The Electrodynamic Origin of the Force of Gravity—Part 2
($F = G m_1 m_2 / r^2$)

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Abstract. The force of gravity is shown to be a small average residual force due to the fourth order terms in v/c of the derived universal electrodynamic contact force between vibrating neutral electric dipoles consisting of atomic electrons vibrating with respect to protons in the nucleus of atoms. The derived gravitational force has the expected radial term plus a new non-radial term. From the radial term the gravitational mass can be defined in terms of electrodynamic parameters. The non-radial term causes the orbits of the planets about the sun to spiral about a circular orbit giving the appearance of an elliptical orbit tilted with respect to the equatorial plane of the sun and the quantization of the orbits as roughly described by Bode's law. The vibrational mechanism that causes the gravitational force is shown to decay over time giving rise to numerous phenomena, including the expansion of the planets (including the earth) and moons in our solar system, the cosmic background radiation, Hubble's red shifts versus distance (due primarily to gravitational red shifting), Tifft's quantized red shifts (Bode's law on a universal scale), Tifft's measured rapid decay of the magnitude of red shifts over time, the Tulley-Fisher relationship for luminosity of spiral galaxies, the unexpected high velocities of the outer stars of spiral galaxies, and Roscoe's observed quantization of the luminosity and size (Bode's law) of 900 spiral galaxies. Arguments are given that this derived law of gravity is superior to Newton's Universal Law of Gravitation ($F = G m_1 m_2 / r^2$) and Einstein's General Relativity Theory ($G_{\mu\nu} = -8\pi G/c^2\, T_{\mu\nu}$).

Review of Part 1. In part 1 of this paper the first term, the radial term, of the force of gravity was derived from the universal electrodynamic force. It was found to have the same form as Newton's Universal Law of Gravitation $F = -G m_{g1} m_{g2} / r^2$ where

$$G m_{g1} m_{g2} = \frac{1}{4\pi \varepsilon_o} \frac{2e^2}{5\pi} \frac{A_1^2 \omega_1^2}{c^2} \frac{A_2^2 \omega_2^2}{c^2} \qquad (18)$$

There will be a range of combinations of amplitude A and frequency ω for which equation (18) above agrees with Newton's Universal Law of Gravitation. Although this equation looks very similar to Newton's Universal Law of Gravitation, it is very different. First it is a local contact force. Second it says gravity is decaying over time by radiating away energy. Third the second term of the gravitational force will turn out to be a non-radial term causing many effects

including the quantization of gravity. All of these gravitational effects must be observed in order to claim that this force law is valid. If the properties of the derived force of gravity are supported by experimental data, then it can be claimed to be superior to the previous theories of gravity such as Newton's Universal Law of Gravitation and Einstein's General Relativity Theory.

Corroborating Circumstantial Evidence. If the conjecture that the source of gravity is due to a statistical residual electromagnetic force between neutral electric dipoles originating from the $(v/c)^4$ terms of the electromagnetic force is correct, then there are consequences which can be used to verify the conjecture. According to electrodynamics these oscillating dipoles must radiate energy. Since the gravitational force dominates on the large scale in the physical universe, the energy radiated by these oscillating dipoles in every atom should be greatest in the vicinity of matter, and be easily observable in its microwave frequency range.

Now hydrogen is the most dominant element in the universe comprising 75% of all visible matter [11]. In order to test this conjecture on the origin of the force of gravity, let us calculate the wavelength λ for this dipole radiation assuming hydrogen atoms.

Assume

$$\beta = 1 \quad N_1 = N_2 = 1 \quad q_{1+} = q_{2+} = e \quad \omega_1 = \omega_2 = \omega \qquad (20)$$

$m_1 = m_2 =$ mass of hydrogen

$A_{1-} = A_{2-} = A <$ atom size for hydrogen

Now $\lambda f = c$ so $\omega = 2\pi f = 2\pi c/\lambda$

$$Gm^2 = \frac{1}{4\pi\varepsilon_o}\frac{2}{5\pi}\frac{e^2A^4\omega^4}{c^4} = \frac{1}{4\pi\varepsilon_o}\frac{2}{5\pi}\frac{e^2A^4}{c^4}\left(\frac{2\pi c}{\lambda}\right)^4$$

$$= \frac{1}{4\pi\varepsilon_o}\frac{2e^2}{5\pi}\frac{16\pi^4A^4}{\lambda^4}$$

Solving for λ obtain

$$\lambda^4 = \frac{2}{5\pi}\frac{e^2}{4\pi\varepsilon_o}\frac{16\pi^4A^4}{Gm^2} \qquad (21)$$

