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Masses of Naked and Constituent Quarks

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Abstract: This is an application of the formulas from [1] for calculating quark masses. The formulas give for heavier quarks: close masses of naked and constituent quarks, and for lighter ones significantly larger masses of constituent than naked quarks. In the basic article [1], Ruđer Bošković's Theory and the assumption of quantum changes at Bošković's non-cohesive limit [2].

Key words: Planck, Bošković, quark, neutron

1. Naked and constituent quarks

Let's quote from [3]: **Naked quark mass**

*The **current** quark mass is also called the mass of the '**naked**' quarks. The mass of the current quark is reduced by the term of the constituent quark covering mass. ...*

The current quark masses of the light current quarks[b] are much smaller than the constituent quark masses. Reason for this is the missing of the mass of the constituent quark covering.

The constituent quark, in contrast, is a combination of both the "naked" current quark and its "dressing" of evanescent gluons and virtual quarks. For the lighter quarks, the mass of each constituent quark is approximately 1/3 of the average mass of the proton and neutron, with a little extra mass fudged in for the strange quark.
Prikažimo tabele iz Wikipedie:

Table 1 mass of naked (current) quarks [3] **and constituent quarks** [4]

Current quark	Mass	Δx
Down quark	4.3–5.2 MeV/c^2	20–40 fm
Up quark	1.8–2.8 MeV/c^2	20–40 fm
Strange quark	92–104 MeV/c^2	
Charm quark	1.3 GeV/c^2	
Bottom quark	4.2–4.7 GeV/c^2	
Top quark	156–176 GeV/c^2	

Constituent quark	Mass
Up quark	336 MeV/c^2[1]
Down quark	340 MeV/c^2[1]
Strange quark	486 MeV/c^2[1]
Charm quark	1550 MeV/c^2[1]
Bottom quark	4730 MeV/c^2[1]
Top quark	177 000 MeV/c^2[1]

Let's calculate: the masses of the constituent quarks.

2. Growth of quark mass

From [1x, f 7] here: let's denote it written a little differently as formula (1), where the mass of the particle is m, Fundamental mass - ***mf = 1.088621711E-28 kg***, from [5, f 3b and 4]. That is, by quantum action on the Bošković boundary of non-cohesion, we get a new quark mass from the previous one:

$$m = m_{-1} + m_f^{1.5} / m_{-1}^{0.5} \qquad (1)$$

Where suffix, "-1": indicates the previous mass. The masses are in **[MeV/c^2]**. For the conversion coefficient ***k = 1.782662E-30***, fundamental particle mass is: ***1.088621711E-28 kg*** / ***k*** = ***61.067*** **MeV/c^2**, and the masses of other quarks are from [7].

Table 2 Naked (m_o) and constituent masses of quarks (I - X)

particle	*61,067*	[MeV/c^2]	$m = m_{-1} + m_f^{1.5}/m_{-1}^{0.5}$								
fund.p.	m_0	I	II	III	IV	V	VI	VII	VIII	IX	X
down	*4,697*	225	257	286	315	342	367	392	416	440	463
up	*2,348*	314	341	367	391	416	439	462	484	506	527
strange	*97*	145	185	220	252	282	311	338	364	389	413
charm	*1273*	1287	1300	1313	1326	1339	1352	1365	1378	1391	1404
bottom	*4184*	4192	4199	4206	4214	4221	4228	4236	4243	4250	4258
top	*170880*	170881	170882	170883	170885	170886	170887	170888	170889	170890	170891
	n = u + 2d			**939,57**							

From the naked mass, we obtain the constituent masses by multiple application of formula (1), the first ten are shown. Under column III it is shown: that a neutron is the sum of one up and two down quarks. It is possible to obtain: the approximate mass of all baryons from [6] by using a number of applications of formula (1).

Let's note that in Table 2 the following quote from [3] applies:

There is almost no difference between current (naked) quark mass and constituent quark mass for the heavy quarks; this is not at all the case for the light quarks.

3. Number of particles

In the article [7] we saw that the naked mass of the up quark takes four different values: (two real and two complexes) which all give a neutron after three applications of (1). In Table 3, we show two real naked masses of the up quark that give a neutron after three applications of formula (1), this time in units where the mass of the fundamental particle is $m_f = 1$:

Table 3 Naked and constituent masses of the two up quarks (ua, ub)

m_o [kg]	*particle*	m_o [$m_f = 1$]	$m = m_{-1} + m_f^{1.5}/m_{-1}^{0.5}$ [$m_f = 1$]		
1,0886217E-28	**f - fund. p.**	1,00000000	**I**	**II**	**III**
8,3731761E-30	**d - down q.**	0,07691539	3,6826468737	4,2037455400	4,6914781461
4,1856458E-30	**ua**	0,03844904	5,1382973662	5,5794515302	6,0028060936
5,0902228E-28	**ub**	4,67584171	5,1382973662	5,5794515302	6,0028060936
1,6749275E-27	**n-neutron**	**15,385762386**		$n = ua_3 + 2*d_3$	**15,385762386**
				$n = ub_3 + 2*d_3$	**15,385762386**

For ease of understanding, the masses are shown in [kg], first column and relative to the fundamental particle (third to sixth column). We see that the two real masses of the naked up quark (ua and ub): give the same neutron mass, lower right. Since there are four solutions for the naked mass of up quarks, we conclude:

In the macro world, galaxies, stars and planets are different from each other; just as in the subatomic world, naked quarks can be different from each other.

The lifetime of most baryons is: 10^{-22} to 10^{-10} sec, [6], which is difficult to detect. Shorter durations of particles: they are even more difficult to observe, so they do not appear in the list [6], although they probably exist.

The existence of multiple solutions for naked and constituent quarks should not be confused with Supersymmetry, [8].

The possible number of these points is infinite, not the existing ones, which is also Bošković's position [2, article 90]:

... So that there is only infinity of possible points, but not of existing points; ...

4. Conclusion

The formula for masses: of naked and constituent quarks is shown. It can be seen why for heavier quarks the mass of the constituents is closer to the mass of the naked quarks, and for the lighter quarks it is significantly greater than the mass of the naked quarks. The importance of: "Fundamental mass", [5] was confirmed once again.

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