# Explanation how and why the decay modes of beauty quarks into leptons decay in LHCb on the basis of the quantized space and time theory

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**Abstract:**

In this paper by using the quantized space and time theory, the internal structure of the beauty quark has been analyzed, and the different modes for decay of beauty quark have been predicted theoretically. Also it has been explained that why the decay of beauty quark into kaon and muons is 88% of its decay into kaon, electron and positron.

Key Words: beauty-quark, HLCb, Length quanta, time quanta, Decay

**1- Introduction**

the elementary particles resulted from Decay of the beauty quark in HLCb can be predicted and explained on the basis of the quantized space and time theory. The exact mass of the elementary and the subatomic particles can be calculated theoretically.

The minimum possible length not separable to smaller lengths and it still contains motion is equal to,

$l_0$ : Length quanta $= 1.409 \times 10^{-15} m$. (1)[1]

The minimum possible time which there is no smaller time interval than it, is equal to,

$\Delta T_0$ : Time quanta $= \frac{l_0}{c} = 0.47 \times 10^{-23}$ (2)[1]

Where $c = 299{,}792{,}458^{i}$ m/s is the speed of light.

**2: Analyzing the structure of the beauty quark**

**2- 1**: Analyzing the structure of the beauty quark by using "Higgs boson formula" [2]

By using the mass detection of Higgs boson formula, we can determine the mass equivalent energy of beauty quark in an exact range [2]

$$Y = 4E_p + (\pm z)E_{p-p}gluon) - (6 \times (\frac{8\pi\varepsilon_0 m_0 c^2 l_0}{4 \times 2\pi \times \varepsilon_0} \times \frac{1}{L}) \times \frac{1}{4\sqrt{1-\frac{v^2}{c^2}}}) \ (3)[2]$$

$(\pm 4)E_{p-p}gluon)$ **:** The energy of created gluons between four protons

$4E_p$ **:** The internal energy of four protons and the gluons between each quark.

$$(6\times(\frac{8\pi\varepsilon_0 m_0 c^2 l_0}{4\times 2\pi\times\varepsilon_0}\times\frac{1}{L})\times\frac{1}{4\sqrt{1-\frac{v^2}{c^2}}})$$

**:** The electromagnetic energy between four protons,

**2-2: Determination the minimum and maximum the amounts of beauty quark energy in decay curve.**

By using the aboded mention equation we can assume that three protons have the highest level of internal energy and by collision another proton to them, their speed can be reduced and the beauty quarks is a conclusion of this process. By zeroing the speed in equ 3 we will have:

$$Y = 4E_{0p} + (4\times E_{p_0-p_0} gluon) - ((6\times\frac{8\pi\varepsilon_0 m_0 c^2 l_0}{4\times 2\pi\times\varepsilon_0}\times\frac{1}{L})\times\frac{1}{4\sqrt{1-\frac{0^2}{c^2}}})$$

(4)

$$Y_{\max} = (4\times M_p\times C^2 \div e) + (16\times 0.88Gev)$$

$$-(6\times(0\bullet 511Mev\frac{l_0}{L})) = 3\bullet 75Gev + 14\bullet 08 - (6\times 0.511Mev) = 17\bullet 86Gev$$

(5)

$L = l_0$: The distance between protons

$Y_{max}$ : The maximum mass equivalent energy of beauty quarks in the speed of zero

$$Y_{min} = 17 \bullet 86Gev - (6 \times (0 \bullet 511Mev \times \frac{l_0}{L}) - (4 \times 0 \bullet 88Gev) \qquad (6)$$

$Y \min$ : The minimum mass equivalent energy of beauty quarks in speed of zero. $l_0 \succ L \succ 2 \bullet 4 \times 10^{-19} m$ (7)

It should be noticed that the length would be curved .in the baryonic universe the smallest length is the space quanta.

By using the calculated numbers in equ 5 and 6, the minimum and maximum amounts of the beauty quark energy in the fig1 [3] can be obtained.