Using the following values for the hydrogen constants from the CRC Handbook of Chemistry and Physics [12] and the radius of the hydrogen atom from Zumdahl [13] one obtains for an upper limit for λ

$$G = 6.67390\times10^{-11}\ \mathrm{Nm^2/kg^2} \qquad \frac{1}{4\pi\varepsilon_o} = 9.0\times10^{9}\ \mathrm{Nm^2/C^2} \qquad (22)$$

$$A \le 0.37\times10^{-10}\ \mathrm{m} \qquad e = 1.60217733\times10^{-19}\ \mathrm{C} \qquad m = 1.6726\times10^{-27}\ \mathrm{kg}$$

$$\lambda^4 \le \frac{2}{5\pi}\left(1.60217733\times10^{-19}\ \mathrm{C}\right)^2 \times \left(9.0\times10^{9}\ \mathrm{Nm^2/C^2}\right)\times$$

$$\frac{16\pi^4\left(0.37\times10^{-10}\ \mathrm{m}\right)^4}{6.67390\times10^{-11}\ \mathrm{Nm^2/kg^2}\left(1.6726\times10^{-27}\ \mathrm{kg}\right)^2}$$

$$\lambda \le 146\ \mathrm{mm}$$

Note that λ is in the microwave range. The *less than* relation comes from the assumption that the electron could not stay bound to the atom if it oscillated too far away from the nucleus beyond the size of the atom.

One of the most significant sources of radiation in the universe is known as the $2.735\,^{o}\mathrm{K}$ cosmic background radiation as shown in Figure 1 as measured by NASA's COBE satellite. Note that the peak in the radiation is at 1 mm wavelength which is much less than 146 mm. Our calculation shows that the derived force of gravity can be made to simultaneously predict the measured experimental strength of the force of gravity and the observed cosmic background radiation by making the current amplitude of vibration of the electron equal to less than 1% of the radius of the atom. This is a very reasonable value and what one might expect. Note that the cosmic background radiation is non-isotropic and shows variations reflecting the matter distribution in space as shown in additional COBE satellite data in Figure 2.

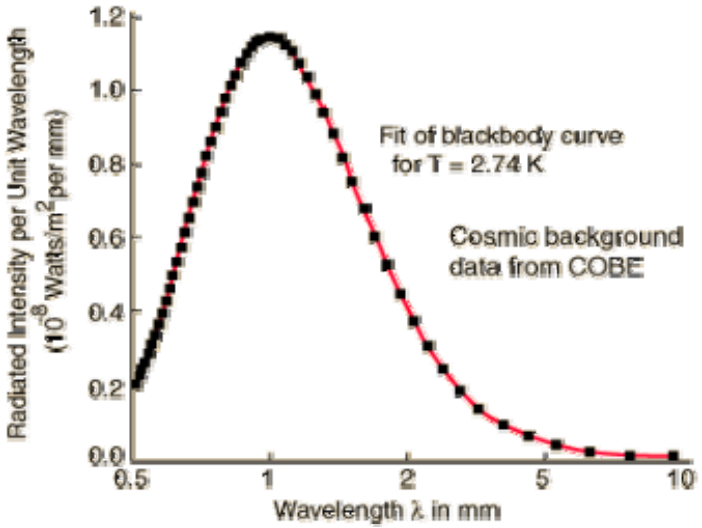

Figure 1.
Cosmic Background Radiation
From NASA's COBE Satellite (COBE1)

In summary the derived radial term of the electrodynamic force of gravity is not only able to predict the observed magnitude and radial direction of the force of gravity, but it also explains the origin of the cosmic background radiation at the same time. Thus it has an advantage over previous theories of gravity in that it explains more observed data. Note that the customary blackbody wavelength distribution as shown in Figure 1 can be shown to be completely classical in origin for finite-size electrons in the shape of a toroid without any need of an auxiliary theory such as quantum mechanics [14].

