A Different Look at the Hydrogen Atom

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Abstract

Connections between the four known types of interactions are being sought in order to unify them and to describe all the interactions using only a single one of them or using a completely new type of interaction. This paper presents a possible simple solution to the problem for the gravitational force and the electromagnetic force only. A simple interpretation of this solution assumes that our Universe is moving at the speed of light. This requires a model of the entire Universe, which would have to be infinitely large and therefore would have to contain an infinite number of universes like ours. This can also be used to build a new model of two kinds of forces, by combining gravity with motion at the speed of light and transforming it into an electromagnetic force, as if these two kinds of interactions depended only on an observer in a certain reference system. This is the second work of three that belong to my physics trilogy. I assume that the mathematical formulas used here are understandable to most people interested in physics, while the other two works [3], on new formulas for solar energy production and gravitational force, require a little more knowledge of mathematics and physics. This document can be found in the German[2] version and the Polish[3] version on my website (meinuniversum.de).

1 Introduction

In this paper it was proved that the ionisation energy of the Hydrogen atom is $(2.18 \cdot 10^{-18}\,J = 13.6\,eV)$ [1] [1], is related to the gravitational field of the Earth. The new formula (3) uses units that have nothing to do with electromagnetism except for the speed of light c. The physical constants from the Committee on Data for Science and Technology (CODATA) [1] table were used for the calculation. However, the numerical values have been rounded off in the calculation results. To understand this formula, an example is shown below of how to calculate the kinetic energy of a satellite that is in orbit around the Earth and moving with the Earth around the Sun, if the calculation is done by an observer located on the Sun.

2 Calculations

2.1 Energy of an object moving around the Earth observed from the Sun

The Earth orbits the Sun with velocity u. A satellite orbits the Earth with velocity v, which is equal to the first cosmic velocity. The satellite has mass m. The satellite has two velocities u and v. The case considered here is that both velocities run parallel to each other, have the same direction and lie in the ecliptic plane. The satellite in this case cannot be seen from the Sun because it is in the Earth's shadow. In this position, the velocity of the satellite for the coordinate system associated with the Sun is represented by the sum (u + v). The kinetic energy of the satellite can be calculated at this position using the following formula.

$$E = \frac{1}{2}m(u + v)^2 \tag{1}$$

After simple transformations we obtain:

$$E = \frac{1}{2}m\,u^2 + \mathbf{m}\,\mathbf{u}\,\mathbf{v} + \frac{1}{2}m\,v^2 \tag{2}$$

The terms in the sum with the factor of $\frac{1}{2}$ need not be explained further, as they are known to all. They are associated with different observers. The former is located on the Sun and the latter on the Earth. The term in the middle of $(m \cdot u \cdot v)$ looks different and is not commonly known, because the average kinetic energy in the orbit in the present case does not include this term. It is not easy to find its (**m u v**) physical meaning.

The explanation of what it could mean is completed with the following example, which gives hope for understanding the close connection between electromagnetism and gravitation.

3   Ionisation energy of the hydrogen atom

The following notations and assumptions have been made, referring to the example given above
- m_e is the mass of the Electron,
- u is the speed of light in vacuum c,
- v is the first cosmic velocity for the Earth ($7912\frac{m}{s}$).

$$E = m_e \, c \, v = 2.16 \cdot 10^{-18} \, \text{J} = 13.486 \, \text{eV} \tag{3}$$

The maximum binding energy of the Electron in the Hydrogen atom is 13.6 eV [1] [1] and it is only 0.12 eV higher than the energy obtained in calculations with the above formula (3). Thus, the result of these calculations may represent the binding energy of the Electron in the Hydrogen atom. The electron can leave the nearby Proton – nucleus of the Hydrogen atom, if it additionally reaches the first cosmic velocity for the Earth, assuming that both particles already move with the speed of light c. This is a direct conclusion from the above formula. From an energy point of view, we can say that when the Electron reaches the first cosmic velocity for Earth, it will have enough energy to be considered a free Electron. The energy approach is, I suppose, more appealing.

4   Summary

Using the above formula (3), the gravitational energy of a free Electron on the Earth was calculated if it moved at the speed of light. It can be compared with the binding energy of the Electron in the Hydrogen atom, resulting from calculations of the theory of electromagnetism, and no big difference of both results can be seen. This proves that, with certain assumptions, the binding energy of the Electron in the Hydrogen atom may be considered as the result of gravitational interaction and its motion at the speed of light. This allows the following statement – electromagnetism is nothing more than gravity and motion at the speed of light.

Such a claim also has more serious consequences concerning the entire Universe and concepts such as mass or rest energy. If our local Universe were moving at the speed of light, as can be inferred from equation (3), then each particle (mass) would already have a momentum equal to $m \, c$ and an energy equal to $m \, c^2$. This would mean, however, that there would be no rest energy for the one unique observer who could observe our local Universe without being in it (so really from the outside) or being in it but not belonging to it. This means that the energy $m \, c^2$ has only been interpreted as rest energy by an observer on Earth. However, it is related to our motion at the speed of light. This external observer would only see waves, according to our school knowledge, which have no mass, like light, because electromagnetic waves cannot have any mass, according to our knowledge. The mass of a body would not be its real property. It is possible to disregard mass and operate in formulas with concepts such as energy or energy density, as was shown in the third paper on gravitational force, although even here mass had to be included in the calculations, which, however, is not immediately noticeable. An example of how the concept of mass can be dispensed with is in electrodynamics, where instead of mass the concept of electric charge was introduced with the concept of indivisible Elementary Charge.

The theoretical model of electromagnetism, however, allows with its theoretical formulae to calculate the allowed energy values of the electron in the hydrogen atom much more precisely. In spite of this, the connection of gravitational forces with electromagnetic forces has been proved in this work, admittedly not at the level of force concepts but at the level of energy concepts, which is equivalent. People of science should make more theoretical efforts in the direction described in this work so that the undoubted connection between gravity and electromagnetism can be confirmed with more precise equations. Other effects and consequences of such a view of the Universe and the various interactions between elementary particles can be expected, which will perhaps be covered in other works.

References

[1] CODATA Tabelle
   https://physics.nist.gov/cuu/pdf/wall_2018.pdf

[2] DE - Wasserstoffatom anders
   http://meinuniversum.de/de/pdf/wasserstoffatom-anders.pdf

[3] PL - Atom Wodoru inaczej
   http://meinuniversum.de/pl/pdf/atom-wodoru-inaczej.pdf

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[1]This energy is calculated in almost every work on electromagnetism and atomic physics under the term, e.g. Rydberg unit of energy.

[2]This unique external observer can observe our local Universe as if it were outside it. This is one possible interpretation of equation (3) that this theoretical observer would allow itself when analysing the above formula.

[3]The three papers have the following titles: „A Different Look at the Power of the Sun ", „A Different Look at the Hydrogen Atom " and „A Different Look at Gravity "