SunQM-5s2: Using {N,n//6} QM to Explore Elementary Particles and the Possible Sub-quark Particles

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Abstract

A {N,n//6} QM structure periodic table with n = 1..12, and N ≤ -15 was built for the elementary particles (based on their mass, not on their sizes). The analyzed result suggested that: 1) All the down-type quarks have {N,2//6}o QM structures, while all the up-type quarks have {N,1//6}o QM structures; 2) The 1st generation of quarks may belong to {-17,n//6} QM structures, the 2nd generation of quarks may belong to {-16,n//6} QM structures, and the 3rd generation of quarks may belong to {-15,n//6} QM structures. 3) A proton (at size of {-15,1//6}) may be the ground state of both Charm quark and Bottom quark, Charm quark {-15,1//6}o may be the first excited state of proton {-15,1//6}, and the Bottom quark {-15,2//6}o may be the second excited state of proton {-15,1//6}. If it is correct, then based on this new elementary particle {N,n//6} QM structure, we may need to make some modification in the current Standard Model: Charm quark may be the 3rd (instead of the 2nd) generation of up-type quark; Top quark may be the 4th generation, although can be up-quark, but its mass fits to the down-quark much better. A new method to expand {N,n//6} QM structure periodic table from n=1..12 to n=1..36, (or even to n=1..6^3, n=1..6^4, etc.) has been proposed. This method seamlessly bridged the {N,n} QM to the classical physics.

Introduction

The SunQM studies have demonstrated that not only the formation of the Solar system was governed by its {N,n} QM [1] ~ [19], but the formation of all force fields was also governed by the {N,n} QM [20] ~ [21]. In previous papers (including the SunQM-5 series [22] ~ [23]), a {N,n//6} QM structure periodic table with n = 1..12, and N ≥ -15 has been built. In the current paper, we tried to build the rest of {N,n} QM structure periodic table for N ≤ -15 with n = 1..12, mainly for the elementary particles and the sub-quark particles. Note: for {N,n} QM nomenclature as well as the general notes for {N,n} QM model, please see SunQM-1 section VII. Note: Microsoft Excel's number format is often used in this paper, for example: x^2 = x^2, 3.4E+12 = $3.4*10^{12}$, 5.6E-9 = $5.6*10^{-9}$. Note: The reading sequence for SunQM series papers is: SunQM-1, 1s1, 1s2, 1s3, 2, 3, 3s1, 3s2, 3s6, 3s7, 3s8, 3s3, 3s9, 3s4, 3s10, 3s11, 4, 4s1, 4s2, 5, 5s1, 5s2, 6 and 6s1. Note: For all SunQM series papers, reader should check "SunQM-9s1: Updates and Q/A for SunQM series papers" for the most recent updates and corrections. Note: I am a {N,n} QM scientist, not an particle physicist. All I did here is to use {N,n//6} QM (including some citizen-scientist-leveled guesses) to explore part of the particle physics.

I. To build a {N,n//6} QM structure periodic table for the elementary particle

In SunQM-1s2's Table 1 and SunQM-5's Table 1, we have showed the result of {N,n//6} QM structural analysis scanning from size of sub-quark (at N= -25) to universe (at N= 25), although only with the size of n = 1. In SunQM-1's Table

4, and SunQM-3s8's Table 4, we have showed the Solar system {N,n//6} QM structure periodic table from N = -5 to N = +5, with (orbital) n = 1 through 12. In SunQM-5's Table 3, we have showed the atom's nucleus-electron system based on {N,n//6} QM structure from N = -11 to N = -16, with (orbital) n = 1 through 12. Thus, the first step to analyze the elementary particles using {N,n//6} QM is to build up its {N,n//6} QM structural periodic table with (orbital) n = 1 through 12, and with N from sub-atom size (N ≤ -13) to sub-quark size (N < -17). Then, the future goal is to build a "master {N,n//6} QM structural table" with the spanning of -25 < N < +25, and (orbital) n = 1 … 12, to cover the whole universe (i.e., SunQM-7's Table 1).

From the text books, all elementary particles are listed as the (rest) mass (e.g., MeV/c^2), rather than the size. So we have to build an elementary particle's {N,n//6} QM structural table base on their mass, not on their sizes, (even though all previous {N,n} QM structural tables were built based on size (or the orbital r), not on mass). We have no idea what is the relationship between the size and the mass for particles. We had tried to tread a particle as a solid ball with evenly distributed mass density (so that we can have the r vs. mass relationship), but it didn't work well (the calculation is not shown here). In SunQM-1s2's Table 2, we had discovered that the mass ratio between proton, down quark and up quark is 36 : 2.5 : 1.6 ≈ 36 : 3 : 2, and we had assumed that these are the (relative) n quantum numbers of n_{proton}' = 36, $n_{down\text{-}qk}$' = 3, and $n_{up\text{-}qk}$' = 2. After that, (while building the master table in SunQM-7), I realized that the size of a proton is at {-15,1//6}, which means its orbital n is {-16,5//6}o orbital shell space. (Note: it follows the rule that all mass between r_n and r_{n+1} belongs to orbit n, and for ~100% mass occupancy, its size is n+1. See SunQM-3s2). Therefore, the previous (relative) n_{proton}' = 36 = 6 * 6^1 is the size, and the proton's true (relative) orbital n is n_{proton} = (6-1)* 6^1 = 5* 6^1 = 30. Then, the up quark's true (relative) orbital n is $n_{up\text{-}qk}$ = 1, and the down quark's true (relative) orbital n is $n_{down\text{-}qk}$ = 2. That is why in Table 1, we have proton at {-16,5//6}o, up quark at {-17,1//6}o, down quark at {-17,2//6}o.

