Scientific Research Publishing

Journal of Applied Mathematics and Physics, 2024, 12, 3758-3764
https://www.scirp.org/journal/jamp
ISSN Online: 2327-4379
ISSN Print: 2327-4352

The Dark Nature of Gravity and the Universe Expansion

Gianni Donati

AIDIC-Italian Association of Chemical Engineering, Milano, Italy
Email: donati43gia@gmail.com

How to cite this paper: Donati, G. (2024) The Dark Nature of Gravity and the Universe Expansion. *Journal of Applied Mathematics and Physics*, **12**, 3758-3764.
https://doi.org/10.4236/jamp.2024.1211225

Received: October 13, 2024
Accepted: November 12, 2024
Published: November 15, 2024

Abstract

Staying on Earth, we do not perceive the 8 km/s velocity of its surface rotation, neither the 20 km/s revolution velocity around the Sun, nor the 200 km/s around the center of the Milky Way, which is apparently fixed in the center of our Universe. From the Earth, Hubble has observed a number of galaxies that are moving away from us at spectacular increasing speeds proportional to their distance. Due to the million light-year distances, the movie observed dates back an equivalent time lag, but shows the expansion of the Universe contrary to the contraction required by Gravity attraction. Lacking a justification, somebody imagined the existence of some mysterious *dark energy* contrasting Gravity, whose nature, after Galileo, Newton, and Einstein, is not completely known. Now that the action of Gravity has been disclosed, the expansion of the Universe is no longer a mystery.

Keywords

Physics, Gravity, Astrophysics, Grand Unified Theory, Neutrino, Particle Physics

1. Introduction

For centuries, with the evidence of the round trip of the Sun in the sky, it was believed that the Earth was the center of the Universe, till Copernicus in 1543 published his book "*The revolutionibus orbium coelestium*".

Copernicus' ideas were not immediately accepted and had to wait 10 years for publication, but they did begin a paradigm shift away from the Ptolemaic geocentric model to a heliocentric model.

In the years from 1609 to 1619, Kepler, using Tycho astronomical observations, published his first two laws about planetary motion, and in 1610, Galileo, using his homemade telescope, gave the proof of the orbiting satellites of Jupiter and

extended this finding to the whole Solar System.

We have to wait for Newton (1687) to obtain a general law for gravity that represented the greatest revolution of the century, allowing, with its simplicity, the sizing of all the celestial bodies known.

In spite of the success of the Universal Gravitational Law, Newton was obsessed with the question of why Gravity obeyed such a simple equation, that is, the mechanism used by bodies to attract themself at a distance.

In the times of Newton, the *ether* was a means to fill the unknown of the propagation of light, but after the experiment (1887) by Michelson and Morley, attempting to detect the difference between the transversal and parallel speed of light relative to the Earth motion, the *ether* concept has been dismissed and replaced by Einstein with vacuum and then corrected with a gravitational field in General Relativity.

Gravity was the nightmare of Einstein, and in spite of his love for simplicity, he asked for support from mathematics and spent ten years writing a complicated field equation (1915) that is impossible to use: the introduction of the artifact of the cosmological constant, the famous *big error of his life*, did not improve the mathematical stability.

Newton and Einstein had problems in the computation of the motion of three celestial bodies and the problem remains unsolved even today.

When Hubble (1929) announced the runaway of galaxies, Einstein rushed to Mount Wilson but never recovered his cosmological constant to fit the new findings till 1990, when most physicists agreed to set it to zero and after 1998, assuming a positive value with the discovery of the expansion acceleration and its final inclusion in the standard model and cosmology model.

Similarly, when, some years before, his university professor Plank succeeded in describing the blackbody radiation spectrum (1900), he contributed to the success of quantum theory with the computation of specific heat of matter and with the photoelectric effect but never applied these concepts to Gravity.

Even Plank did not believe in the new theories of the atomic structure, and we had to wait for Fermi's discovery of neutrino in the continuous proton-neutron transformations of beta decay (1937).

The ingredients where all available for understanding the nature of Gravity, the main energy that moves the Universe.

Instead, almost one century has been dedicated to correcting Newton with science fiction effects such as *dark matter* and *energy*, imagining new unknown objects in the sky, or building costly experiments to demonstrate dated theories.

In what follows, as requested by my keen readers, I will show how the ran away velocity increase of galaxies is already included in the new theory of Gravity that, for the sake of the novel readers, will be briefly resumed.

2. Gravity as a Flux of Neutrino

Gravity is not a force but is the result of the continuous flux of neutrino emitted

by matter.