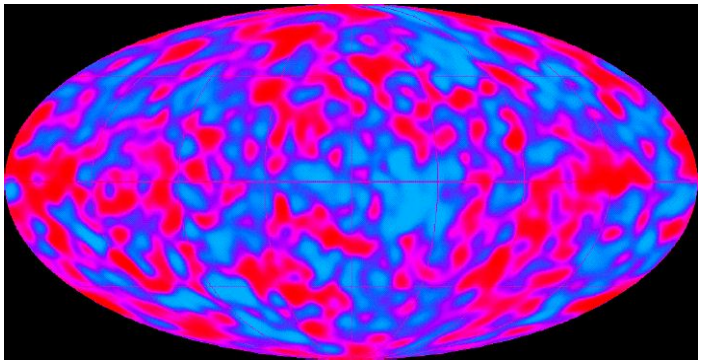

Figure 2.
Cosmic Background Radiation COBE
NASA Two Year Skymap (COBE2)

Decay of the Force of Gravity. Another consequence of this electrodynamic theory of gravitation is that the force of gravity is decreasing over time. The emission of the radiation above causes a decay of the force of gravity due to a decrease in the value of the mass. The rate of decay depends on an atom's position in an astronomical body and the size of the astronomical body. Since the oscillating electrons in all atoms can both absorb and emit radiation, those atoms nearest the center of an astronomical body lose their oscillation energy the slowest while those atoms nearest the surface of the astronomical body lose their energy the fastest. The rate of decay of the gravitational force of an astronomical body will depend on the ratio of the volume of the body to its surface area. Thus, the larger the radius of an astronomical body, the slower its force of gravity decays. So the force of gravity within a planet would decay faster than the force of gravity within the sun.

Applying these notions to the universe as a whole, the rate of weakening of gravity depends on a body's position in the universe. Since the oscillating electrons in all atoms can both absorb and emit radiation, those atoms in large astronomical bodies nearest the center of the universe lose their oscillation energy the slowest while those atoms in astronomical bodies nearest the edge of the universe lose their energy the fastest. Similarly those atoms near the center of a galaxy lose their oscillation energy slower than those atoms near the edge of the galaxy. Thus the rate of decay of the gravitational force depends on position in the universe.

Is there any evidence that the force of gravity has decayed? Yes. The expansion of the earth and the resulting separation of the continents have been documented. Figures 3 and 4 shows the three dimensional stretch marks under the oceans and through the continents that details the approximately 70% expansion of the earth since its surface solidified. The weakening of the force of gravity is the only reasonable explanation for the 70% expansion of the earth. Most cosmological models, such as the Big Bang model, have the earth contracting over time as it cools with gravity being constant and can not explain this data.

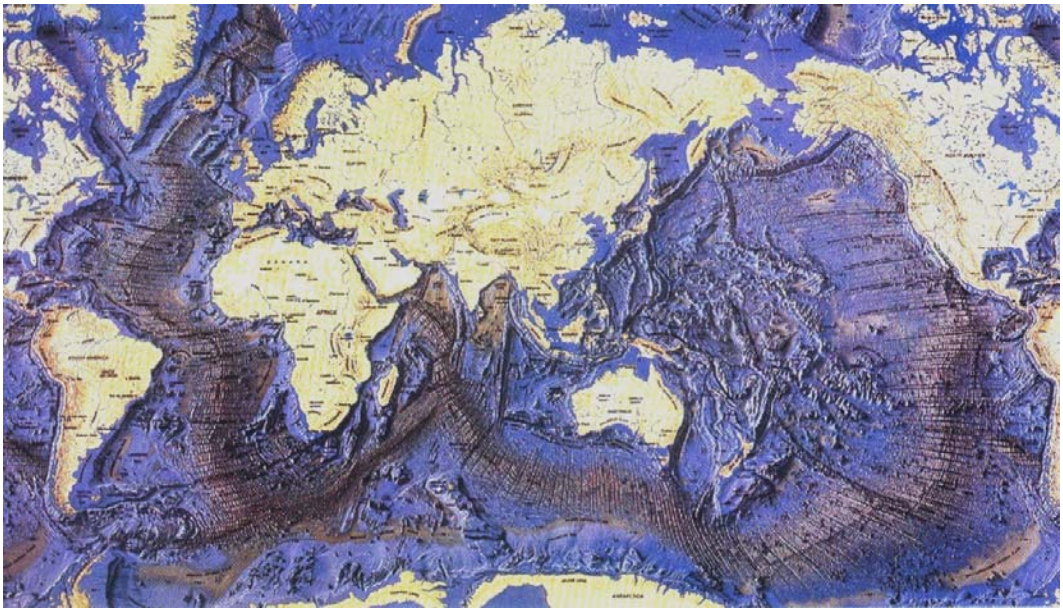

Figure 3.
Stretch Marks of Earth's Expansion. Copyright by Marie Tharp 1977/2003.
Reproduced by permission of Marie Tharp Oceanographic Cartographer,
One Washington Ave, South Nyack, NY 10960.