Then, how to fill in the {N,n//6} QM states between proton {-16,5//6}o = {-17,30//6}o and up-quark {-17,1//6}o for n = 2 … 29? For the Solar system, galaxy, or nucleus, we used r_n with r_n / r_1 = n^2. However, for particles we have to use their mass. In SunQM-1s2 we had assumed that it has the similar r vs. mass linear relationship as the Schwarzschild's formula for the black hole: $r_{BlackHole} = 2.95 * M_{BlackHole} / M_{sun}$, (unit = km, see wiki "black hole"). By doing so, it assumed that all particle mass (M_n) has the same relationship to n(s) as that of r to n:

$M_n / M_1 = r_n / r_1 = n^2$	(the orbital shell version)	eq-1a
$M_{n+1} / M_1 = r_{n+1} / r_1 = (n+1)^2$	(the size version)	eq-1b

where in eq-1a, M_n is the mass of the particle at n orbit QM state (from the surface to the point center of the mass ball), and M_1 is the mass of the particle at size n=1 (the reference, equivalent to r_1) QM state. Notice that eq-1a and eq-1b are equivalent. Because we used proton's mass as the reference point $M_1 = M_{proton}$, the eq-1 is straightforward for $M_n > M_{proton}$. For $M_n < M_{proton}$, we need to use the interior {N,n} QM to calculate (with n < 1). Thus, in Table 1, eq-1 was used to calculate all mass of particles from N = -16 down to N = -24. For example, a {-16,5//6}o orbital shell's mass is calculated as 1351 * (5/6)^2 = 938 MeV/c^2 (where 1351 MeV/c^2 comes from: x*(5/6)^2 = 938, x= 1351 MeV/c^2); a {-17,2//6}o orbital shell's mass is calculated as 1351 * (2/6/6)^2 = 4.17 MeV/c^2; a {-18,5//6}o orbital shell's mass is calculated as 1351 * (5/6/6/6)^2 = 0.724 MeV/c^2; etc.

Besides eq-1, there is an alternative way to calculate the relationship of a particle's mass to its n. This is based on the equation of r_{nuc} = 1.25E-15 * (M#)^(1/3), where M# is the atomic mass number (the number of protons Z, plus the number of neutrons N, see wiki "Atomic nucleus") of the atom's nucleus, and r_{nuc} is the radius of the atom's nucleus. Based on that, we can fit the nuclide's n_{nuc} (in SunQM-5's Table 2 column 11) to (M_n / M_1)^(2/3) quite well. Using equation (M_n / M_1)^(2/3) = n^x, this fitting result gave M_n / M_1 ≈ n^(3/2) = n^(1.5) (instead of eq-1's M_n / M_1 = n^2, fitting data is not shown here). A more careful fitting gave M_n / M_1 ≈ n^(3/1.87) ≈ n^(1.6) (also fitting data is not shown here). However, we decided not to use those fitting results for the calculation in Table 1, because they did not significantly improve the matching between the calculated (particle's) mass to the experimental data. Because that there are too many this kind of guesses and approximations in this study, it makes this part of the {N,n} master period table (from N = -16 to N = -24) to be a "citizen scientist leveled" estimation.

Table 1. Using {N,n//6} QM and eq-1 to calculate the mass for all QM states, and to match up-type (in blue) and down-type (in green) quarks in the Standard Model.

		n=											
	{N,n//6}	1	2	3	4	5	6	7	8	9	10	11	12
	-23					0.012 eV/c^2, neutrino <0.12eV							
N=	-22	0.017 eV/c^2, neutr	0.069 eV/c^2, neutrino <	0.155 eV/c^2	0.276 eV/c^2	0.431 eV/c^2	0.621 eV/c^2	0.845 eV/c^2	1.103 eV/c^2	1.396 eV/c^2	1.724 eV/c^2	2.086 eV/c^2	2.483 eV/c^2
	-21	0.6 eV/c^2	2.5 eV/c^2	5.6 eV/c^2	9.9 eV/c^2	15.5 eV/c^2	22.3 eV/c^2	30.4 eV/c^2	39.7 eV/c^2	50.3 eV/c^2	62.1 eV/c^2	75.1 eV/c^2	89.4 eV/c^2
	-20	22 eV/c^2	89 eV/c^2	201 eV/c^2	357 eV/c^2	559 eV/c^2	804 eV/c^2	1095 eV/c^2	1430 eV/c^2	1810 eV/c^2	2234 eV/c^2	2704 eV/c^2	3217 eV/c^2
	-19	0.8 KeV/c^2	3.22 KeV/c^2	7.24 KeV/c^2	12.87 KeV/c^2	20.11 KeV/c^2	28.96 KeV/c^2	39.41 KeV/c^2	51.48 KeV/c^2	65.15 KeV/c^2	80.44 KeV/c^2	97.33 KeV/c^2	115.83 KeV/c^2
	-18	29 KeV/c^2	116 KeV/c^2	261 KeV/c^2	463 KeV/c^2	724 KeV/c^2, electron 511Kev	1042 KeV/c^2	1419 KeV/c^2	1853 KeV/c^2	2345 KeV/c^2	2896 KeV/c^2	3504 KeV/c^2	4170 KeV/c^2
	-17	1.04 MeV/c^2, up qk 1.9 MeV	4.17 MeV/c^2, down qk 4.4 MeV	9.38 MeV/c^2	16.68 MeV/c^2	26.06 MeV/c^2	37.53 MeV/c^2	51.08 MeV/c^2	66.72 MeV/c^2	84.44 MeV/c^2	104.24 MeV/c^2	126.14 MeV/c^2	150.11 MeV/c^2
	-16	38 MeV/c^2	150 MeV/c^2, strange qk 87 MeV	338 MeV/c^2	600 MeV/c^2	**938 MeV, proton, size {-15,1}**	1351 MeV/c^2	1839 MeV/c^2	2402 MeV/c^2	3040 MeV/c^2	3753 MeV/c^2	4541 MeV/c^2	5404 MeV/c^2
	-15	1.4 GeV/c^, charm qk 1.32 GeV	5.4 GeV/c^2, bottom qk 4.24 GeV	12.2 GeV/c^2	21.6 GeV/c^2	33.8 GeV/c^2	48.6 GeV/c^2	66.2 GeV/c^2	86.5 GeV/c^2	109.4 GeV/c^2	135.1 GeV/c^2	163.5 GeV/c^2	194.5 GeV/c^2
	-14	49 GeV/c^2, top qk 173 GeV	195 GeV/c^2	438 GeV/c^2	778 GeV/c^2	1216 GeV/c^2	1751 GeV/c^2	2383 GeV/c^2	3113 GeV/c^2	3940 GeV/c^2	4864 GeV/c^2	5885 GeV/c^2	7004 GeV/c^2
	-13	1751 GeV/c^2	7004 GeV/c^2	15758 GeV/c^2	28014 GeV/c^2	43772 GeV/c^2	63032 GeV/c^2	85794 GeV/c^2	112057 GeV/c^2	141823 GeV/c^2	175090 GeV/c^2	211858 GeV/c^2	252129 GeV/c^2