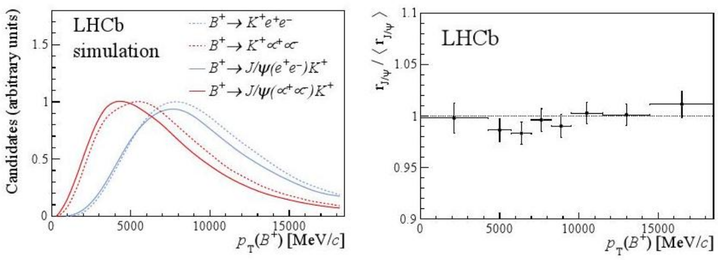


Figure 3: Differential $r_{J/\psi}$ measurement. The distributions of (left) the $B^+$ transverse momentum, $p_T$, and (right) the ratio $r_{J/\psi}$ relative to its average value $\langle r_{J/\psi} \rangle$ as a function of $p_T$. The distribution from the $B^+ \to J/\psi K^+$ decays is similar to that of the corresponding $B^+ \to K^+\ell^+\ell^-$ decays such that the measurement of $r_{J/\psi}$ tests the kinematic region relevant for the $R_K$ measurement. The lack of any dependence of the value of $r_{J/\psi} / \langle r_{J/\psi} \rangle$ as a function of $B^+$ $p_T$ demonstrates control of the efficiencies.

Fig1[3]

3-: the structure of beauty quark in at least one time quanta is:

$$\Delta T_0 : \text{Time quanta} = \frac{l_0}{c} = 0.47 \times 10^{-23} \qquad (8)$$

The beauty quark can be modeled by four protons. The first three protons make a regular triangular pyramid and the fourth proton can collides to its surfaces or corners of this pyramid.

The major point in the beauty quarks decay is the type of collision of the fourth proton, weather to the surfaces or the corners.

**3: Theoretical calculation of the ratio of the two different modes of beauty quark**

**3-1:** Calculation of the effective volumes on the type of forth proton collision

$V1$**:** The total volume of the regular triangle pyramid

$V2$: The effective volume to collision of the fourth proton to the corners.

$V3$: The effective volume to collision of the fourth proton to the surfaces of the regular triangle pyramid.

As the time and space are quantized, so the volume is quantized too and in the same way the inertial mass is quantized. The radius of proton is determined by dividing the mass of proton into electron (mass quanta). [1]

$$r_p = \left(\sqrt[3]{\frac{M_p}{M_e}}\right) \times l_0 = 12 l_0 \qquad (9)$$

$r_p$ :. The radius of proton

Therefore the amount of the regular triangle sides is equal to:

$$a = 2 \times 2 \times 12 l_0 = 48 l_0 \qquad (10)$$

And only two protons, not more, can exist on each surface.

As there is a gluon between those two protons so we have:

$$a + 1l_0 = 49l_0 \qquad (11)$$

$$V1 = \frac{\sqrt{2}}{12}a^3 = \frac{\sqrt{2}}{12} \times 49^3 l^3{}_0 = 13865 l_0{}^3 \qquad (12)$$

$$V2 = 4 \times (\frac{\sqrt{2}}{12} \times (24 \times l_0)^3) = 6516 l_0^3 \qquad (13)$$

$$V3 = V1 - V2 = 13865 l_0^3 - 6516 l_0^3 = 7349 l_0^3 \qquad (14)$$

By knowing these amounts, the ratio of the decay of proton in the case of collision to the aides and the corners will be achieved.

$$R = \frac{6516 l_0{}^3}{7349 l^3{}_0} = 0 \bullet 886 \qquad (15)$$

**3-2: theoretical prediction of the modes of beauty quark decay.**

The decay of each subatomic particle takes place by energy exchange between elementary particles [1].

$$p_{\max} = \frac{h \times \sqrt{1 - \frac{v_{\max}{}^2}{c^2}}}{l_0 \times \sqrt{1 - \frac{v^2}{c^2}}} \qquad (16)$$

$$E_{\max} = \frac{p_{\max} c^2}{v_{\max}} \qquad (17)$$

P max: The maximum momentum of each elementary particle related to its speed

v max: Maximum speed of charged elementary particles

E max: The maximum radiated energy from an elementary particle in relation with its speed.

**3-2-1: The prediction of the type of elementary and subatomic particlesc from collision of fourth proton to the corners of the regular triangle pyramid and calculation the mass of them.**

The first assume is: the fourth proton collides to the corners.So there are three protons on the base of pyramid and their distance to fourth proton is as a diameter of a single proton.