According to Hook's law of elasticity in three dimensions the elastic material of the crust of the earth expands very slowly due to the change in the strength of gravity, but it eventually reaches its elastic limits and starts to crack and come apart. The giant three-dimensional stretch marks below show that the origin of the bursting of a seam in the surface of the earth started at the position of the present Dead Sea in Palestine then proceeded down the Red Sea into the Indian Ocean where it forked to form the Pacific and Atlantic Oceans. Although the splitting up of the surface of the earth formed large pieces called plates, the continual movement of the plates apart from one another (see Figures 7 and 8) can only be explained by an expanding earth. Only an expanding earth model can conserve energy and angular momentum for the movement of the continental plates.

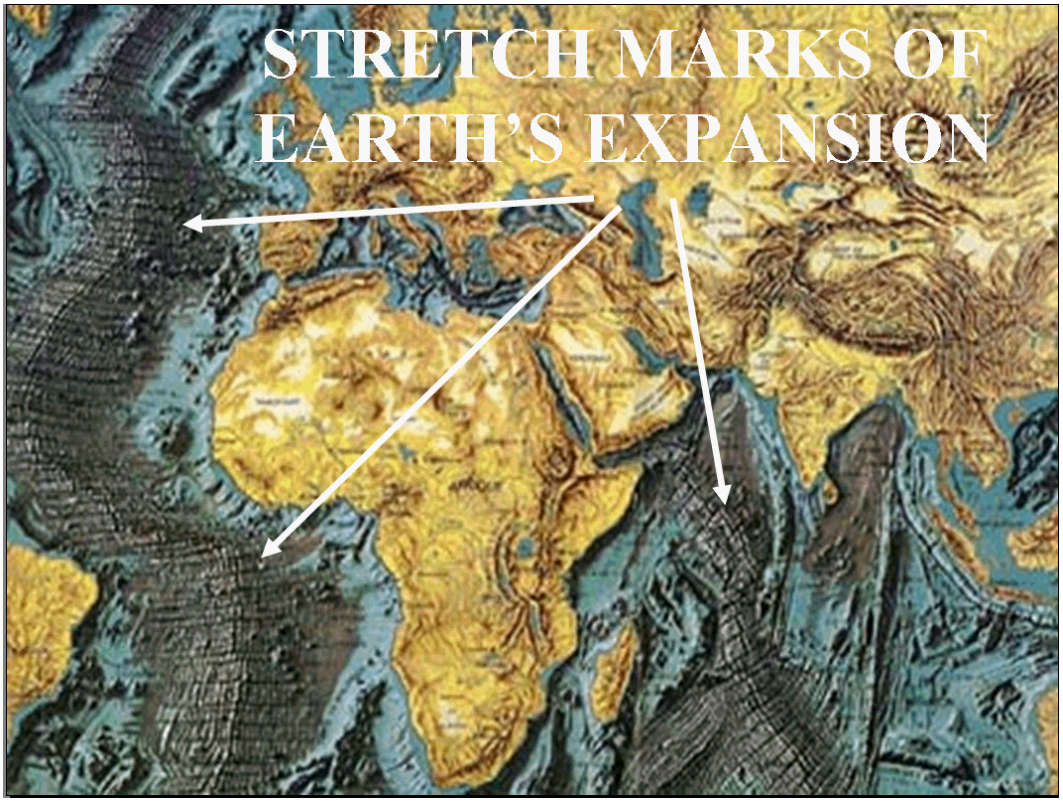

Figure 4.
Close-up of Earth's Expansion Stretch Marks.

The maps by Marie Tharp (Figures 3 and 4) were confirmed by the World Ocean Floor (1977) map of the U.S. Navy Office of Naval Research shown in Figure 5 and the Sandwell-Smith NOAA Satellite Map of the Scripps Oceanographic Institute of 1997 shown in Figure 6. The motion of the continental plates away from each other in Figures 7 and 8 also confirms the expansion of the earth of about 25 cm per year currently.