Note: up-quark mass = 1.9 MeV/c^2, down-quark mass = 4.4 MeV/c^2, obtained from wiki "Elementary particle".
Note: Yellow cells are the ground state of {N,n//6} QM

II. Using the Standard Model to support the particle {N,n//6} QM structure table, and using particle {N,n//6} QM structure table to modify (or improve?) the Standard model

In Table 1, using eq-1 and based on the experimental mass data of proton (938 MeV/c^2), up quark (1.9 MeV/c^2) and down quark (4.4 MeV/c^2), other (possible) particles' mass are calculated based on {N,n//6} QM structure (from N = -13 to N = -23). It is hard to say how accurate (or even how correct) these calculated mass values are. However, by comparing to another set of (the completely independent) experimental data (see Table 3a), we do see some interesting results. According to the Standard Model [24], the experimental mass of down quark (4.4 MeV/c^2), strange quark (87 MeV/c^2), and bottom quark (4.24 GeV/c^2) fitted to the calculated mass of {-17,2}o QM state (4.17 MeV/c^2), {-16,2}o QM state (150 MeV/c^2), and {-15,2}o QM state (5.4 GeV/c^2) quite well. Also, the experimental mass of up quark (1.9 MeV/c^2), and charm quark (1.32 GeV/c^2) fitted to the calculated mass of {-17,1}o QM state (1.04 MeV/c^2), and {-15,1}o QM state (1.4 GeV/c^2) quite well. This result led us to believe that all the down-type quarks have (orbital quantum number) n = 2, or {N,2//6}o QM structures, while all the up-type quarks have (orbital quantum number) n=1, or {N,1//6}o QM structures. The major result of this analysis led us to further propose that the 1st generation of quarks belong to N = -17, or have {-17,n//6} QM structures, the 2nd generation of quarks belong to N = -16, or have {-16,n//6} QM structures, and the 3rd generation of quarks belong to N = -15, or have {-15,n//6} QM structures. If this analysis is correct, then we have to re-organize the quark generations to that shown in either Table 3b, or Table 3c. It means, charm quark should be the 3rd (instead of the 2nd) generation of up-type quark. Top quark should be the 4th generation, although can be up-quark, but its mass fits to the down-quark much better.

If the calculation in Table 1 is correct, then a proton (at size of {-15,1//6}) is the ground state of the Charm quark, and it is also the ground state of the Bottom quark. In other words, Charm quark {-15,1//6}o is the first excited state of proton {-15,1//6}, and the Bottom quark {-15,2//6}o is the second excited state of proton {-15,1//6}. Similarly, there should be a ground state at size of {-17,1//6} for the up-quark (which is at the first excited state of {-17,1//6}o), and for the down-quark (which is at the second excited state of {-17,2//6}o). According to {N,n//6} QM, this {-17,1//6} sized particle (with mass ≈ 724 KeV/c^2) is expect to be the true "fundamental particle" of up-quark and down-quark. (Note: also see section III for an alternative explanation).

Table 2a (left). Generations and mass of quarks based on the Standard Model (according to wiki "Elementary particle").
Table 2b (middle). Modification of the quark generation in the Standard Model based on the {N,n//6} QM (in Table 1).
Table 2c (right). Modification of the quark generation in the Standard Model based on the {N,n//6} QM (in Table 1), with the least deviation of the top quark's mass to that of {N,n//6} QM.

generation	up-type qk	down-type qk
1st	up qk, 1.9 MeV/c^2	down qk, 4.4 MeV/c^2
2nd	charm qk 1.32 GeV/c^2	strange qk 87 MeV/c^2
3rd	top qk 173 GeV/c^2	bottom qk 4.24 GeV/c^2

generation		up-type qk	down-type qk
	{N,n//6}	n=1	n=2
1st	N= -17	1.04 MeV/c^2, up qk, 1.9 MeV/c^2	4.17 MeV/c^2, down qk, 4.4 MeV/c^2
2nd	N= -16	38 MeV/c^2, missing	150 MeV/c^2, strange qk 87 MeV/c^2
3rd	N= -15	1.4 GeV, charm qk, 1.32 GeV/c^2	5.4 GeV/c^2, bottom qk, 4.24 GeV/c^2
4th	N= -14	49 GeV/c^2 top qk, 173 GeV/c^2	195 GeV/c^2, missing

generation		up-type qk	down-type qk
	{N,n//6}	n=1	n=2
1st	N= -17	1.04 MeV/c^2, up qk, 1.9 MeV/c^2	4.17 MeV/c^2, down qk, 4.4 MeV/c^2
2nd	N= -16	38 MeV/c^2, missing	150 MeV/c^2, strange qk 87 MeV/c^2
3rd	N= -15	1.4 GeV, charm qk, 1.32 GeV/c^2	5.4 GeV/c^2, bottom qk, 4.24 GeV/c^2
4th	N= -14	49 GeV/c^2 missing	195 GeV/c^2, top qk, 173 GeV/c^2

III. A ground state {N,1//6} sized structure is often "accompanied" by a first excited state {N,1//6}o QM structure, and its application in the elementary particle QM structural analysis

