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# The Formula for the Neutron Mass from Quarks (English)

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**Abstract**: We define the Planck factor by which we determine the mass of neutron from the mass of quarks. The views of Ruđer Bošković [1] and the formula from my previous article were used.

**Keywords:** Planck factor, Bošković, quark, neutron, proton

Particle physics claims that a neutron is composed of one up and two down quarks, (1):

$$m_{neutron} = m_{up} + 2 * m_{down} \quad (1)$$

While the proton is composed of two up, one down quark and gluons, (2):

$$m_{proton} = 2 * m_{up} + m_{down} + m_{gluons} \quad (2)$$

Denote by m - the mass of any particle, by $m_f = 1.088621711*10^{-28}$, the fundamental mass determined in [2, f 3b]. Let us introduce a dimensionless quantity, call it the **Planck factor**, **p** (3):

$$p = (1 + \sqrt{\frac{m_f^3}{m^3}}) \quad (3)$$

We consider that the mass of quark changes in the process of mass capture in proportion to **p** (4):

$$m_1 = m_0 * p_o \quad (4)$$

Here is: $m_o$ - initial mass of the quark and $m_1$ mass after mass capture. Suppose that complex particles are formed by a vortex, ie repeating the previous formula, so a general formula is:

$$m_n = m_{n-1} * p_{n-1} \quad (5)$$

**Table. Proton and Neutron from quarks using (5)**

| **Particle** | **$m_o$ [MeV]** | **$m_o$ [kg]** | **$m_1$** | **$m_2$** | **$m_3$** |
|---|---|---|---|---|---|
| f-fund. p. | 61,0672061 | 1,088621711E-28 | 2,17724342E-28 | 2,94701522E-28 | 3,60865909491E-28 |
| d-down q. | 4,6970079 | 8,373176145E-30 | 4,00900934E-28 | 4,57628866E-28 | 5,10724496761E-28 |
| u-up q. | 2,3479753 | 4,185645769E-30 | 5,59366207E-28 | 6,07391207E-28 | 6,53478504349E-28 |
| p-proton | 938,2722 | 1,67262192369E-27 | **$2*m_{u2}+m_{d2}=$** | **1,67241128E-27** | |
| n-neutron | 939,5655 | 1,67492749787E-27 | | **$m_{u3}+2*m_{d3}=$** | 1,67492749787E-27 |

After the second iteration, formula (5) for up and down quarks closely gave the proton (**blue bold**), ie after three iterations it exactly gave the neutron (**black bold**).
Even if we roughly say that based on the previous Table, the masses of quarks range from: = 8.37 – 8.38 $*10^{-30}$ kg, $m_u$ = 4.18 – 4.19 $*10^{-30}$ kg and the ratio of the initial masses of the down and up quark is: $m_{do} / m_{uo}$ = 2 – 2.001, that is a good agreement with the data from the literature. I find that the initial value of the quark mass is less important than the following attitude.

***The Planck factor from formula (3) is key to understanding the quantum world.***

# Conclusion

This article is an abbreviated English version of the paper in Serbian ("**Masa Neutrona iz Masa Kvarkova, Kako?"**), In which the process of obtaining the formula is presented. It is applied: Bošković's understanding of forces in nature and original understanding of the role of Planck's mass and length and the Hypothetical Fundamental Particle. The **Planck factor**, by the formulas shown, allows the capture of mass by elementary particles, and can be used in a large number of situations.

An approximate formula for a proton (a proton also contains gluons) was obtained, with a vortex with two iterations and a neutron vortex with three iterations. It is suggested: a very narrow range of values that the up and down quarks can have in order for the formulas to be valid.

# References:

[1] Boscovich J. R.: (a) "Theoria philosophia naturalis redacta ad unicam legem virium in natura existentium", first (Wien, 1758) and second (Venetiis, 1763) edition in Latin language; (b) "A Theory of Natural Philosophy", in English, The M.I.T. Press, Massachusetts Institute of Technology, Cambridge, Massachusetts and London, England, first edition 1922, second edition 1966.

[2] Branko Zivlak, Fundamental Particle, https://vixra.org/abs/1312.0141