Gravitational Quantum Bit

Fran De Aquino
Professor Emeritus of Physics, Maranhao State University, UEMA.
Titular Researcher (R) of National Institute for Space Research, INPE
Copyright © 2021 by Fran De Aquino. All Rights Reserved.
https://frandeaquino.pro.br
deaquino@elointernet.com.br

The *Quantum* Computers use *qubits* (or *qbits*), the *quanta bits*, which can assume values 0 or 1, or a *superposition* of both. In this work, we propose a new type of *quantum* bit, the *Gravitational Quantum Bit* or Gqbit, which can be used as an information unit. The concept of the Gqbit is based on the theory of the *Gravitational Electromotive Force* (Gemf) [1], which shows that, when an electron absorbs a *quantum* of energy sufficient strong, the gravitational force acting upon it (its weight) changes of direction. The weight of the electron can assume *two* fundamental statuses. *For up*, (gravitational force in *opposite direction* to the gravity g)and, *for down* (gravitational force in the *same direction* of g). Conventionally, we can then assume that *for up*, the weight of the electron represents the number **0**, and that *for down*, it represents the number **1**, similarly to the *spin* of the electron, which can be interpreted as if the electron rotates in one direction or the other - in this case, rotation in one direction would represent **0** and, in the other, it would represent **1.**
Key words: Quantum bit, qubits, qbits, Gravitational Quantum bit, Gqbit, Quantum Computers, Quantum Computing.

INTRODUCTION

Through the allocation of electrons, a conventional bit is able to assume a single piece of information as positive or negative, or even 0 or 1. All modern computing is built on top of this binary base.

Recently, with the arising of the Quantum Computers, which use the *quanta bits* called *qubits* (or *qbits*), which can assume values 0 or 1, or a *superposition* of both, the computing had a strong advance in several aspects.

However, the current *quanta* chips used in the Quantum Computers need to be kept at temperatures close to absolute zero (milikelvins). Besides, these computers need differentiated spaces to work. All of this constitutes a strong difficulty to the advancement of quantum computing.

Here, we propose a new type of *quantum* bit, the *Gravitational Quantum Bit* or Gqbit. The concept of the Gqbit is based on the theory of the *Gravitational Electromotive Force* (Gemf) [1], which shows that, when an electron absorbs a *quantum* of energy sufficient strong, the gravitational force acting upon it changes of direction. The gravitational force upon the electron (its weight) can assume *two* fundamental statuses. *For up*, (gravitational force in *opposite direction* to the gravity g)and, *for down* (gravitational force in the *same direction* of g). Conventionally, we can then assume that *for up*, the gravitational force represents the number **0**, and that *for down* , it represents the number **1** .

THEORY

The electrical current arises in a conductor when an outside force acts upon the free electrons of the conductor. This force is called, in a generic way, of *electromotive force* (EMF). Usually, it has *electrical* nature. In a previous paper we have shown that this force can have *gravitational* nature (*Gravitational Electromotive Force*), and we have proposed a system to produce Gravitational Electromotive Force, called *Gravelectric Generator*, which converts *Gravitational Energy* directly into *Electrical Energy* [1].

The *Gravitational Electromotive Force* upon a single electron can arise, for example, when a photon beam with photons of frequency f strikes on the electron, and it absorbs a *quantum* of energy $U = Nhf$, $N = 1,2,...$, in a such way that its gravitational mass, m_{ge}, becomes strongly *negative*, in accordance with the following equation [2]:

$$m_{ge} = \chi_e m_{i0e} = \left\{1 - 2\left[\sqrt{1+\left(\frac{Un_r}{m_{i0}c^2}\right)^2} - 1\right]\right\} m_{i0e} = \\ = \left\{1 - 2\left[\sqrt{1+\left(\frac{Nhf}{m_{i0e}c^2}\right)^2} - 1\right]\right\} m_{i0e} \qquad (1)$$

where m_{ioe} is the *rest* inertial mass of the electron; $n_r = 1$ is the index of refraction of the electron and c is the speed of light.

Note that if $Nf > 1.18 m_{i0e} c^2 / h = 1.6 \times 10^{20}$ *, then $\chi_e < 0$. Therefore, if the electron is subjected to gravity $\vec{g}$, the gravitational force upon it will have *opposite direction* to $\vec{g}$, and will be given by

$$\vec{F}_g = m_{ge}\vec{g} = \chi_e m_{ioe}\vec{g} = -|\chi_e| m_{ioe}\vec{g} \qquad (2)$$

If the value of $|\chi_e|$ is sufficient strong the gravitational force upon the electron can move it, producing a fundamental unit of electrical current.

When the photon beam, which strikes on the electron is turned *off*, the value of U becomes *zero*, and according to Eq. (1), the value of m_{ge} reduces to $m_{ge} = m_{i0e}$. Consequently, the Gravitational Electromotive Force upon the electron is reduced for $\vec{F}_g = m_{ioe}\vec{g}$. Thus, the Gravitational Electromotive Force upon the electron can assume *two* fundamental statuses. *For up* (in respect to the gravity $\vec{g}$; $\vec{F}_g - |\chi_e| m_{ioe}\vec{g}$), and *for down* ($\vec{F}_g$ in the *same direction* of $\vec{g}$; $\vec{F}_g = m_{ioe}\vec{g}$).