We have demonstrated [1] [2] that this flux is almost constant for all known elements and is equal to **Fo = 6.668E+20** neutrino per gram and second.

Surprisingly, this information is contained in the experimental data of all existing nuclides, stable and unstable, as far as the distribution of protons and neutrons is concerned, and the 15-minute half-life of neutrons is known.

Fermi approach to beta decay has been extended to all nuclides radioactive and stable: protons p and neutrons n continuously transform with the following reaction scheme:

$$\begin{array}{ll} \beta^- \text{ emission} & n \overset{k_1}{\leftrightarrow} p + \beta^- + \nu \\ \beta^+ \text{ emission} & p \overset{k_2}{\leftrightarrow} n + \beta^+ + \nu \\ \text{Orbital electron capture} & p + \beta^- \overset{k_3}{\leftrightarrow} n + \nu \end{array} \tag{1}$$

A neutrino ν is produced and the electron-positron is annihilated, yielding two γ photons having an energy of 0.511 Mev each, equal to the rest-energy of an electron.

$$\beta^- + \beta^+ = 2\gamma \tag{2}$$

We have found for k_1, k_2 and k_3 the following values:

$$k_1 = 0.0009625 \qquad k_2 = 4.71554\text{E}{-}06 \qquad k_3 = 0.00105382 \tag{3}$$

The computation of the neutrino emission for each nuclide can be easily done, and the mean value per gram and second over all nuclides is surprisingly almost constant.

In the case of two bodies, M and m, the neutrino emitted by M crosses unchanged the nucleons of m, whose emitted neutrino subtracts in the direction of M and sums in the opposite one.

The unconventional momentum balance results in the well-known Newton Universal Gravitational Equation:

$$F = \left(Fo\ \mu c r_n^2 / 4m_n\right) M\ m / r^2 = GM\ m / r^2 \tag{4}$$

where μ is the neutrino mass, c speed of light, m_n the nucleon mass, r_n the nucleon radius and r de distance between masses.

The Gauss constant G can be computed from the neutrino flux Fo:

$$G = \left(Fo\ \mu c r_n^2 / 4m_n\right) = 1\text{E} - 28Fo \tag{5}$$

This strictly relates gravitation to intrinsic properties of matter and is not surprising because gravity is a property of matter and, more specifically, of nuclei.

Newton was lucky because the quasi-constancy of Fo allowed him to establish his Universal Gravitational Iaw.

It may be argued that this does not change too many things, but instead, the change is drastic for two reasons:

- The calculation of orbital motion does not require balancing forces but only summing the vector flux of neutrino with no limit to the number of bodies

involved.

- Gravity requires the sacrifice of the loss of the mass of the bodies that are small in our lifetime, but it has a great influence on the long-term cosmological ones.

We have already mentioned how the dated three-body problem can be solved, how the delay of Earth's revolution due to the loss of mass of the Sun [3] can be justified, and the role of Gravity in the life of the stars [4].

The same destiny will encounter the myriad of Galaxies spread around our Milky Way, but, as far as Hubble's findings are concerned, Gravity also influences their motion.

3. The Effect of Gravity on Galaxies Velocity

Hubble, in his famous paper [5], revealed his findings in the years spent at Mount Wilson telescope investigating the sky: seen from the hearth and having an estimate of the Earth motion in the Milky Way, the Galaxies distant from 1.2 to 19 mpc (megaparsec) (4E+06 - 6.2E+07 ly (lightyear)) where moving away from us with velocities in between 80 and 1330 km/s.

Velocities have been derived by measuring the redshift of the light of specific stars by the Doppler effect and distances using binary stars called Cepheids, present in the Galaxy, and the Hubble Law simply reads:

$$V = HD \tag{6}$$

where V is in km/s D, in mpc and therefore $H = 70$ has the dimension of the inverse of time (km/s·mpc).

This equation represented a revolution at that time because it enlarged the view of the Universe: the inverse of the Hubble constant has been readily used to date its age, and the *big bang* theory has been the basis for its cosmological evolution, no matter if there remained unsolved problems.

Our good sense observes that the Hubble movie dates back some million years, the time necessary for light to cover distances, and our knowledge of Gravity suggests that some of the stars measured may have suffered some change.

Nevertheless, a dated phenomenon is still proof, and in addition, Hubble recognized that there are almost 100 galaxies in the sphere of Andromeda, 0.7 - 1. mpc (2.3 - 3.5 E+06 ly) far from us, that are blue-shifted and are attracted towards the Milky Way with a speed the order of 300 km/s.

