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Weight Gain from Static Charging

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Abstract

This paper announces the discovery that a statically charged object gains weight, equal to approximately 7×10^{-11} grams per excess electron when the object is negatively charged and 5×10^{-11} grams per excess proton when positively charged. The weight gain is not instantaneous but increases to a maximum and then decays with the excess charge.

Keywords

Weak Electric Fields, Gravity, Mass, Charge, Unification, Discovery

1. Introduction

Early theoretical efforts to unify electromagnetism and gravity by extending general relativity to five dimensions include that of Theodor Kaluza in 1921 [1], Albert Einstein in 1925 [2], and Oskar Klein in 1926 [3], who attempted to incorporate quantum theory, which Einstein opposed, in what has come to be known as the Kaluza–Klein theory. More recent theoretical efforts to unify the forces, which now include the strong and weak nuclear forces, include M-Theory [4] and Quantum Gravity [5]. To date no satisfactory experimental evidence exists to confirm or deny any of these.

The solution may begin with experimentation. The primary differences between the gravitational and electric forces are magnitude and direction: for a given separation, like charges repel many orders of magnitude more than like masses (the only stable kind we know of) attract. Experimentation where the magnitudes are similar must necessarily involve either very strong gravitational fields or very weak electric fields. The former cannot be created in a lab, the latter never are, research has been concentrated exclusively on ever stronger electric fields. This may be a critical oversight.

The phenomenon was discovered while attempting to measure forces between small charge densities separated by relatively large distances, using a scale that is accurate to 1/1000th of a gram. The scale would maintain a constant reading indefinitely of exactly 50.000 g for the test mass that came with it, and likewise would not fluctuate for any test item, until the item was charged. A stand was made to separate the test item from the scale as far as possible and the fluctuation was still observed. Furthermore, it was observed that any test object's weight increases after charging, reaches a maximum and then decreases as the excess charge decays. The observed weight gain is less per unit charge for positively charged items than for negatively charged items, with the ratio being about 5/7.

The rest of this article is organized as follows. Section 2 describes the methods and materials for the experiment. Section 3 describes the results. Section 4 contains the discussion and next steps.

2. Methods and Materials

The experiment consists of a conductor on a stand atop a scale that has been zeroed. A small wire is touched to the conductor and then removed and it is verified that the scale returns to zero. Next a statically charged object is held near the conductor and then removed and again it is verified that the scale returns to zero. Finally, the statically charged object is held near the conductor while touching it with the wire and then both are removed, charging the conductor by induction. The scale does not return to zero but steadily gains weight, reaching a maximum and then decreasing as the excess charge on the conductor decays.

The setup is shown in **Figure 1**. A hollow aluminum sphere composed of 2 hemispheres with a radius of 3.4 cm was used as the conductor. It was placed on a stand 24 cm above the floor to ensure that no measurable Coulomb attraction exists between it and the floor.

A large smooth Styrofoam ball was used to charge the sphere by induction. When rubbed against cotton such as denim, it charges negatively and allows the

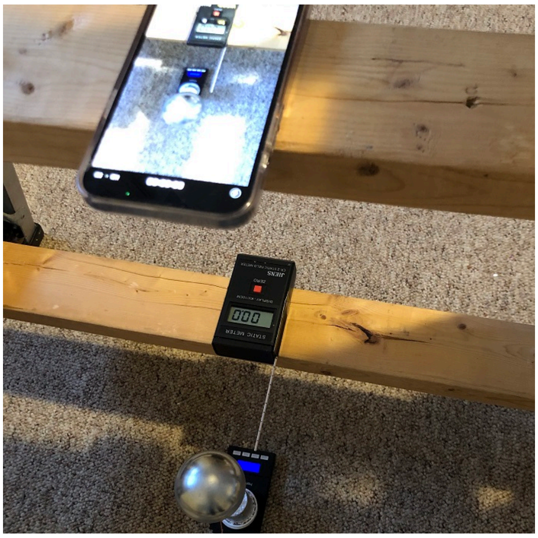

Figure 1. A 3.4 cm radius hollow aluminum sphere atop a stand 24 cm above a digital scale, with a static meter 10 cm away horizontally, recorded from above.

sphere to be charged positively. When rubbed against polyester, it charges positively and allows the sphere to be charged negatively.

A static meter was placed 10 cm from the sphere, the distance for which it is calibrated to measure the surface voltage due to static charge, with a resolution of 0.1 kV

The readings on the scale and the static meter were recorded with an iPhone until the scale auto shutoff. The weight and voltage were then entered into Excel in one second intervals.

