# On the Söllinger, Weizsäcker Relations and Bošković's Curve of Force (English version)

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**Abstract.** In "The Code of Nature" [1] Helmut Söllinger gives his and Carl Friedrich von Weizsacker's (1912-2007) relationships between the fundamental physical constants. The first section examines Söllinger's the relationship between the masses of protons and electrons, and the fundamental physical constants. The second is about the Weizsacker's assumption of proportionality between the Planck length, Compton wavelength and radius of the Universe. In the third section, I try to explain, the previous relationships, in light of the attractive-repulsive forces of the Ruđer Bošković (1711-1787), the earliest founder of quantum theory.

## 1. Relation of Helmut Söllinger

*"The simplest and most convincing formula the author has found is:" [1]*

$$\mathbf{m_e^3 * m_p^3 = (e^2\, h/4\pi\varepsilon_o cGR_u)^2}$$

The relationship seems interesting, So, I took to check, through my relationships and dimensionless values of physical quantities [2]. Mathematical and physical constants such as the relations that appear in this paper are given in **App 1**. Since the $\mathbf{e^2/\varepsilon_o=2hc/\acute{\alpha}}$, $\boldsymbol{\acute{\alpha}}$ is the inverse of fine structure constant and $\boldsymbol{\pi\,'=2\pi}$, then we can write the simplified form:

$$\mathbf{m_e * m_p = (h^2/\,\pi'\acute{\alpha}GR_u)^{2/3}}$$

Then, if it includes values from **App 1**, we obtain:

$$\mathbf{m_e \times m_p = 1.5236552226e\text{-}57\ kg^2}$$

$$\mathbf{(h^2/\,\pi'GR_u)^{2/3}=1.5181593981e\text{-}57\ kg^2}$$

That is:

$$\mathbf{m_e * m_p \neq (h^2/\,\pi'GR_u)^{2/3}}$$

To be equality, we have to find coefficient of proportionality. Thus we obtain:

$$\mathbf{m_e * m_p = k * (h^2/\,\pi'\acute{\alpha}GR_u)^{2/3}\,;\ \ k=1.003620058} \qquad \mathbf{(1)}$$

Or, proposed relationship is close, but not exact, because there are only three significant digits that correspond.

Now, the question is what is contained in the coefficient of proportionality **k**, the relation to be valid. We see that the relation appears radius of the universe but not the mass, it is easy to justify with the assumption that it is contained in the universal gravitational constant, **G**. So that relationship has masses of protons, electrons, and the Universe, and the radius of the Universe only. It is expected that the relation contains parameters related to the length of the electron and proton. The main candidates are, Compton wavelength of the proton and the classical electron radius.

Second reason, why it can be expected that such a simple relationship is not exact is the fact that the fundamental constants of physics are compared with two different types of masses, one elementary and one composite particle. Between **protons** and **electrons**, by the value of the mass, there are two fundamental particles of the first generation (**up** and **down** quark). This will be discussed in more detail in section three on the basis the force curve of Ruđer Bošković.

Insight into my files, I found that:

$$\pi'^{-2/3} * \acute{\alpha}^{-1/3} * M_u^{-1/3} R_u^{2} m_p^{1/3} * r_e^{-1} * \lambda_p^{-1} * 2^{cy/3} = 1.003620 \quad / cy = e^{\pi'}, \ \pi' = 2\pi \ / \qquad (2)$$

If we take:

$$G = c^2 M_u / R_u \qquad \text{and} \qquad \beta = r_e/\lambda_p = 2.13252558501$$

We get:

$$R_u^4 (c/\lambda_p)^3 * h/(\pi' M_u * 2^{cy}) * (G m_p)^{-2} = 1 \qquad (3)$$

That is no less simple relations of Söllinger's, but includes classical electron radius and Compton wavelength in relationship with the fundamental physical constants R**,** **c,** $\lambda_p$**, h,** $M_u$**, G,** $m_p$. Relation (3) can be checked using the table in **App. 1** Of course, you can write a relation, as in the Söllinger in the form of the product of the two masses.

$$m_x * m_y = (h^2/\pi' G R_u)^{2/3} \quad \text{ili} \quad m_x^3 * m_y^3 = (h^2/\pi' G R_u)^2 \qquad (4)$$

In addition to determine, what masses of the **x** and **y** are. That would be discussed in Section 3.