The expansion of the earth caused the north pole of the earth to rotate with respect to the surface of the earth due to conservation of energy and angular momentum. This caused the newest stripes added to the ocean bottom being produced along the mid-ocean ridges to be magnetized with varying degrees of magnetization and orientation. Scientists have measured the magnetization of the ocean bottom by measuring the magnetic field strength at a certain depth in the ocean using a cable dragged magnetometer and subtracting out the theoretically expected strength of the magnetic field of the earth as shown in Figure 9. This reveals that there are stripes of similar magnetization that are parallel to the mid ocean ridges indicating that a three-dimensional expansion has occurred. A closer examination of the sea floor polarity in the central upper part of Figure 9 reveals that the rate of expansion of the ocean bottom was much greater in the past than it is now. This supports the notion of something like an exponential decay of the strength of the force of gravity with a very strong initial decay rate and a very weak decay rate at the present time.

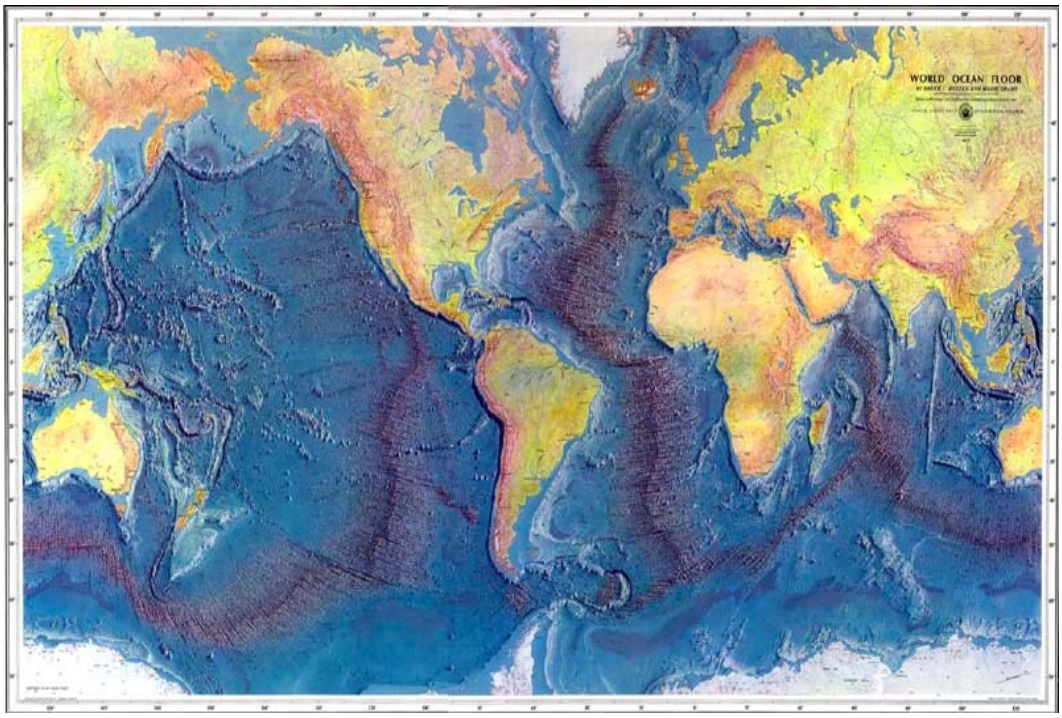

Figure 5.
US Office of Naval Research World Ocean Floor Map 1977.

