

Abstract

Neutral bodies are composed of equal numbers of positive and negative particles, each of constant mass m . Electrostatic forces of repulsion and attraction, proportional to the charges, according to Coulomb's law, cancel out exactly everywhere. Gravitational forces of attraction, proportional to square of the charges, remain, in a medium called aether. Newton's law of gravity, expressed in terms of masses of composing particles, is expressed in terms of square of the charges and in terms of volume V of the aether occupied by a charge Q as spherical shell of radius a . Gravity is shown to be a pushing force of attraction between two bodies, by virtue of composing particles occupying spherical volumes of the aether, one obstructing another and pushed towards each other, in accordance with inverse square law. This explanation of gravity is more realistic than curving of space-time continuum in general relativity.

Keywords: Aether, Coulomb's Law, Electric Charge, Electric Field, Force, Gravitational Constant, Gravity, Mass, Newton's Law of gravity.

1. Introduction

A great scientist of 19th Century, J. C. Maxwell, derived the expression for speed of light as in equation (1), where μ_0 is permeability and ϵ_0 permittivity of electric field occupying a vacuum. This speed of light c , in a vacuum, is the same everywhere in the Universe.

Coulomb's law of electrostatics and Newton's law of gravity, illustrated in Figure 1, give the combined electrostatic force of repulsion or attraction and gravitational force of attraction \mathbf{F} between stationary particles, charge Q of mass m_1 and charge K of mass m_2 , as spherical shells of radii a and b , volumes V_1 and V_2 , distance r apart, as in equation (2) and the electrostatic field \mathbf{E}_o in equation (3), where $\hat{\mathbf{u}}$ is a unit vector in the direction of force of repulsion, G is gravitational constant. Force of repulsion is regarded as positive.

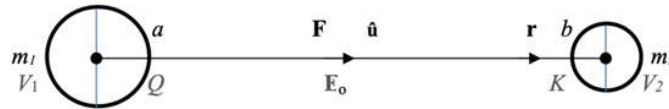


Figure 1: Force \mathbf{F} between two particles as spherical shells of charge Q of mass m_1 , radius a and volume V_1 and charge K of mass m_2 , radius b and volume V_2 , distance r apart.

$c = \sqrt{1/\mu_0\epsilon_0} = 299\,792\,458\text{ m/s} \quad (1)$	$\mathbf{F} = \pm \frac{QK}{4\pi\epsilon_0 r^2} \hat{\mathbf{u}} - G \frac{m_1 m_2}{r^2} \hat{\mathbf{u}} \quad (2)$	$\mathbf{E}_o = \pm \frac{Q}{4\pi\epsilon_0 r^2} \hat{\mathbf{u}} = \pm E_o \hat{\mathbf{u}} \quad (3)$
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For charge Q , a spherical shell of radius a , intrinsic energy E_n contained in field \mathbf{E}_o , is given by volume integral in equation (4)

$$E_n = \frac{\epsilon_0}{2} \int_V E_o^2(dV) = \frac{\epsilon_0}{2} \int_a^\infty \left(\frac{Q}{4\pi\epsilon_0 r^2} \right)^2 (4\pi\epsilon_0 r^2)(dr) = \frac{Q^2}{8\pi\epsilon_0 a} \quad (4)$$

The author derived a mass-energy equivalence law as in equation (5), different from the relativistic equation [1, 2, 3]. Combining equations (1), (4) and (5) gives mass m_1 in terms of electric charge Q , as in equation (6).

$E_n = \frac{\epsilon_0}{2} \int_V E_o^2(dV) = \frac{\epsilon_0}{2} \int_a^\infty \left(\frac{Q}{4\pi\epsilon_0 r^2} \right)^2 (4\pi\epsilon_0 r^2)(dr) = \frac{Q^2}{8\pi\epsilon_0 a} \quad (4)$	$E_n = (m_1 c^2) / 2 \quad (5)$	$m_1 = \mu_0 Q^2 / 4\pi a \quad (6)$
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In equation (2) for neutral bodies composed of equal numbers of positive and negative charges, electrostatic forces of repulsion and attraction cancel out everywhere. Substituting for the masses m_1 and m_2 from equation (6), into equation (2), gives gravitational force, in equation (7) for charges of magnitudes Q and K and in equation (8) for electrons and positrons, where $Q = K = e$ and radius $b = a$.