## 2. Relation Carl Friedrich von Weizsäcker's

The second relation in [1], was originally attributed to Weizsäcker says:

$$\lambda_p \sim l_{pl}^{2/3} * R_u^{1/3} \qquad \text{or} \qquad \lambda_p^3 \sim l_{pl}^2 * R_u$$

Can be written as equality in the form:

$$\varsigma \lambda_p = l_{pl}^{2/3} * R_u^{1/3} \qquad (5a)$$

We apply values from **App 1** and get: **ς=2.445349**

Where:

$$\varsigma = 2^{2(\pi'\beta+1)*(\pi'\beta+2)/3} \qquad \textbf{(5b)}$$

The methodology by which I came to the previous relationship is not yet fully published, because there are a number of ways of achieving the result. For me it would mean a validation, if entirely different approach to get the same results. However, in the works of renowned scientists of the eighteenth century, Ruđer Bošković (originals of his works can be found in [4]); I found the approach which can explain the relations.

## 3. Attractive-repulsive force of the Ruđer Bošković

Text and image are fully downloaded from [5].

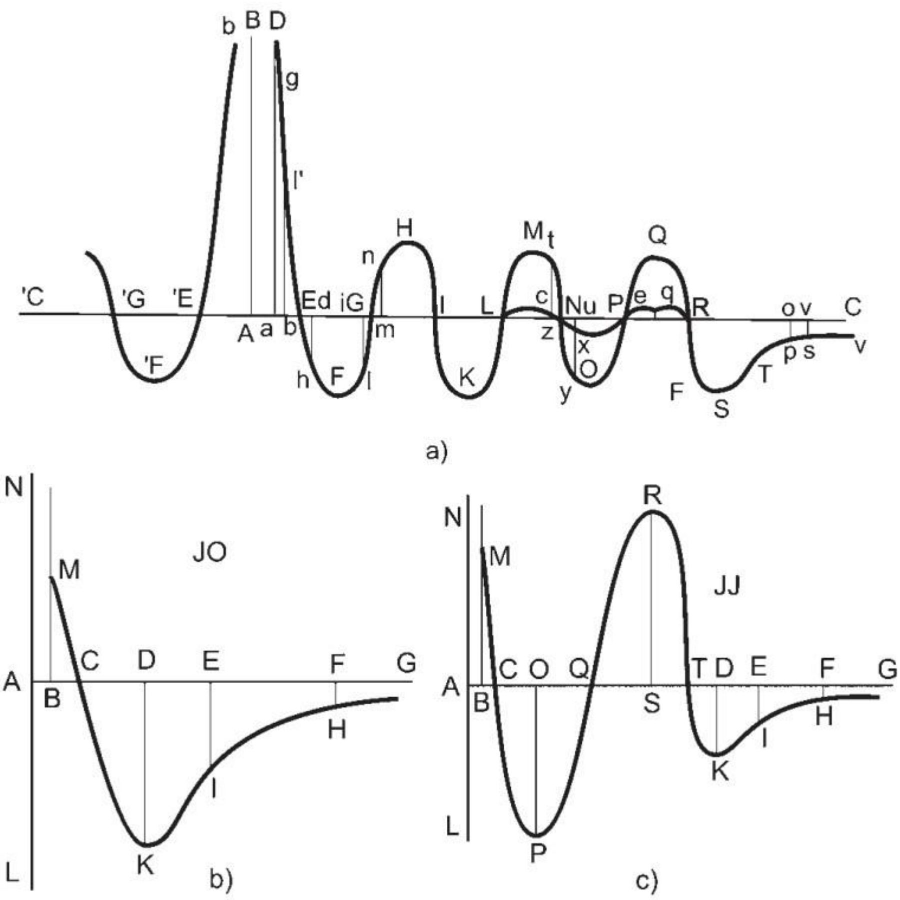


FIGURE 1 – General (a) and some particular (b, c) shapes of Boscovich’s curve that represents the attractive and repulsive forces (bottom and upper rdinates,respectively) vs. distance (abscissa) between the elementary points or particles of matter [4]