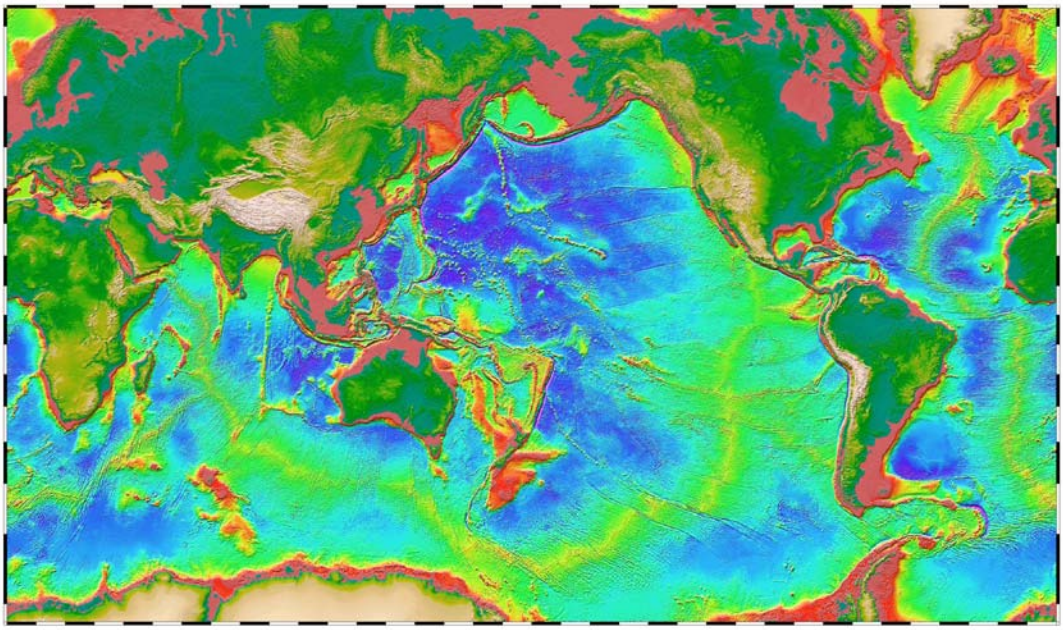

Figure 6.
Sandwell-Smith NOAA Satellite Map (Scripps Oceanographic Institute 1997)

The expansion of the earth should not be unique in our solar system. The pictures of the surface of Jupiter's moon Ganymede in Figure 10 shows clearly the expansion cracks without the presence of oceans. Figure 11 shows the mares or seas of the Earth's moon showing where it expanded. Figure 12 shows the current expansion of the planet Venus.

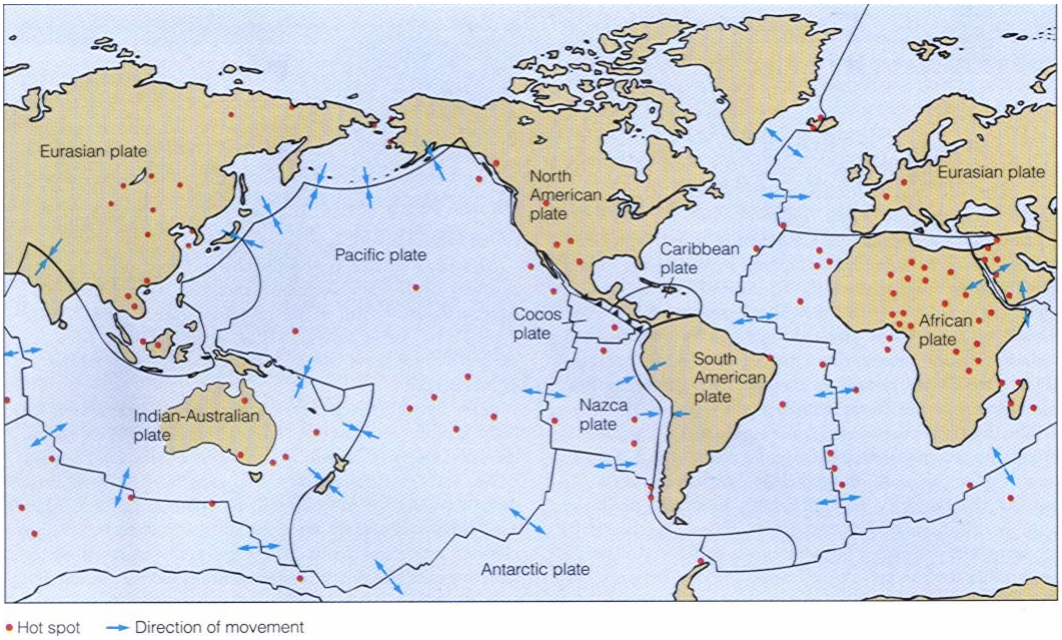

Figure 7.
Movement of Tectonic Plates
Supports Earth Expansion.

Thus the electrodynamic derived force of gravity appears to be the only theory of gravity that describes an expanding earth, moon, planets, and stars as observed, due to the rapid decay of the strength of gravity producing the cosmic background radiation.