If four active masses of four protons impacted on each other's by using above mentioned formulas we will have:

$$E_{\max} = \frac{P_{\max} \times C^2 \times 3}{v_{\max}} = \frac{3 \times C^2 \times h \times \sqrt{1 - \frac{v_{\max}{}^2}{c^2}}}{24 \times v_{\max} \times l_0 \sqrt{1 - \frac{v^2}{c^2}}} \qquad (18)$$

Because the distance of fourth proton of the three other protons is equal to 24 times of space quanta it can be assumed that:

$$v = v_{\max} = 299792407 \bullet 5 m/s \qquad (19)$$

Then we have:

$$E_{\max} = 1 \bullet 7 \times 10^{-11} j = M_{\mu} \times C^2 j \qquad (20)$$

$M_{\mu}$ **:** The mass of muon.

The mass of muon incredibly has been calculated.

There are three quarks in a proton, and regarding to proton model [1]

Each proton has three active masses, so the beauty quark will have 12 active masses by considering the fourth proton. The second three- active mass of each proton will cause to produce anti-muon. The last three-active mass will create kaon.

In determination of kaon mass it should be considered that 2/3 of proton masses has converted to muons particles. Now by passing a time quanta, the distance of active masses is foure space quanta, so the following decay will be occured.

$$E_{\max} = \frac{P_{\max} \times C^2 \times 2}{v_{\max}} = \frac{2 \times C^2 \times h \times \sqrt{1 - \frac{v_{\max}{}^2}{c^2}}}{4 \times v_{\max} \times l_0 \sqrt{1 - \frac{v_{\max}{}^2}{c^2}}} = 439 Mev \tag{21}$$

$$B^+ \to K^+ \mu^+ \mu^- \tag{22}$$

In kaon production two active masses covert to two quarks u and s instead of coefficient 3 in equ 20, coefficient 2 should be used.

**3-2-2: The prediction of the type of elementary and subatomic particles from collision of fourth proton to the surfaces of the regular triangle pyramid and calculation the mass of them**

.In calculation the mass of resulted particles of beauty quark decay, the main point is the determination of the speed of fourth electron in collision to surfaces of the regular triangle pyramid.

If the subatomic particles reach to the distance of space quanta of each other, because of the minimum possible distance of each other, they cannot have any speed in relation with each other's and the electromagnetic force applies strongly.

So the speed of the fourth proton in relation to the pyramid, when its distance to it, is equal to one space quanta will be zero.

By using the equ 18

$$E1_{\max} = \frac{P_{\max} \times C^2}{v_{\max}} = \frac{C^2 \times h \times \sqrt{1 - \frac{v_{\max}{}^2}{c^2}}}{1 \times v_{\max} \times l_0 \sqrt{1 - \frac{0^2}{c^2}}} = 8.18 \times 10^{-14}\, j = M_e \times C^2 \qquad (23)$$

$M_e$: The mass of electron

The mass of the resulted particle of decay is obtained. This particle is electron. According to the symmetry in the quantized space and time theory [1], positron creates simultaneously to electron. As the same way in the part **3-2-2 production of kaon will be occured after creation of electron - positron couple and the following decay for beauty quark will take place.**

$$B^+ \rightarrow K^+ \mu^+ \mu^- \qquad (24)$$

**4-: Detection the internal energy of leptons in beauty quarks decay.**

The number of leptons and kaons can be calculated in LHCb, by assuming a speed limit for each of them. For example the mass equivalent energy of electron and muon by assuming the speed limit will be $E_e = 0 \bullet 02Gev$ [2] and $E\mu = 4 \bullet 38Gev$ [2] respectively.

Prediction of the type of elementary particles resulted from beauty quark decay, according to the type of collision of fourth proton to the regular triangle pyramid is much more facilitated..

**5-Conclusion:**

Explanation of the recent results regarding to decay of beauty quarks to muons, electrons and positrons in LHCb, can be facilitated and done clearly by using the concepts of the quantized space and time theory which can exactly. Predicts the type of resulted particles of beauty quark decay and calculates the exact mass of them.

**Further research:**

Design of some other possible experiment in LHCb to achieve the experimental result which is supporting and compatible with theories. Achievements.

**Reverences:**

**[1]Hadronic journal volume 33, Number3, June 2010 Quantized space a-Time and internal structure of elementary particles: A new model 249 Hamid Reza Karimi Electrical engineering Department Azadof south of Tehran 17776-13651, Iran hr.karimy@gmail.com.**

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**[3]Test of lepton universality in beauty-quark decays(LHCb collaboration).arXiv:2103.11769v1[hep-ex]22Mar 2021.https://arxiv/abs/2103.11769**