In the {N,n//6} QM structure (master) periodic table (see SunQM-7's Table 1, also copied in the Appendix of current paper), we see that a ground state {N,1//6} sized QM structure is quite often "accompanied" by a first excited state {N,1//6}o QM structure. (Note: The definition of an orbital electron's ground state is different between {N,n} QM and Bohr-QM. The orbital n=1 is the ground state in Bohr-QM, but it is the first excited state in {N,n} QM. See SunQM-7's section I-f for detailed explanation). For example, Virgo Super Cluster at {10,1//6} size is "accompanied" by Laniakea at {10,1//6}o orbital shell space with a size of {10,2//6}, Milky Way galaxy at {8,1//6} size is "accompanied" by a Halo structure at {8,1//6}o orbital shell space with a size of {8,2//6}, Sun core at {0,1//6} size is "accompanied" by a Sun ball at {0,1//6}o orbital shell space with a size of {0,2//6}, A Sun-massed black hole at {-3,1//6} size is "accompanied" by a Sun-massed neutron star at {-3,1//6}o orbital shell space with a size of {-3,2//6}. According to wiki "chemical element", the abundance of element in our galaxy is H ~73.9%, He ~24%. For the nuclides, a hydrogen nucleus has size of {-15,1//6}, it is "accompanied" by a helium nucleus at {-15,1//6}o orbital shell space with a size of {-15,2//6}. Also for the nuclides, an oxygen nucleus (with $n_{nuc} = 5.5 \approx 1 * 6^1$, see SunQM-5 Table 2) has size of {-14,1//6}, it is "accompanied" by a Fe nucleus (with $n_{nuc} = 12.2 \approx 2 * 6^1$, see SunQM-5 Table 2) at {-14,1//6}o orbital shell space with a size of {-14,2//6}, (also see SunQM-5's section II-b discussion-2).

Here, the word "accompanied" has two meanings: 1) the {N,2//6} sized QM state has a solid (or at least an obvious) structure in comparison with the {N,1//6} sized QM structure, while the other {N,n=3..6//6} sized QM states may not have an obvious structure (for example, Sun's {0,1//6}o orbital shell has an obvious structure end at {0,2//6}, while Sun's corona {0,n=2..5//6}o orbital shells do not have any obvious structure); 2) the {N,2//6} sized QM structure has a relative high abundancy among {N,n=1..6//6} sized QM structures, just like the helium has the abundancy of 24% (relative to hydrogen's 73.9%), and the rest elements (add together) have the abundancy of only 2.1%.

The above analysis revealed that, in the {N,n//6} QM, the ground state (in size of {N,1//6}) is the most stable QM state, so it has the very stable physical structure; the first excited state (at {N,1//6}o orbital shell space, or in size of {N,2//6}) is the second most stable QM state, so it also has a (relative) stable physical structure; the rest higher excited states (in sizes of {N,n=3..6//6}) have much less stability, so they have a much less stable physical structure (or short-life) in the micro-or macro-world; In the celestial-world, the stabilities of some higher excited states (in sizes of {N,n=3..6//6}) are so low that their physical structures are often not being observed (because of their short-life, e.g., only exist during the process of a celestial body's quantum collapsing or quantum explosion, see SunQM-1s1's Table 7b). According to this analysis, we guessed that there may be a {-1,2//6} sized (celestial) structure to "accompany" the "ground state" {-1,1//6} QM structure of white dwarf, and that there may be a {-2,2//6} sized (celestial) structure to "accompany" the "ground state" {-2,1//6} QM structure of the undiscovered celestial body.

Furthermore, it is reasonable to guess that the up-type quarks are the "ground state" quarks that have sizes of {-17,1//6}, {-16,1//6}, and {-15,1//6}, and the down-type quarks are the "first excited" quarks that have sizes of {-17,2//6}, {-16,2//6}, and {-15,2//6} that "accompany" the "ground state" quarks. However, if using eq-1 for this hypothesis, then the calculated mass values do not match the experimental data well (see Table 1). On the other hand, if we modify eq-1 by replacing the quantum number of orbit n by quantum number of size (= n+1, see eq-2)

$M_n / M_1 = (n + 1)^2$ eq-2

then, the calculated mass values are not bad in matching to the experimental data (for both the up-type (in yellow) and down-type quarks (in blue), see Table 3). This result makes Table 3 to be an alternative possibility other than that of Table 1 (although we don't know how valid eq-2 is). However, by forcing up-type quarks to be the {N,1//6} QM ground states, we are forcing proton (938 MeV/c^2) and Charm quark (1.32 GeV/c^2) to share the same {-16,5//6}o QM state. Obviously, the possibility of the configuration shown in Table 3 is not high.

Table 3. Forcing up-type quarks as {N,1//6} size (in yellow) and down-type quarks as {N,2//6} size (in blue) by using eq-2 to calculate the mass of {N,n//6} QM states.