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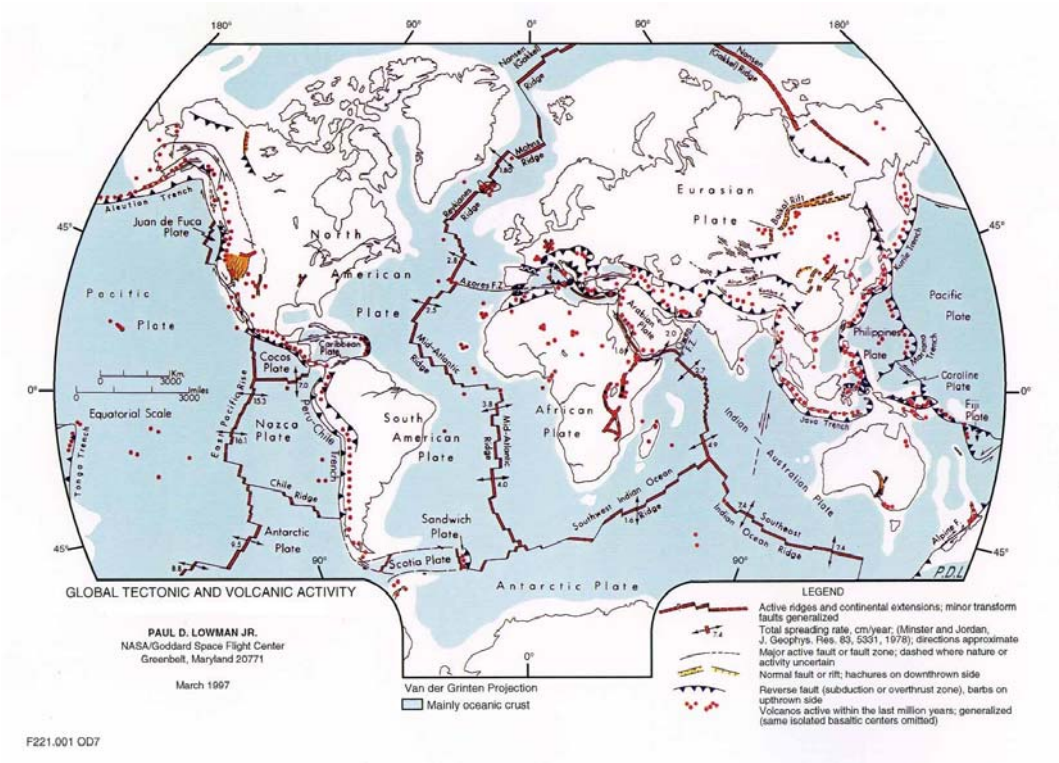

Figure 8.
Detailed Movement of Tectonic Plates Supports Earth Expansion [15])

