion of elementary particles may provide a platform for unification of the four fundamental interactions. This note also proposes several ways to validate the hypothesis at the macro- and micro-scale.

Let's hypothesize that the energy of universal expansion is behind every force in the universe, and see where it leads. For example, can the expansion be causing gravity instead of opposing it? The following sketch will help explaining how the expansion may produce the predicted by general relativity (GR) space-time curvature near Earth, under the assumption that elementary particles expand proportionally with space in a discontinuous step-wise manner.

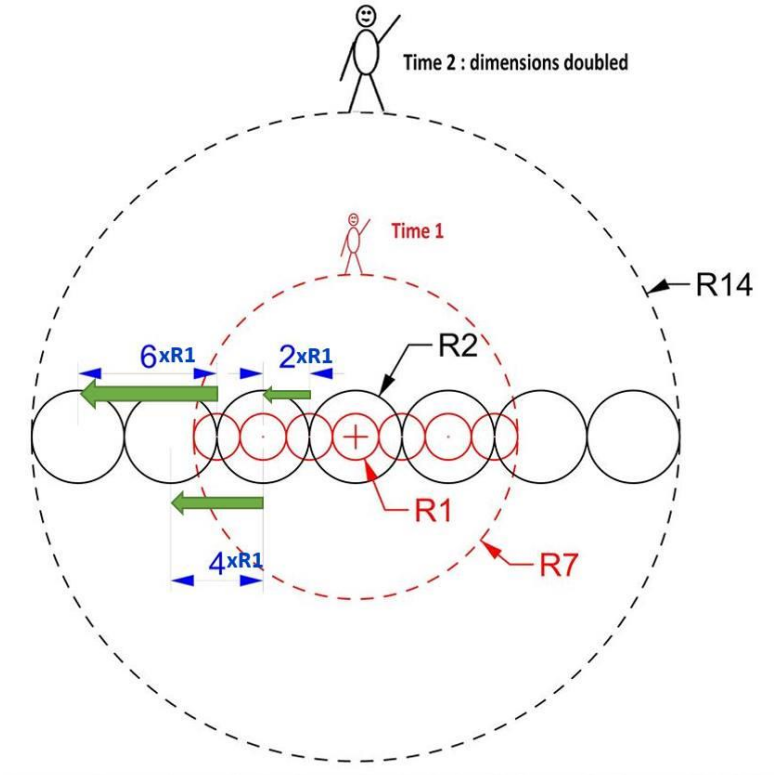

Figure 1: The expansion of matter produces relativistic shifts in the constituents

The sketch shows two consecutive moments in red and black. The absolute dimensions have doubled between time 1 and time 2. An observer wouldn't notice such a change, because he would have doubled in size, too. He may feel the acceleration (g) at his feet, though. Importantly, the sketch also shows the centers of gravity of the constituents moving outwards even though the relative sizes are not changing. The constituents would be moving outwards even after re-normalizing by a factor of 2.

According to GR, the space-time curvature (or the time dilation) near Earth is equivalent to the dilation produced by a speed equal to the escape velocity of 11.2 km/s. The ratio between 11.2 km/s and the absolute speed of our planet's hypothetical surface expansion can be calculated as 10^{-6}, presuming atoms expand with the speed of light at every step[1]. The step duration of 10^{-20}s is tentatively selected to match the gamma frequency associated with the electron, because atoms mostly interact via their electron clouds. A similar ratio of 10^{-6} can also be also derived after excluding the expansion of space inside and outside the atoms, which does not contribute to the true motion of the constituents. The latter estimate is equal to the ratio between the radius of the nucleus (~10^{-15}m) and the lattice size (~10^{-9} m). The similarity of these two independent ratios implies the expansion of matter can produce space-time curvature as a function of radius R and density ρ, mimicking the escape velocity formula written in density terms $V \sim \sqrt{\rho}\, R$. Note that in reality every particle may be expanding its size not twice, but thousands of times at every step, giving a new meaning to Schrodinger's wave function.