		n =											
	{N,n//6}	1	2	3	4	5	6	7	8	9	10	11	12
	-23					0.012 eV/c^2							
N =	-22	0.048 eV/c^2	0.108 eV/c^2	0.192 eV/c^2	0.299 eV/c^2	0.431 eV/c^2, neutrino < 0.12eV	0.587 eV/c^2	0.766 eV/c^2	0.97 eV/c^2	1.197 eV/c^2	1.448 eV/c^2	1.724 eV/c^2	
	-21	1.72 eV/c^2	3.88 eV/c^2	6.89 eV/c^2	10.77 eV/c^2	15.51 eV/c^2	21.11 eV/c^2	27.58 eV/c^2	34.9 eV/c^2	43.09 eV/c^2	52.14 eV/c^2	62.05 eV/c^2	
	-20	62 eV/c^2	140 eV/c^2	248 eV/c^2	388 eV/c^2	558 eV/c^2	760 eV/c^2	993 eV/c^2	1257 eV/c^2	1551 eV/c^2	1877 eV/c^2	2234 eV/c^2	
	-19	2.2 KeV/c^2	5 KeV/c^2	8.9 KeV/c^2	14 KeV/c^2	20.1 KeV/c^2	27.4 KeV/c^2	35.7 KeV/c^2	45.2 KeV/c^2	55.8 KeV/c^2	67.6 KeV/c^2	80.4 KeV/c^2	
	-18	80 KeV/c^2	181 KeV/c^2	322 KeV/c^2	503 KeV/c^2	724 KeV/c^2, up qk 1.9 MeV	985 KeV/c^2	1287 KeV/c^2	1628 KeV/c^2	2010 KeV/c^2	2433 KeV/c^2	2895 KeV/c^2	
	-17	2.9 MeV/c^2, down qk 4.4 MeV	6.5 MeV/c^2	11.6 MeV/c^2	18.1 MeV/c^2	26.1 MeV/c^2	35.5 MeV/c^2	46.3 MeV/c^2	58.6 MeV/c^2	72.4 MeV/c^2	87.6 MeV/c^2	104.2 MeV/c^2	
	-16	104 MeV/c^2, strange qk 87 MeV	235 MeV/c^2	417 MeV/c^2	651 MeV/c^2	938 MeV/c^2, charm qk 1.32 GeV, proton	1277 MeV/c^2	1668 MeV/c^2	2111 MeV/c^2	2606 MeV/c^2	3153 MeV/c^2	3752 MeV/c^2	
	-15	3.8 GeV/c^2, bottom qk 4.24GeV	8.4 GeV/c^2	15 GeV/c^2	23.5 GeV/c^2	33.8 GeV/c^2	46 GeV/c^2	60 GeV/c^2	76 GeV/c^2	93.8 GeV/c^2	113.5 GeV/c^2	135.1 GeV/c^2	
	-14	135 GeV/c^2, top qk 173GeV	304 GeV/c^2	540 GeV/c^2	844 GeV/c^2	1216 GeV/c^2	1655 GeV/c^2	2161 GeV/c^2	2735 GeV/c^2	3377 GeV/c^2	4086 GeV/c^2	4863 GeV/c^2	
	-13	1751 GeV/c^2	7004 GeV/c^2	15758 GeV/c^2	28014 GeV/c^2	43772 GeV/c^2	59567 GeV/c^2	77801 GeV/c^2	98467 GeV/c^2	121565 GeV/c^2	147093 GeV/c^2	175053 GeV/c^2	

IV. Expand {N,n//6} QM structure periodic table from n = 1..12 to n = 1..6^2 (or even to 6^3, 6^4, ...) for each N

In Table 1, depends on what resolution ΔM (the difference of mass between two adjacent QM states) we want, we can add more sub-stable {N,n//6^j} QM states (where integer j > 0) between the two existing (adjacent) QM states by decreasing the ΔM (i.e., by increasing the j integer value, see example in Table 4). For example, the N = 16 period (or super shell) {-16,n=1..5//6}o in Table 1 contains 5 individual n states from n= 1 to n=5, each separated by ΔM around ~100 MeV/c^2 to ~300 MeV/c^2. This is using {-16,1//6}o as the unit (of the period or super shell). In Table 4, if we use the {-17,1//6}o as the unit (of the period or super shell), then {-16,n=1..5//6}o can be written as {-16,n=1..35//6^2}o, and it contains 35 individual QM states from n= 1 to n=35, each separated by ΔM around ~3 MeV/c^2 to ~100 MeV/c^2. If we use the {-18,1//6}o as the unit (of the period or super shell), then {-16,n=1..5//6}o can be written as {-16,n=1..215//6^3}o, and it contains 215 individual QM states from n= 1 to n=215, each separated by ΔM around ~0.1 MeV/c^2 to ~10 MeV/c^2. If we use the {-19,1//6}o as the unit (of the period or super shell), then {-16,n=1..5//6}o can be written as {-16,n=1..1295//6^4}o, and it contains 1295 individual QM states from n= 1 to n=1295, each separated by ΔM around ~0.002 MeV/c^2 to ~2 MeV/c^2, and so on so forth. We can interpret this as, for each N period, we can detect 6^1 – 1 = 5 of different energy leveled (relatively stable) particles, and we can also detect 6^2 – 1 = 35 of (smaller) different energy leveled (relatively unstable) particles, and we can even detect 6^3 – 1 = 215 of (much smaller) different energy leveled (highly unstable) particles, or even 6^4 -1 = 1295 of (tiny) different energy leveled (extremely unstable) particles, and so on so forth. All these QM states are available according to the {N,n//6} QM, although most of them are less stable as the ΔM decreases. This may be the reason that why more and more elementary particles are being found.

The general physics told us that the Solar system is made of atoms. Based on the {N,n} QM (master) periodic table, this sentence can be translated as that the {N=0..4,n=1..5//6}o QM structure (i.e., the Solar system) is made of the "building blocks" of {-12,n=1..7//6}o QM structures (i.e., the atoms). The general physics also told us that a galaxy is made of stars.

Based on the {N,n} QM (master) periodic table, this sentence can also be translated as that the {N=0..7,n=1..5//6}o QM structure (i.e., a galaxy) is made of the "building blocks" of {0,n=1..2//6} QM structures (i.e., the stars). Again, the general physics told us that all atoms are made of nucleus and electron shells. Based on the {N,n} QM (master) periodic table, this sentence can be translated as the {-12,n=1..7//6}o QM structures (i.e., the atoms) are made of the "building blocks" of {N=-15..-14,n=1..5//6}o = {-15,n=1..35//6}o QM structures (i.e., the nuclides). Here we defined that **{N=-15..-14,n=1..5//6}o = {-15,n=1..35//6}o = {-14,n=1..35//6^2}o**. The meaning of {-14,n=1..35//6^2}o is that we analyze the N = -14 period QM structures by using {-15,n//6} as the "building blocks", so that N = -14 period contains 6^2 – 1 = 35 different QM states (most of them are sub-stable, or intermediate QM states). In general, we define {N,n//6^j}o (with integer j) to express that we analyze N super shell QM structures by using {N-j+1,n//6}o QM structures as the "building blocks" (or "fundamental particles"), so that in N period there are total 6^j -1 different QM states (most of them are sub-stable, or intermediate QM states). In comparison, the original N period {N,n=1..5//6}o (with j=1) has 6^j -1 = 5 different QM states from {N,1//6}o to {N,5//6}o, with {N,n=1..5//6}o as the "building blocks".

