

Proof of the Nature and Equations of Dark Energy Based on the Principle of Conservation of Mass-Energy in the Universe 2025

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Undoubtedly, one of the most critical phenomena in the universe is the Big Bang. For countless years, humankind has endeavored to unravel its mysteries, seeking to elucidate its genesis and its ultimate fate.

At the start of the Big Bang, an extraordinarily vast amount of energy was released, propelling matter along straight trajectories as the universe expanded. Interestingly, observational data and theoretical calculations indicate that a substantial amount of energy remains unaccounted for in directly observable forms, leading to the conceptualization of what we call "missing energy" or, more commonly, "dark energy."

Furthermore, it is a ubiquitous characteristic of celestial objects to exhibit rotational motion. Consider, for instance, the Moon's rotation around its axis and its orbit around the Earth, the Earth's axial spin and its orbital path around the Sun, the Sun's axial rotation and its orbit around the supermassive black hole at the center of the Milky Way, and so forth. Therefore, rotational motion seems to be an intrinsic property of components in the universe.

However, in accordance with the fundamental principle of the conservation of mass-energy, the aggregate quantity of mass and energy within a closed system remains invariant over time. Consequently, if we consider the overall motion of celestial objects, the resultant motion is the vector sum of both their linear (translational) and rotational components.

Typically, our analyses tend to focus predominantly on linear motion, often neglecting or failing to quantify the contribution of rotational motion. In essence, the rotational energy of the universe is the same energy that is missing.

In fact, the sum of linear and rotational motion expresses the overall motion, or in other words, the sum of linear and rotational energy represents the total energy that is always constant.

Based on this framework, we can assert that the principle of mass-energy conservation remains universally valid. This combination of linear and rotational motion predicts a cyclic and repetitive motion for the motion of the universe and we can express the comprehensive equations of motion and energy. Drawing upon the preceding discussion, we can delineate the following relations:

According to the principle of energy conservation:



Total Energy = Linear Energy + Rotational Energy

$$E_T = E_l + E_r$$

$$E_T = \frac{1}{2} m v_l^2 + \frac{1}{2} m r^2 \omega^2$$

On the other hand, according to the Monte Carlo technique we have calculated the total energy at the Big Bang moment:

$$E_T = 10^{110} J$$

We have two types of motion: one is linear with constant acceleration a , and the other is rotational with a constant angular velocity ω , which is equal to the Hubble constant H :

$$\omega = H = 2.33 \times 10^{-18} \text{ 1/s}$$

Therefore, we could calculate the linear speed at the Big Bang moment v_{l_0} , maximum radius r_{max} and the acceleration then write the equation of motion:

$$\frac{1}{2} M_u v_{l_0}^2 = 10^{110} J \Rightarrow v_{l_0} \cong 4.5 \times 10^{28} \text{ m/s}$$

$$\frac{1}{2} M_u H^2 r_{max}^2 = 10^{110} J \Rightarrow r_{max} = 2 \times 10^{46} \text{ m}$$

$$v_l^2 - v_{l_0}^2 = 2 a r_{max} \Rightarrow a = -5 \times 10^{10} \text{ m/s}^2$$

$$r = \frac{1}{2} a t^2 + v_{l_0} t + r_0 \Rightarrow r = (-2.5 \times 10^{10}) t^2 + (4.5 \times 10^{28}) t + r_0$$

$$v_l = a t + v_{l_0} \Rightarrow v_l = (-5 \times 10^{10}) t + 4.5 \times 10^{28}$$

$$v_r = \omega r \Rightarrow v_r = (2.33 \times 10^{-18}) [(-2.5 \times 10^{10}) t^2 + (4.5 \times 10^{28}) t + r_0]$$

$$\Delta \theta = \omega \Delta t \Rightarrow \Delta \theta = (2.33 \times 10^{-18}) \Delta t$$

Where M_u is the total mass of the universe, r is the maximum radius of the universe, v_r is the tangential speed, $\Delta \theta$ is the changed angle.

Result:

The rotational kinetic energy, a form of energy often overlooked in observations, is therefore equivalent to dark energy.

$$E_r = E_{Dark}$$

$$E_T = E_l + E_{Dark}$$



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