Conventionally, we can then assume that *for up*, the force $\vec{F}_g$ represents the number **0**, and that *for down* $\vec{F}_g$ it represents the number **1** (See Fig.1), similarly to the *spin* of the electron, which can be interpreted as if the electron rotates in one direction or the other - in this case, rotation in one direction would represent **0** and, in the other, it would represent **1.**

According to the *Quantum Superposition Principle* an *electron* partially exists in all theoretically possible states simultaneously before being measured. But when measured or observed, the system shows itself in a single state. Thus, in theory the Gravitational Electromotive Force (Gemf) generated on the electron (Fig. 1) can assume infinitely different values between positions **1** and **0** . This is therefore, a promising information unit, that here will be called *Gravitational Quantum Bit* or Gqbit. Thus, it is clear that the Gqbit can be **0** , **1** or a *superposition* of both. Based on the above explained, the Gqbit can be represented as a linear combination of $|0\rangle$ and $|1\rangle$ †.

Now consider the device shown in the Fig.2. It is a promising device that can be used as a Gqbit. The Gravitational Electromotive Force (Gemf) generated in the piezoelectric crystal can assume infinitely different values between positions **1** and **0**.

When the photon beam is *On* (Fig.2 (a)) the Gemf produced in the crystal generates a voltage V between the ends of the crystal, which would represent **0.** When the photon beam is *Off* (Fig.2 (b)), $V = 0$ would represent **1.**

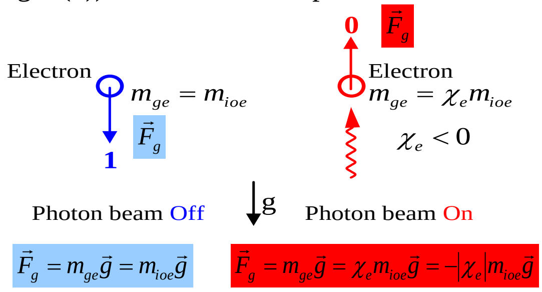

Fig. 1 – *For up*, the gravitational force $\vec{F}_g$ represents the **0** of the Classical Computation. When $\vec{F}_g$ changes *for down*, it represents the **1** .

---

* The number of photons, N, absorbed by an electron, in the time unit, can be expressed by $N = ft$. If the lamina has thickness d (see Fig.2), and the velocity of the photons inside the lamina is $v = c/n_r$, then we can write that $\bar{d} = v\bar{t} = (c/n_r)\bar{t}$ or $\bar{t} = (n_r/c)\bar{d}$. Consequently, we have $N = f\,\bar{t} = (n_r/c)\bar{d}f$ or $Nf = (n_r/c)\bar{d}f^2$. Thus, for $Nf > 1.6 \times 10^{20}$, we must have $(n_r/c)\bar{d}f^2 > 1.6 \times 10^{20}$ or $f > 2.19 \times 10^{14} / \sqrt{n_r \bar{d}}$. For $n_r \cong 1.5$ and $\bar{d} \cong 0.1m$, we get $f > 5.65 \times 10^{14} Hz$ and $\lambda < c/fn_r = 3.53 \times 10^{-7} m = 353nm$ (*ultraviolet UVA* 320nm-400nm).

† The state of a quantum bit, $|\psi\rangle$, is expressed by $|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$ where α and β are complex numbers that indicate probability amplitudes of the states **0** and **1**, respectively. The values $|\alpha|^2$ and $|\beta|^2$ are the probabilities that the quantum bit is found in the states **0** or **1**, respectively. Normalization requires that $|\alpha|^2 + |\beta|^2 = 1$. Therefore, a quantum bit is defined as a pair of number (α, β) as $q = \begin{bmatrix} \alpha \\ \beta \end{bmatrix}$, [3].

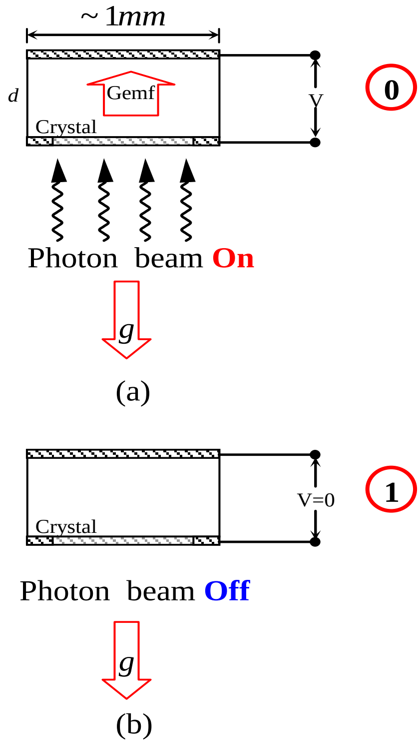

Fig. 2- A promising device that can be used as a Gravitational *Quantum* bit (Gqbit).

CONCLUSION

It is important to note that a *quantum* chip with Gqbits, as the one shown in Fig.2, works at room temperature, unlike current *quantum* chips that need to be kept at temperatures close to absolute zero (milikelvins). Besides to working at room temperature, the quantum computers with Gqbits do not need differentiated spaces like current quantum computers. In this way, the Computers with Gqbits can be much more efficient in both respects.

References

[1] De Aquino, F. (2016).*The Gravelectric Generator: Conversion of Gravitational Energy Directly Into Electrical Energy*, Bulletin of Pure & Applied Sciences- Physics Year : 2016, Volume : 35d, Issue : 1and2 First page : **(55)** last page : **(64)** Print ISSN : 0970-6569. Online ISSN : 2320-3218. DOI : 10.5958/2320-3218.2016.00008.7

[2] De Aquino, F. (2010) *Mathematical Foundations of the Relativistic Theory of Quantum Gravity*, Pacific Journal of Science and Technology, **11** (1), pp. 173-232.
Available at: https://hal.archives-ouvertes.fr/hal-01128520

[3] Han K. H., and J. H. Kim (2002). *Quantum-inspired evolutionary algorithm for a class of combinatorial optimization*, IEE . Transaction on Evolutionary Computation 6 (6): 580–593.