Here is a very important question: if (in an ideal situation) we found a complete set of {-16,n=1..35//6^2}o QM state particles, and found none of {-16,n=1..215//6^3}o QM state particles (except those 35 particles that already shown in {-16,n=1..35//6^2}o), then can we say that {-17,n=1..5//6}o are the true "fundamental particles"? We believe the answer should be "yes". Furthermore, if (in above situation) we found a complete set of {-17,n=1..5//6}o QM state particles, then can we say that {-18,1//6} sized (or mass) particle is the ultimate "fundamental particle"? Again, we believe the answer should be "yes".

When $\Delta M \rightarrow 0$, the number of intermediate states increases to infinity, the QM goes back to classical physics. This is equivalent to when r_1 moving inward to close to 0, the multiplier n' will go up to infinity, and the QM goes back to classical physics. This property can be used for the explanation of particle scattering, or photon propagation. In SunQM-6s1, the photon propagation was explained as it is excited from low n to high n (of the QM bound states nLL). When $r_1 \rightarrow 0$, $n' \rightarrow \infty$, the quantum process becomes a continues process (as that in the classical physics, because the difference between the two adjacent QM states closes to zero). So in the {N,n//q} QM, the quantum process of a particle scattering can also be described as a classical physics scattering (because {N,n//q} QM allows Simultaneous-Multi-Eigen-Description (SMED), so r_1 is allowed to move inward to close to 0, which causes the multiplier n' goes up to infinity).

This property can also be used to explain why the atomic world can be naturally described by (the Planck constant based) QM, and the celestial world is naturally described by the classical physics. This is because that atom is the building block of the atomic world, so its r_1 (which is Planck constant based) doesn't need to be move inward, and this r_1 produced r_n is naturally in quantum state. In contrast, the celestial world's building block is also atom, according to the Simultaneous-Multi-Eigen-Description (SMED), atom's r_1 is equivalent to a celestial world's r_1 that moved inward to close to 0, so that the corresponding multiplier n' increased to astronomically high, therefore the difference between the two adjacent quantum states close to 0, and it becomes a continues process (of the classical physics).

In the {N,n//6} QM periodic table (Table 1), we designed it as n = 1..12 for each N period, and with the number of n = 1..5 in bold fond. This is because the most {N,n//6} QM structural information is in n = 1..5, and the rest information is (almost all) in n = 6..11, and there is very little useful information in n > 12. According to Table 4, we can also present Table 1's each N period as n = 1..36, or n = 1..216, or even n = 1..1296, etc., QM states (from N = -24 to N = +15). Although most of these QM states are short-life (intermediate) QM states, with (practically) no useful information.

In many cases, the {N,n//q} QM states provided us a series of "snap shot" pictures that revealed how a dynamic process (of the quantum number n increasing or decreasing) is roughly going. This is like a comic strip (连环画). Then, the {N,n//q^j} QM allows us to add more intermediate QM states in between the original QM states, so that a quantum dynamic process (like reading a (discontinues) comic strip book) can be viewed as a classical dynamic process (like watching a (continues) comic strip movie, or a cartoon movie, or 动画片电影). See SunQM-7's section I-k for detailed examples.

Table 4. In {N,n//6} QM periodic table, we can add more and more sub-stable {N,n//6^j} QM states (where integer j > 0) between the two adjacent QM states (if needed).

			n=																																																				
	{N,n//6}, MeV		**1**	**2**	**3**	**4**	**5**	6	7	8	9	10	11	12	...	17	18	...	23	24	...	29	30	...	35	36	...	71	72	...	107	108	...	143	144	...	179	180	...	215	216	...	431	432	...	447	448	...	863	864	...	1079	1080	...	1295	1296
N=	-18	{-18,n//6}	0.029	0.116	0.261	0.463	0.724	1.042																																																
	-17	{-17,n//6}	1.042	4.17	9.38	16.7	26.1	37.5																																																
	-17	{-17,n//6^2}						1.042	1.42	1.85	2.35	2.90	3.50	4.17	...	8.37	9.38	...	15.3	16.7	...	24.4	26.1	...	35.5	37.5																														
	-16	{-16,n//6}	37.5	150	338	600	938	1351																																																
	-16	{-16,n//6^2}						37.5	51.1	66.7	84.4	104	126	150	...	301	338	...	551	600	...	877	938	...	1277	1351																														
	-16	{-16,n//6^3}																								37.5	...	146	150	...	332	338	...	592	600	...	928	938	...	1339	1351															
	-16	{-16,n//6^4}																																							37.5	...	149.4	150.1	...	160.7	161.4	...	599.1	600.4	...	936.5	938.2	...	1349	1351

V. Some other (citizen scientist leveled) guesses based on the elementary particle {N,n//6} QM periodic table

1) Like that a proton (or a neutron) is made of three quarks, we guessed that a quark at size of {-17,1//6} is made of (an unknown number of) {-20,1//6} sized QM structures (see SunQM-5's Figure 7). Each {-20,1//6} sized QM structure has the (rest) mass of 938E+6 / 36^5 = 15.5 eV/c^2 (see Table 1). We also guessed that a {-20,1//6} sized QM structure is made of (an unknown number of) {-25,1//6} sized QM structures (see SunQM-5's Figure 8). Each {-25,1//6} sized QM structure has the (rest) mass of 15.5 / 36^5 = 2.6E-7 eV/c^2.