*„Roger Boscovich (1711-1787) held that the elementary particles of whichmatter is built were non-extended and indivisible points. Depending on the distance between points, an attractive or repulsive force appears, that can be represented graphically by Boscovich’s curve. The elementary points are combined producing more complex particles of the fi rst order, and the first order particles are combined producing the second order particles, etc. Then atoms, molecules,*

*macromolecules, nano-particles, bodies are formed. Whatever the level of the particles, the same force law can describe the interaction between them. Boscovich's theory is the very first quantum theory that contributed to the discovery of the structure of atoms and inspired many scientists for further development of modern comprehension of material structure."*

If we return to the (4) and (5) and compare with Figure 1 we see a logical assumption that there is a simple relation between the particles of the same order. Moreover, it is expected even closer connection with neighboring points. Take the points E and G where the first particle is in a stable equilibrium, while G is unstable and particle absent. We can compare this situation with the orbits of the planets, where we have two focal points that are important, even though they have no mass.

So, we started from the assumption that in (4) **x** is **up** quark, and **y** virtual quark with mass that should satisfy some conditions.

Thus we have:

$$\mathbf{m_{up}^3 * m_y^3 = (h^2/ \pi' G R_u)^2} \qquad \textbf{(6)}$$

Since, the neutron is composed of two down quarks and one up quark then we can consider that the point in which the up quark in the neutron, is the focus of neutrons. If not, then two down quarks would not be the same type of particle, which is a contradiction. On the same logic, we can attribute mass, for the center of the proton. Even, we know that there is no particle there.

For the virtual mass $\mathbf{m_y}$, we have all following relations:

$$\mathbf{m_y=h^{2/3}/(GR_u)^{1/3}=3.7067804666E\text{-}28\ kg} \qquad \textbf{(7)}$$

$$\mathbf{m_y=h^{2/3}/(R_u^4\ M_u^{-1}T_u^{-2})^{1/3}=3.7067804666E\text{-}28\ kg} \qquad \textbf{(8)}$$

$$\mathbf{m_y=(hR_u^{-2}\ M_u^{1/2}T_u)^{2/3}=3.7067804666E\text{-}28\ kg} \qquad \textbf{(9)}$$

$$\mathbf{m_y=h^{2/3}/(c^2\ M_u\ R_u^2)^{1/3}=3.7067804666E\text{-}28\ kg} \qquad \textbf{(10)}$$

$$\mathbf{m_y=h^{2/3}R_u^{-4/3}\ M_u^{1/3}T_u^{2/3}=3.7067804666E\text{-}28\ kg} \qquad \textbf{(11)}$$

For the **up** quark mass goes:

$$\mathbf{m_{up}=M_u^{1/3}(h/\pi' \acute{\alpha} c R_u)^{2/3}=4.0956280300839E\text{-}30\ kg} \qquad \textbf{(12)}$$

Or in relation to the mass of the electron:

$$\mathbf{m_{up}=\beta * \acute{\alpha}^{1/3} * m_e/\varsigma =4.0956280300839E\text{-}30\ kg} \qquad \textbf{(13)}$$

If we return to the relation (1) we have:

$$\mathbf{m_y * m_{up} \equiv (h^2/ \pi' \acute{\alpha} G R_u)^{2/3}} \qquad \textbf{(14)}$$

$$m_y^3 * m_{up}^3 \equiv (h^2 / \pi' \acute{\alpha} G R_u)^2 \qquad (15)$$

Relation (14) and (15) are identities because we determine the masses so that these relations are satisfied. Therefore, there can only be a question whether $\mathbf{m_y}$ and $\mathbf{m_{up}}$ exactly represent what was said, especially if the $\mathbf{m_{up}}$ really is **up** quark mass.

**Up** quark mass is determined experimentally with low accuracy, and is said to be equal to 1.5-3.3 ($MeV/c^2$), which corresponds to the values 2.6745E-30 to 5.8839E-30 kg. This means that the value of (12) and (13) fits somewhere in the middle of the previous interval, which is good but it is still no proof.