Now, let's consider a much larger than Earth sphere, which constituents represent millions of galaxies. Assuming flat space, one can calculate time dilation matching the red-shift measurements. Based on the sketch, however, the red-shift would not produce changes in the relative dimensions and distances inside the expanding sphere. This is equivalent to a static universe, without a Big Bang. In addition, if expansion causes gravity, then the critical density [1] relation $\rho_c \sim H_0^2$ implies that the Hubble constant H_0 depends on the square root of the density ρ_c within the selected mega sphere. This may explain the latest discrepancies in the Hubble constant [2,3] since the CMB measurements correspond to a much larger and more homogeneous sphere than the rest of the measurements. Such a correlation may provide a way to validate the hypothesis.

There are at least two other ways to validate the hypothesis:

1. At the macro-scale: The sketch implies the following relation: (velocity) => (time dilation) => (space-time curvature). Applying the same logic to spiral galaxies or galactic clusters, one can argue that their rotational velocities should be also adding to the space-time curvature. It is easy to show that the rotational curves flatten in areas, where the curvature due to kinematic time dilation exceeds the curvature due to gravitational time dilation. There would be no need to introduce dark matter. Mathematical details and several similar examples are available in [4].

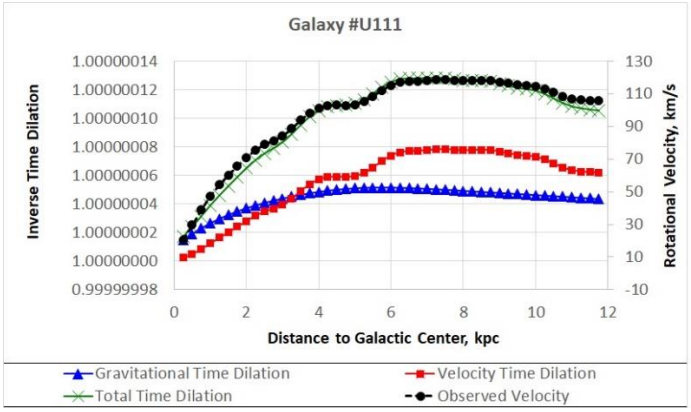

Figure 2: Correlation between time dilation and rotational velocities

[1] Due to the exponential character of the absolute expansion, only the last step is mathematically significant when deriving the velocity.

2. At the micro-scale: The expansion energy cannot produce quantum effects unless particles expand in a discontinuous step-wise manner at very high rates, possibly in the gamma range. Due to the mass-frequency relation, different type particles should step their sizes up at different rates (e.g. 1840:1 for proton vs. electron). The relative sizes would vary because of the asynchronous expansion, but the discontinuities would smoothen out at the macro-scale producing continuous Einsteinian curvature. Out-of-phase particles would make space for each other mimicking attraction, while expanding in-phase particles would mimic repulsion. The rapid relative fluctuations may also give a physical meaning to the spin property. At every step, the particle would create a disturbance, or a photon that is virtual because it would be quickly outgrown by the particle. The inertial mass may be redefined as an average quantity showing how often a particle is available for interaction. The conservation laws would still work due to the very stable averages at such high rates of fluctuation. There would be, however, instantaneous mass outliers to be exploited. Quantum tunneling may represent such an outlier where a particle can breach a classically impossible energy barrier due to instantly smaller mass (Imagine an out-of-phase particle being squeezed out while small by two synchronously expanding neighbors). According to quantum mechanics, momentum is conserved during tunneling. The outlined here step-expansion model implies momentum may not always be preserved because of the mass outliers. If this is correct, a large number of quantum tunneling events can be organized to develop a reactionless drive (similar to NASA's EM Drive), which would enable interstellar travel. We are currently experimenting [5] with orienting electrically the nitrogen inversion of ammonia for propulsion purposes. There is 10 TW of inversion power stored in 1 m^3 of ammonia waiting to be released in an environmentally safe way. Cooperation with THz laser labs is being sought for the project.

References

[1] Friedman, A, "Über die Krümmung des Raumes". Z. Phys., (1922)

[2] Plack Collaboration, arXiv:1807.06209, (2018).

[3] A. G. Riess, et al., Astrophys. J. 826:56 (2016).

[4] Markov, N., *Time dilation and space-time curvature*, viXra.org, (2019)

[5] Markov, N., *A Quantum Propulsion Method*, IMAM2019, (2019)