The Milky Way with a mas of 1.36E+45 g at the distance r of 2.163E+24 cm (2.28E+06 ly) has an escape velocity $vesc = \left(2G\frac{M}{r}\right)^{0.5} = 9.145\text{E}+06$ (cm/s), that is superior to the velocity $V = 4.90\text{E}+06$ (cm/s) computed with Hubble equation (6).

This is, therefore, an exception to the expansion theory, but if we leave additional criticisms and stay to facts, we can trust Hubble and his law outside the sphere of influence of the Milky Way and apply our gravitation equation to solve the problem of Galaxies running away and continuously accelerating.

The variation of momentum with time of a galaxy or a generic star distant r,

having velocity v and mass m must equal the attraction of the Milky Way with mass M = 1.36E+45 g.

$$\frac{\mathrm{d}(mv)}{\mathrm{d}t} = m\frac{\mathrm{d}v}{\mathrm{d}t} + v\frac{\mathrm{d}m}{\mathrm{d}t} = -\frac{GMm}{r^2} \tag{7}$$

Gravity, to perform its work, emits a flux of neutrino of mass μ and we can easily write:

$$\frac{\mathrm{d}m}{\mathrm{d}t} = -Fom\mu \tag{8}$$

The acceleration of the Galaxy, therefore, is:

$$\frac{\mathrm{d}v}{\mathrm{d}t} = -\frac{GM}{r^2} + Fo\mu v \tag{9}$$

Table 1. Hubble data from 0.7 to 19 megaparsec and computation of the acceleration due to gravity attraction and gravity loss of weight.

D	R	$V = H^*D$	v	r	$vesc = \left(2G\frac{M}{r}\right)^{0.5}$	$-\frac{GM}{r^2}$	$Fio\ m\ v$	$\frac{\mathrm{d}v}{\mathrm{d}t}$
mpc	ly	km/s	cm/s	cm	cm/s	cm/s^2	cm/s^2	cm/s^2
0.7	2.28E+06	−300	−3.00E+07	2.16E+24	9.15E+06	−1.9E−11	−3.1E−08	−3.1E−08
1	3.26E+06	−300	−3.00E+07	3.09E+24	7.65E+06	−9.5E−12	−3.1E−08	−3.1E−08
1.06	3.46E+06	−300	−3.00E+07	3.28E+24	7.43E+06	−8.4E−12	−3.1E−08	−3.1E−08
1.2	3.91E+06	84	8.40E+06	3.71E+24	6.98E+06	−6.6E−12	8.7E−09	8.69E−09
1	3.26E+06	70	7.00E+06	3.09E+24	7.65E+06	−9.5E−12	7.25E−09	7.24E−09
2	6.52E+06	140	1.40E+07	6.18E+24	5.41E+06	−2.4E−12	1.45E−08	1.45E−08
3	9.78E+06	210	2.10E+07	9.27E+24	4.42E+06	−1.1E−12	2.17E−08	2.17E−08
4	1.30E+07	280	2.80E+07	1.24E+25	3.83E+06	−5.9E−13	2.9E−08	2.9E−08
5	1.63E+07	350	3.50E+07	1.55E+25	3.42E+06	−3.8E−13	3.62E−08	3.62E−08
6	1.96E+07	420	4.20E+07	1.85E+25	3.12E+06	−2.6E−13	4.35E−08	4.35E−08
7	2.28E+07	490	4.90E+07	2.16E+25	2.89E+06	−1.9E−13	5.07E−08	5.07E−08
8	2.61E+07	560	5.60E+07	2.47E+25	2.71E+06	−1.5E−13	5.8E−08	5.8E−08
9	2.94E+07	630	6.30E+07	2.78E+25	2.55E+06	−1.2E−13	6.52E−08	6.52E−08
10	3.26E+07	700	7.00E+07	3.09E+25	2.42E+06	−9.5E−14	7.25E−08	7.25E−08
11	3.59E+07	770	7.70E+07	3.4E+25	2.31E+06	−7.8E−14	7.97E−08	7.97E−08
12	3.91E+07	840	8.40E+07	3.71E+25	2.21E+06	−6.6E−14	8.7E−08	8.7E−08
13	4.24E+07	910	9.10E+07	4.02E+25	2.12E+06	−5.6E−14	9.42E−08	9.42E−08
14	4.57E+07	980	9.80E+07	4.33E+25	2.04E+06	−4.8E−14	1.01E−07	1.01E−07
15	4.89E+07	1050	1.05E+08	4.64E+25	1.98E+06	−4.2E−14	1.09E−07	1.09E−07
16	5.22E+07	1120	1.12E+08	4.94E+25	1.91E+06	−3.7E−14	1.16E−07	1.16E−07
17	5.54E+07	1190	1.19E+08	5.25E+25	1.86E+06	−3.3E−14	1.23E−07	1.23E−07
18	5.87E+07	1260	1.26E+08	5.56E+25	1.80E+06	−2.9E−14	1.30E−07	1.3E−07
19	6.20E+07	1330	1.33E+08	5.87E+25	1.76E+06	−2.6E−14	1.38E−07	1.38E−07

Table 1 reports data computed with Hubble law (6) and the acceleration of galaxies with Equation (9).