All of the relations, (7) to (14) contain factors **1/3** and **2/3**. That is indicative, because the electrical charge, is given by the same factors, but this still is not proof.

Bošković's theory, presented here with only one image provides a rational basis for these two masses. From the above relation we see that $\mathbf{m_y}$ is function of **h,** $\mathbf{R_u}$**,** $\mathbf{T_u}$ $\mathbf{M_u}$ and $\mathbf{m_{up}}$ same in addition with fine structure constant **ά.** Or we can say that $\mathbf{m_y}$ and $\mathbf{m_{up}}$ are the product of the whole universe. In this way, the whole is linked with their parts that make it, which is consistent with the Mach principle. Similar relations are valid for all other masses in the universe. Each particle can be, mathematically expressed through the whole universe. If not, then how is it? Well, you have a "big bang"!

To sum up: We started with the relation, which proposed by Helmut Söllinger, a set up relation [1], and then in (14) and (15) we received relation connecting masses with fundamental physical constants.

Weizsäcker's relationship, best fits the special forces curve of Bošković in Figure 1b), so that B corresponds to Planck length, D, Kompton's wavelength and G, the radius of the universe. A more detailed analysis of this case would be desirable and can easily be done by those who read the original Bošković's work [4].

## 4. Conclusion

Using the force curve of Ruđer Bošković, is given a rational explanation for the relations, which connect the masses and lengths with the fundamental physical constants. I explained mass of **up** quark, which is a fundamental constituent of matter.

Is presented, the role of the constants: **β, ά, ς, 1/3, 2/3**, which are also associated with other physical constants and values of **h,** $\mathbf{R_u}$**,** $\mathbf{T_u}$ $\mathbf{M_u}$**,** $\mathbf{m_p}$**,** $\mathbf{m_e}$**,** $\boldsymbol{\lambda_p}$**,** $\mathbf{l_{pl}}$**,** whose names, values, and relationships with precise calculations are given in **App 1.**

During this work, I had in mind that the whole and the parts of the universe are in indissoluble relation to one another. Also there is nothing mysterious, but everything takes place in cycles, and therefore, instead of the term "the duration of the universe", I used "cycle of the universe". That indicated that neither the universe has no beginning and no end. Only, this cycle lasts longer, 1.672621777E-27 sec. To avoid trouble with the unit system, I used values that were expressed in parts of the whole to which they belong. So, everything was calculated with the dimensionless quantities. For the purposes of this paper, it is then converted into the meter-kilogram-seconds system, which is better accessible to understand.

These relations, like all relationships in physics should be considered approximate until, we understand the whole functioning of the Universe.

However, errors can be the result of neglecting the second and third generations of elementary particles, whose life period is a few dozen rows less than the life of the first generation of particles, and thus practically negligible.

Deviations from the assumption that the Universe is flat, which is confirmed by all research, can also be considered to be almost negligible. Heisenberg's uncertainty principle remains the border for the accuracy.

Ruder Bošković in [4], in the 18th century speaks of attractive and repulsive forces. Currently adopted terminology is the gravity-antigravity. Talks about the effect of gravity on the distance or the gravitons, and other irrational beliefs have been avoided if there were more respect to Bošković's work. I am convinced that accurate determination of, dimensionless ratio, which are among the physical sizes, good way to understand the whole Universe [2].

Novi Sad, Serbia, February 2013. Branko Zivlak

## References:


1. Helmut Söllinger, The Code of Nature,viXra:1301.0110

2. Branko Zivlak, Fine Structure Constant And Relations Between Dimensionless Constants, viXra: 1301.0139

3. CODATA internationally recommended values of the Fundamental Physical Constants, (2010) values of the constants.

4. Bošković, R.: Philosophiae naturalis theoria redacta ad unicam legem virium in natura existentium, Beč, 1758. (prvo izdanje), Venecija, 1763. (drugo izdanje); A Theory of natural philosophy. Cambridge, M.I.T. Press, Cambridge, 1922. i 1966.;

5. Dragoslav Stoiljković, Ruđer Bošković utemeljivač savremene nauke, Univerzitet Novi Sad Tehnološki fakultet, Novi Sad, Srbija