2) Other scientists have proposed the possible mass and structures of tetraquark, pentaquark, hexaquark, or even haptaquark (see wiki "tetraquark", wiki "Pentaquark", wiki "Hexaquark", wiki "Haptaquark"). We guessed that these kind of multi-quark structures may correlate to the {-16,n=7..12//6} sized QM structures as shown in Table 1. For example, a {-16,7//6} sized QM structure with mass of 1351 MeV/c^2 may correlates to a tetraquark, a {-16,8//6} sized QM structure with mass of 1839 MeV/c^2 may correlates to a pentaquark, a {-16,9//6} sized QM structure with mass of 2402 MeV/c^2 may correlates to a hexaquark, and a {-16,10//6} sized QM structure with mass of 3040 MeV/c^2 may correlates to a haptaquark.

3) Gamma decay comes from a nucleus that changes from a higher energy nuclear state to a lower energy nuclear state. For example, an excited state of $^{12}_{6}C^*$ decays to its ground state $^{12}_{6}C$ by emitting a 4.4 MeV gamma ray [25]. Now we try to use Table 4 kind of analysis to explain it. First, we need to know the (rest) mass of the nuclear ground state of $^{12}_{6}C$. According to SunQM-5's Table 3, we found the nucleus of $^{12}_{6}C$ has a {-15,4//6}o QM structure. Then according to Table 1 (of current paper), we found that a {-15,4//6}o QM structure correlates to a particle with the (rest) mass of 21.6 GeV/c^2, and we assumed that this 21.6 GeV/c^2 correlates to the (rest) mass of the ground state $^{12}_{6}C$ nucleus, or, in other words, the ground state $^{12}_{6}C$ nucleus correlates a rest energy of 21616.0 MeV (≈ 21.6 GeV). Next, according to the Einstein's equation $E = mc^2$, and $m = E/c^2$, and $\Delta E = (\Delta m)(c^2)$ (see Giancoli's physics text book page 975), we assumed that a 4.4 MeV gamma ray is emitted from an excited state of $^{12}_{6}C^*$ nucleus that has a (rest) mass of 4.4 MeV/c^2 higher than the ground state (of 21.616 GeV/c^2, or at {-15,4//6}o QM state). This means, we need to use the method in Table 4 to find a sub-stable (or intermediate) QM state between {-15,4//6}o QM state and {-15,5//6}o QM state. After a search in Table 5, we found that after moving r_1 inward to {-15,4//6}o = {-15,4//6^6}o, or at the n=4 's multiplier n' = 4*6^5 = 31104 (note: this is still the same ground state, with rest mass = 21616.0 MeV/c^2), a Δn' = 3 higher excited state (with the multiplier n' = 4*6^5 +3 = 31107) has the resting mass = 21620.2 MeV/c^2, or 4.2 MeV/c^2 higher than that the ground state. Therefore, we believed that an excited state of $^{12}_{6}C^*$ decays to its ground state $^{12}_{6}C$ by emitting a 4.4 MeV gamma ray can be (approximately) described by a nuclear {N,n} QM structural de-excitation transition from a Δn' = 3 higher excited state (with the multiplier n' = 4*6^5 +3 = 31107, correlates to the rest mass of 21616.0 MeV/c^2, or correlates to a rest energy of 21616.0 MeV) to a {-15,4//6}o = {-15,4//6^6}o QM ground state (with the multiplier n' = 4*6^5 = 31104, correlates to the rest mass of 21620.2 MeV/c^2, or correlates to a rest energy of 21620.2 MeV), with a transitional energy of 4.2 MeV. Of course, if we use even higher-frequency multiplier n' (e.g., n' = 4*6^6), we will get more accurate description for a 4.4 MeV gamma emission transition.

Table 5. Searching for a {N,n//6^j} QM state that has ~ 4.4 MeV/c^2 higher mass value than the {-15,4//6}o QM state's mass value (at 21616.0 MeV/c^2).

			n=																							
		{N,n//6}, MeV	1	2	3	4	5	6	7	8	9	10	11	12	...	17	18	...	23	24	...	29	30	...	35	36
N=	-17	{-17,n//6}	1.042	4.17	9.38	16.7	26.1	37.5																		
	-16	{-16,n//6}	37.5	150	338	600	938	1351																		
	-16	{-16,n//6^2}						37.5	51.1	66.7	84.4	104	126	150		301	338		551	600		877	938		1277	1351
	-15	{-15,n//6}	1351	5404	12159	21616	33775	48636																		
	-15	{-15,n//6^2}						1351	1839	2402	3040	3753	4541	5404		10846	12159		19852	21616		31561	33775		45972	48636
	-15	{-15,n//6^3}																								1351
	-15	{-15,n//6^4}																								
	-15	{-15,n//6^5}																								
	-15	{-15,n//6^6}																								

		{N,n//6}, MeV	...	71	72	...	107	108	...	143	144	...	179	180	...	215	216	...	...	1295	1296
N=	-17	{-17,n//6}																			
	-16	{-16,n//6}																			
	-16	{-16,n//6^2}																			
	-15	{-15,n//6}																			
	-15	{-15,n//6^2}																			
	-15	{-15,n//6^3}		5255	5404		11935	12159		21317	21616		33401	33775		48187	48636				
	-15	{-15,n//6^4}															1351			48561	48636
	-15	{-15,n//6^5}																			1351
	-15	{-15,n//6^6}																			

		{N,n//6}, MeV	...	...	7775	7776	...	15551	15552	...	23327	23328	...	31103	***31104***	...	***31107***	...	38879	38880	...	46655	46656
N=	-17	{-17,n//6}																					
	-16	{-16,n//6}																					
	-16	{-16,n//6^2}																					
	-15	{-15,n//6}																					
	-15	{-15,n//6^2}																					
	-15	{-15,n//6^3}																					
	-15	{-15,n//6^4}																					
	-15	{-15,n//6^5}			48623	48636																	
	-15	{-15,n//6^6}				1351		5403	5404		12158	12159		21614.6	***21616.0***		***21620.2***		33773	33775		48634	48636

Conclusion

A {N,n//6} QM structure periodic table with n = 1..12, and N ≤ -13 was built for the elementary particles (based on their mass). If it is correct, then we may need to rearrange the generation of some quarks in the Standard Model based on the {N,n//6} QM.