Ocean Magnetic Stripes

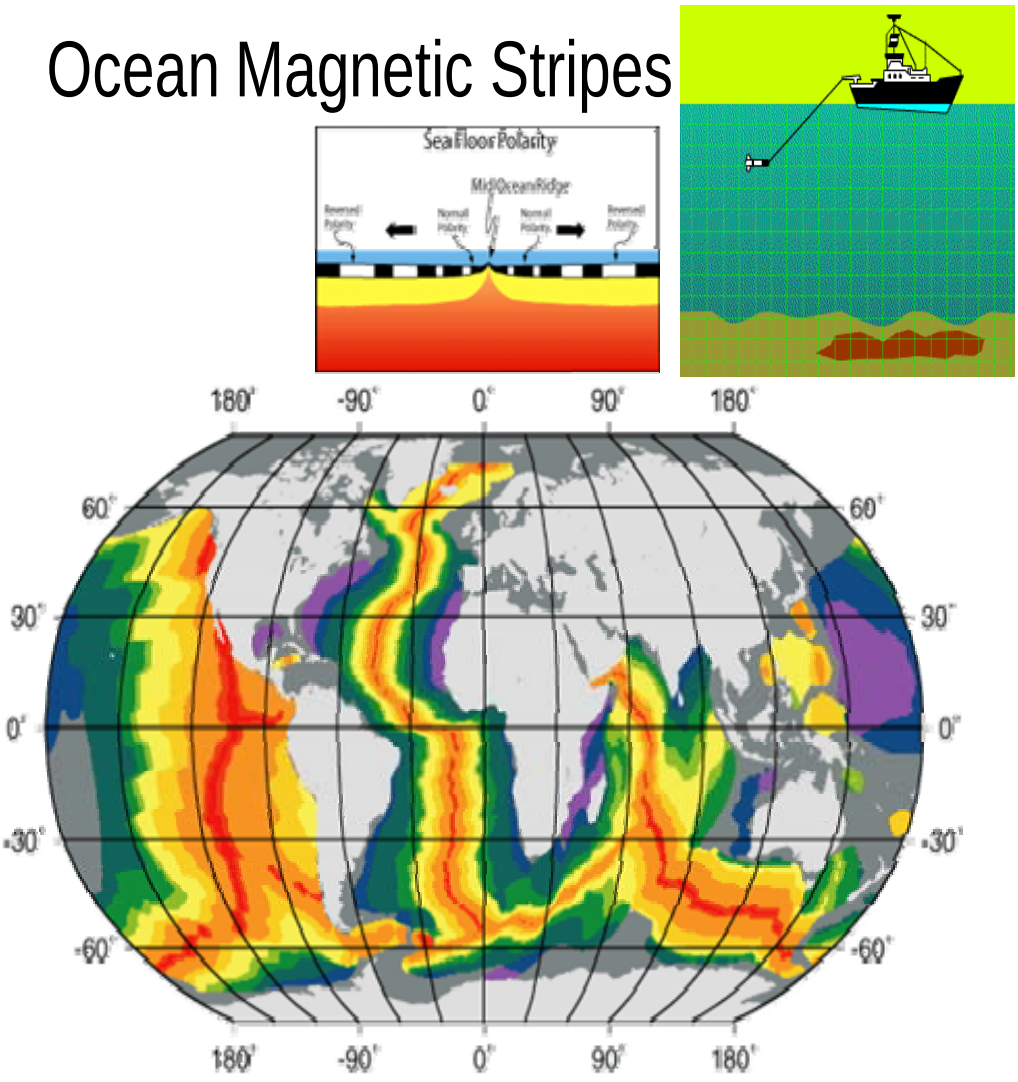

Figure 9.
Parallel Magnetic Ocean Floor Stripes on Both Sides of Mid Ocean Ridges.

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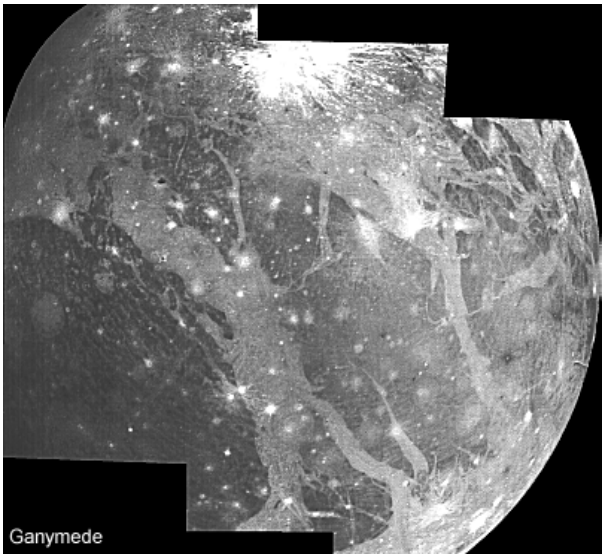

Figure 10
Expansion cracks in the surface of Jupiter's moon Ganymede (NASA).

Figure 11.
Mares or Seas of the Moon Showing Where It Expanded

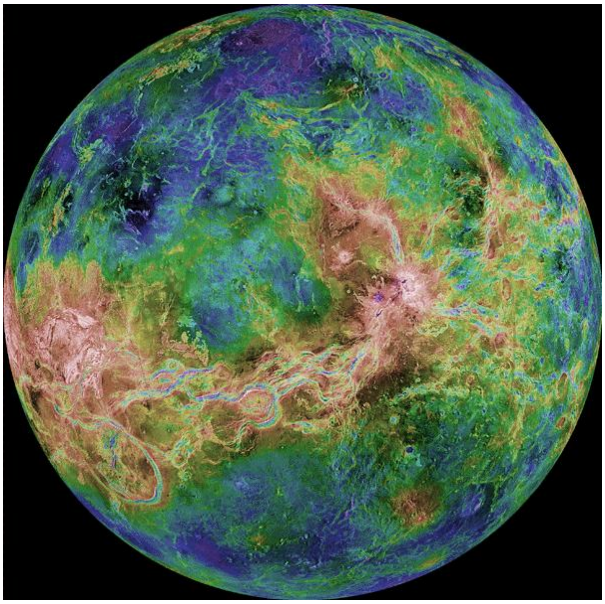

Figure 12.
Radar Image of the Current Expansion of the Planet Venus