The data of Andromeda galaxy and its environmental stars are within the distance of 1.2 mpc, while, for higher distances, the Hubble equation is used for velocity calculations.

We can see that gravitational attraction is very small compared to the acceleration due to gravitational mass loss due to the large distances and high velocities.

There is no strange energy contrasting Gravity, but it is gravity itself that kills its attraction, the same way that it increases the time of revolution of Earth due to the loss of mass of the Sun and shortens the life of the Sun and of all the stars.

In the case of Andromeda, the attraction and loss of mass cooperate and the estimated 2.5 - 4 billion years for the collision with the Milky Way should be reduced.

To compute the time needed to increase velocity, we can integrate Equation (9), and we can do it easily neglecting the attraction contribution:

$$t - to = \frac{\ln\left(\frac{v}{vo}\right)}{Fo\mu} \tag{10}$$

The time $t - to$ for an increase of velocity 10% is 2.92E+06 years, 30% is 8.04E+06, and 50% 1.24E+07 years for all cases, the same order of magnitude of the distances in ly.

No drastic changes, therefore, occurred in the movie seen in the telescope of Hubble and in our improved one, and it makes us feel easier and more confident in the investigation of the extreme areas of the Universe.

This new aspect of Gravity is important, not only for far Galaxies, but for all bodies moving in the sky at high speed, like comets and even future spacecraft.

4. Conclusions

This short note has been written in homage to Hubble, who spent his life looking at the stars in the sky and did not have enough time to be granted the Nobel Prize.

The strange thing is that for almost a century, to explain his findings, the scientists were only able to propose a *dark energy* whose nature nobody knows.

It is stranger that, after the famous people involved and findings of the first fifty years of the last century and after the knowledge, in the meantime gained, on the nuclear atom, Gravity has been abandoned to itself, taking shortcuts populated by unknown energies and phantom objects.

Nowadays, the Hubble measurements of the velocity of the galaxies have been refined with powerful telescopes, including the orbiting Hubble one, showing a Universe of larger size and full of billions of Galaxies distributed almost uniformly far away, even in small angles of view near some constellation.

Apparently, we are no longer in a privileged center of the Universe, but if we want to explore it, we can no longer ignore the main energy that moves the Galaxies,

the Sun, and the other Stars.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Donati, G. (2004) Il legame nucleare e il peso del neutrino [The Nuclear Bond and the Neutrino Weight]. *La Chimica e L'Industria*, **5**, 62-66. http://www.academia.edu/8243167/

[2] Donati, G. (2006) L'universo invisibile [The Invisible Universe]. ICPN, 92-97. http://www.academia.edu/8243430/

[3] Donati, G. (2017) Rethinking the Earth in the Solar System. *Journal of Applied Mathematics and Physics*, **5**, 631-638. https://doi.org/10.4236/jamp.2017.53054

[4] Donati, G. (2024) The Mysterious Fate of Stars (Past, Present and Future of the Universe). *Journal of Applied Mathematics and Physics*, **12**,1308-1320. https://doi.org/10.4236/jamp.2024.124080

[5] Hubble, E. (1929) A Relation between Distance and Radial velocity among Extra-Galactic Nebulae. *Proceedings of the National Academy of Sciences*, **15**, 168-173.

Notation

F: Newton attraction force (g·cm/s^2)
G: Gauss constant (6.668E−08 cm^3·s^{-2}·g^{-1})
D: Distance (mpc)
H: Hubble constant (70 km/s mpc)
M, m: Masses (g)
P: Proton
n: Neutron
β^+, β^-: Positron, electron
v: Neutrino
γ: Photon
k_1, k_2, k_3: Kinetic constants
to, t: Actual and variable time
μ: Neutrino mass (1.55277E−36 g)
Fo: Mean neutrino flux (6.668E+20 υ/g·s)
m_n: Nucleon mass (g)
r_n: Nucleon radius (cm)
R: Distance (ly)
r: Distance (cm)
c: Speed of light (cm/s)
V: Velocity (km/s)
v: Velocity (cm/s)