## App. 1

| (No) | ***Constants and*** *Relations* | *Value (m-kg-sec)* |
|---|---|---|
| | ***natural logarithm base e=*** | ***2.718281828*** |
| | ***two pi π'=*** | ***6.2831853071796*** |
| | ***inverse fine structure constant ά=*** | ***137.035999074*** |
| | ***Cycle cy=exp(π')=*** | ***535.491655525*** |
| | ***Mass universe*** $M_u$***=*** | ***1.73944912E+53*** |
| | ***Radius universe*** $R_u$***=*** | ***1.2916529938E+26*** |
| | ***Cycle of universe*** $T_u$***=*** | ***4.3084906220E+17*** |
| | ***proton mass*** $m_p$***=*** | ***1.672621777E-27*** |
| | ***electron mass*** $m_e$***=*** | ***9.1093829075E-31*** |
| | ***Planck constant h=*** | ***6.626069573E-34*** |
| | ***speed of light c=*** | ***2.99792458E+08*** |
| | ***Planck mass e-8*** $m_{pl}$***=*** | ***2.176510000E-08*** |
| | ***Planck length e-35*** $r_{pl}$***=*** | ***1.6161987731E-35*** |
| | ***Universal gravitational constant G=*** | ***6.673836011E-11*** |
| | ***Classical electron radiju*** $r_e$***=*** | ***2.8179403267E-15*** |
| | ***proton Compton wavelength*** $\lambda_p$***=*** | ***1.3214098562E-15*** |
| | *ratio* $\beta=r_e/\lambda_p=$ | *2.13252558501* |
| **(1)** | $m_e * m_p =$ | *1.52365522261E-57* |
| **(1)** | $(h^2/\pi'\acute{\alpha}GR)^{2/3}$ | *1.51815939805E-57* |
| **(2)** | $\pi'^{-2/3}\acute{\alpha}^{-1/3}M_u^{-1/3}R_u^{2}m_p^{1/3}*r_e^{-1}\lambda_p^{-1}*2^{cy/3}=$ | *1.0036200577* |
| **(3)** | $R_u^{4}(c/\lambda_p)^3*h/(\pi'M_u*2^{ci})*(Gm_p)^{-2}=1$ | *1.0000000000* |
| **(5b)** | $\varsigma=2^{[2(\pi'\beta+1)/(\pi'\beta+2)+1]/3}=$ | *2.445349420064* |
| **(5a)** | $l_{pl}^{2/3} * R_u^{1/3} =$ | *3.2313088256E-15* |
| **(5a)** | $\varsigma\lambda_p=$ | *3.2313088256E-15* |
| **(7)** | $m_y=h^{2/3}/(Gr_u)^{1/3}=$ | *3.7067804666E-28* |
| **(8)** | $m_y=h^{2/3}/(r_u^{4}m_u^{-1}t_u^{-2})^{1/3}=$ | *3.7067804666E-28* |
| **(9)** | $m_y=(hr_u^{-2}m_u^{1/2}t_u)^{2/3}=$ | *3.7067804666E-28* |
| **(10)** | $m_y=h^{2/3}/(c^2m_ur_u^{2})^{1/3}=$ | *3.7067804666E-28* |
| **(11)** | $m_y=h^{2/3}r_u^{-4/3}m_u^{1/3}t_u^{2/3}=$ | *3.7067804666E-28* |
| **(12)** | $m_{up}=M_u^{1/3}(h/\pi'\acute{\alpha}cR_u)^{2/3}=$ | *4.0956280301E-30* |
| **(13)** | $m_{up}=\beta*\acute{\alpha}^{1/3}*m_e/\varsigma=$ | *4.0956280301E-30* |
| **(14)** | $m_y*m_{up}=$ | *1.5181593981E-57* |
| **(14)** | $(h^2/\pi'\acute{\alpha}GR_u)^{2/3}$ | *1.5181593981E-57* |
| **(15)** | $m_y^{3}*m_{up}^{3}=$ | *3.4990658620E-171* |
| **(15)** | $(h^2/\pi'\acute{\alpha}GR_u)^{2}=$ | *3.4990658620E-171* |