$\mathbf{F}_G = -G \frac{m_1 m_2}{r^2} \hat{\mathbf{u}} = -G \left(\frac{\mu_0}{4\pi} \right)^2 \frac{Q^2 K^2}{ab} \hat{\mathbf{u}} = -\chi \frac{Q^2 K^2}{r^2} \hat{\mathbf{u}} \quad (7)$	$\mathbf{F}_G = -G \frac{m^2}{r^2} \hat{\mathbf{u}} = -G \left(\frac{\mu_0 e^2}{4\pi a} \right)^2 \hat{\mathbf{u}} = -\chi \frac{e^4}{r^2} \hat{\mathbf{u}} \quad (8)$
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where $\chi = G(\mu_0/4\pi a)^2$ is a constant. Equations (7) and (8) are Newton's law of gravity in terms of square of the charges.

Equation (6) gives mass m_1 of charge Q as an impregnable spherical shell or hollow sphere of radius a and volume $V_1 = (4/3)\pi a^3$, surface charge intensity as vector $\boldsymbol{\sigma} = \hat{\mathbf{u}}Q/4\pi a^2$, where $\hat{\mathbf{u}}$ is a unit vector in the radial direction.

$m_1 = \frac{\mu_0 Q^2}{4\pi a} = \frac{\mu_0 (4\pi a^2)^2 \sigma^2}{4\pi a} = 3V_1 \mu_0 \sigma^2 \quad (9)$	$\mathbf{F}_G = -G \frac{m_1 m_2}{r^2} \hat{\mathbf{u}} = -G \frac{(3\mu_0 \sigma^2)^2 V_1 V_2}{r^2} \hat{\mathbf{u}} = -\zeta \frac{V_1 V_2}{r^2} \hat{\mathbf{u}} \quad (10)$
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For an electron or positron, σ^2 , in equation (10), is a constant and $\zeta = G(3\mu_0 \sigma^2)^2$ is a constant. Equation (10) is Newton's law of gravity in terms of volumes of space, of zero electric field, occupied by the charges.

2. Newton's Law for Force of Gravity Between Bodies

Force of attraction between a mass X containing $N/2$ positive charges and $N/2$ negative charges, each of magnitude Q and mass m_i and another mass Y of $R/2$ positive and $R/2$ negative charges, each of magnitude K and mass m_j , is deduced from equations (7) and (9), as:

$$\mathbf{F}_G = -\frac{G}{Z^2} XY \hat{\mathbf{u}} = -\frac{G}{Z^2} \sum_{i=1}^N m_i \sum_{j=1}^R m_j \hat{\mathbf{u}} = -\frac{\chi}{Z^2} \sum_{n=1}^N Q_n^2 \sum_{n=1}^R K_n^2 \hat{\mathbf{u}} = -\frac{\chi}{Z^2} NRQ^2 K^2 \hat{\mathbf{u}} = -\frac{\zeta}{Z^2} NRV_1 V_2 \hat{\mathbf{u}} \quad (10)$$

For a body composed of electrons and positrons, $m_i = m_j$, $Q^2 = K^2$, $N = R$, $V_1 = V_2$ and equation (10) becomes:

$$\mathbf{F}_G = -\frac{G}{Z^2} XY \hat{\mathbf{u}} = -\frac{G}{Z^2} \sum_{i=1}^N m_i \sum_{j=1}^R m_j \hat{\mathbf{u}} = -\frac{\chi}{Z^2} \sum_{n=1}^N Q_n^2 \sum_{n=1}^R K_n^2 \hat{\mathbf{u}} = -\frac{\chi}{Z^2} N^2 e^4 \hat{\mathbf{u}} = -\frac{\zeta}{Z^2} N^2 V^2 \hat{\mathbf{u}} \quad (11)$$

where Z is the separation of gravity of the two masses. A body composed of electrons and positrons, where $Q^2 = K^2 = e^2$, gives:

3. Concluding Remarks

- Gravity is force of attraction between charged particles as hollow spheres with zero field inside and radial lines of force outside.
- For neutral bodies, electrostatic forces of repulsion and attraction cancel out, but the gravitational forces of attraction add up.
- Gravity is a pushing force of attraction between particles in a medium called aether, one obstructing another in their shadows.

References: [1]. doi.org/10.33140/ATCP.03.02.01 [2]. [doi.org/10.47363/JPSOS/2023\(5\)186](https://doi.org/10.47363/JPSOS/2023(5)186) [3]. doi.org/10.33140/ATCP.02.04.10