3. Results

The Styrofoam ball gains more negative charge when rubbed against denim than it does positive charge when rubbed against polyester, so the conducting sphere could be charged more positively than negatively. Figure 2 shows the weight change and surface voltage versus time for a positive charge, where the maximum induced surface voltage was +400 V. The maximum weight gain was 0.506 g. Figure 3 shows the weight change and surface voltage versus time for a negatively

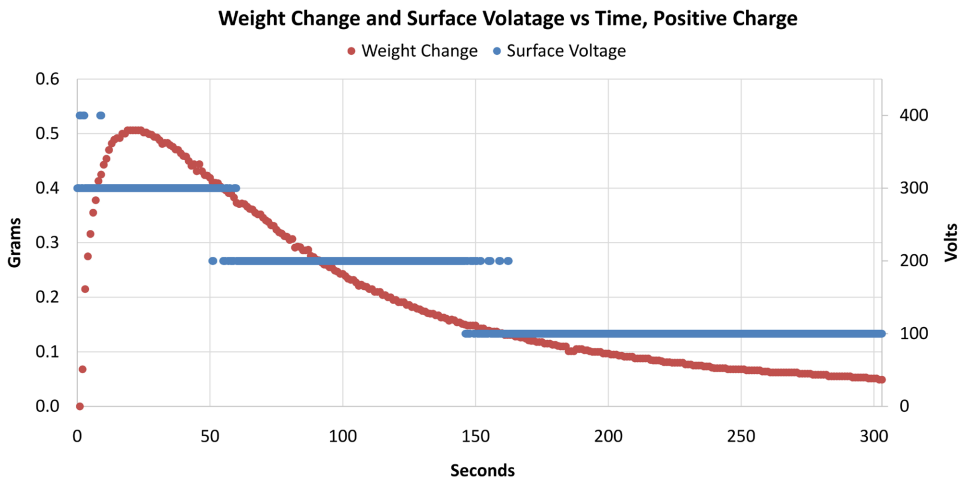

Figure 2. Weight change in grams and surface voltage vs time in seconds, positively charged.

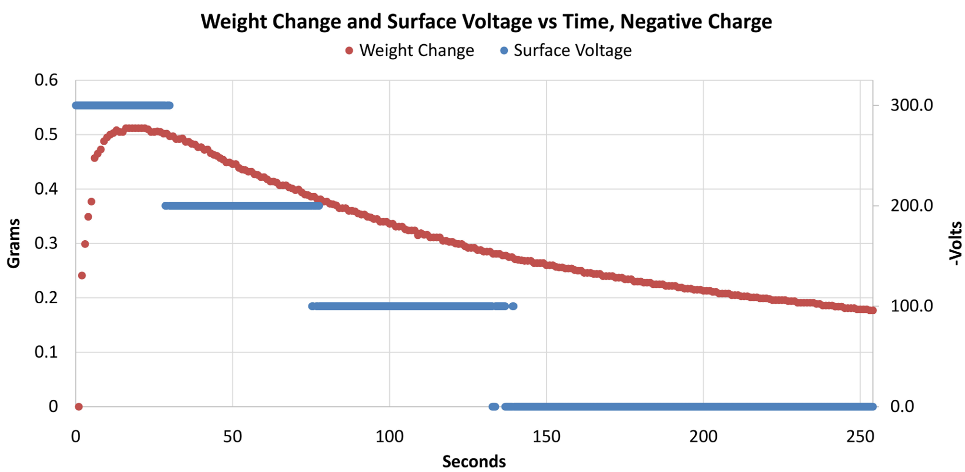

Figure 3. Weight change in grams and surface voltage vs time in seconds, negatively charged.

charged item, where the maximum induced surface voltage was −300 V. The maximum weight gain was 0.512 g.

From the capacitance of an isolated conducting sphere ($4\pi\varepsilon_0$ R), 400 V corresponds to a static charge of 1.5×10^{-9} Coulombs or about 9×10^{9} excess protons. Similarly, −300 V corresponds to a static charge of 1.0×10^{-9} Coulombs or about 7×10^{9} excess electrons. The maximum weight gain per positive charge was therefore 3×10^{5} kg/C or 5×10^{-11} g/proton. The maximum weight gain per negative charge was 4.5×10^{5} kg/C or 7×10^{-11} g/electron.

4. Discussion and Next Steps

Initially it was thought that the excess charge affected the electronics in the scale, creating the observed fluctuation in the reading, but this was eliminated by holding the charged Styrofoam ball, with a surface voltage over 2.0 kV, near the scale. Not until the ball was within 1cm of the scale did the reading change, and then only by 0.023 g, an order of magnitude less than the observed weight gains.

The limitation of only one significant figure for surface voltage prevented a precise measurement of the weight gain per unit charge, and how or to what extent this leads and/or lags the excess charge. Nonetheless at least three observations remain unexplained from known theory: The weight gain, the difference in magnitude for positive and negative charge, and the delay from when an object is charged to when the maximum weight gain is reached.

This is a previously unobserved relationship between gravity and charged particles, and may present an opportunity to unify the gravitational and electric forces. The obvious next step is to quantify this phenomenon as precisely as possible, model the results and then determine if it fits with any known theory.

Except for research in the biomedical field [6] [7], there appears to be very little interest in the study of weak electric fields, historically and at present. A published precise measurement of the electric force about the region of zero, that is, on the order of magnitude of the gravitational force between lab-sized objects, is lacking. It is entirely possible that the electric force does not approach zero asymptotically. It could cross through at very small magnitudes and then approach zero from the opposite side, reversing direction such that like charges attract and opposites repel at very small magnitudes. At the very least, confirming the absolute $1/R^2$ nature of the electric force as R approaches infinity to the limit of existing technology seems a worthwhile pursuit.

Conflicts of Interest

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

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