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SunQM-6s2: Using Bohr atom, {N,n} QM field theory, and non-Born probability to describe a photon's emission and propagation (part 2).
SunQM-7: Using {N,n} QM and Simultaneous-Multi-Eigen-Description (SMED) to describe our universe.
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Appendix: {N,n//6} QM structure (master) Periodic Table (from sub-quark to universe), copied from SunQM-7's Table 1.

			n= "n state" or "n shell" or "n orbit space"											
		{N,n//6}	1	2	3	4	5	6	7	8	9	10	11	12
N=		-24												
"N period" or "N super-shell"	particle sub-	-23					0.012 eV/c^2, neutrino <0.12eV							
"-1" Force	eV/c^2	-22	0.017 eV/c^2	0.069 eV/c^2	0.155 eV/c^2	0.276 eV/c^2	0.431 eV/c^2	0.621 eV/c^2	0.845 eV/c^2	1.103 eV/c^2	1.396 eV/c^2	1.724 eV/c^2	2.086 eV/c^2	2.483 eV/c^2
	particle	-21	0.6 eV/c^2	2.5 eV/c^2	5.6 eV/c^2	9.9 eV/c^2	15.5 eV/c^2	22.3 eV/c^2	30.4 eV/c^2	39.7 eV/c^2	50.3 eV/c^2	62.1 eV/c^2	75.1 eV/c^2	89.4 eV/c^2
	eV/c^2	-20	22 eV/c^2	89 eV/c^2	201 eV/c^2	357 eV/c^2	559 eV/c^2	804 eV/c^2	1095 eV/c^2	1430 eV/c^2	1810 eV/c^2	2234 eV/c^2	2704 eV/c^2	3217 eV/c^2
	particle	-19	0.8 KeV/c^2	3.22 KeV/c^2	7.24 KeV/c^2	12.87 KeV/c^2	20.11 KeV/c^2	28.96 KeV/c^2	39.41 KeV/c^2	51.48 KeV/c^2	65.15 KeV/c^2	80.44 KeV/c^2	97.33 KeV/c^2	115.83 KeV/c^2
	KeV/c^2	-18	29 KeV/c^2	116 KeV/c^2	261 KeV/c^2	463 KeV/c^2	724 KeV/c^2, electron 511Kev	1042 KeV/c^2	1419 KeV/c^2	1853 KeV/c^2	2345 KeV/c^2	2896 KeV/c^2	3504 KeV/c^2	4170 KeV/c^2
S/RFs force	particle MeV/c^2	-17	1.04 MeV/c^2, up quark 1.9 MeV	4.17 MeV/c^2, down quark 4.4 MeV	9.38 MeV/c^2	16.68 MeV/c^2	26.06 MeV/c^2	37.53 MeV/c^2	51.08 MeV/c^2	66.72 MeV/c^2	84.44 MeV/c^2	104.24 MeV/c^2	126.14 MeV/c^2	150.11 MeV/c^2
		-16	38 MeV/c^2	150 MeV/c^2, strange qk 87 MeV/c^2	338 MeV/c^2	600 MeV/c^2	**938 MeV/c^2, proton, size {-15,1}**	1351 MeV/c^2	1839 MeV/c^2	2402 MeV/c^2	3040 MeV/c^2	3753 MeV/c^2	4541 MeV/c^2	5404 MeV/c^2
	Atom's nuclues, particle GeV/c^2	-15	He nucleus n_{nuc}=2, orbit {-15,1}o size {-15,2}	Li nucleus n_{nuc}=3, orbit {-15,2}o size {-15,3}	Be, B nucleus n_{nuc}<=4, orbit {-15,3}o size {-15,4}	C, N, nucleus n_{nuc}<=5, orbit {-15,4}o size {-15,5}	O, F,Ne nucleus n_{nuc}<=6, orbit {-15,5}o size {-15,6//6} ={-14,1}	Na, Mg, nucleus n_{nuc}<=7, orbit {-15,6}o size {-15,7//6}	Al, Si, nucleus n_{nuc}<=8, orbit {-15,7}o size {-15,8//6}	P, S, Cl, nucleus n_{nuc}<=9, orbit {-15,8}o size {-15,9//6}	Ar, K, Ca, nucleus n_{nuc}<=10, orbit {-15,9}o size {-15,10//6}	Sc, Ti, V, nucleus n_{nuc}<=11, orbit {-15,10}o size {-15,11//6}	Cr,Mn,Fe, nucleus n_{nuc}<=12, orbit {-15,11}o, size {-15,12//6}= {-14,2}	
		-14	orbit {-14,1}o, size {-14,2}, n_{nuc}=7..12, Z=11..26 nuclides Na,Mg,Al,Si,P,S,Cl, Ar,K,Ca,Sc,Ti,V,Cr, Mn,Fe	orbit {-14,2}o, size {-14,3}, n_{nuc}=13..18, Z=27..47 nuclides Co,Ni,Cu,Zn,Ga,Ge,As, Se,Br,Kr,Rb,Sr,Y,Zr,Nb ,Mo ,Tc,Ru,Rh,Pd,Ag	orbit {-14,3}o, size {-14,4}, n_{nuc}=19..24, Z=48..70 nuclides	orbit {-14,4}o, size {-14,5}, n_{nuc}=25..30, Z=71..96 nuclides	orbit {-14,5}o, size {-14,6} ={-13,1}, n_{nuc}=31..36, Z=97..118 nuclides	Og118 nucleus size {-13,1}						
		-13						H-atom size						
E/RFe force	atom	-12	H, He, electron shell orbit	period 2 atom's electron outer shell (unshrunk) orbit, maximum actual size of atom {-12,3}	period 3 atom's electron outer shell unshrunk orbit	period 4 atom's electron outer shell unshrunk orbit	period 5 atom's electron outer shell unshrunk orbit	period 6 atom's electron outer shell unshrunk orbit	period 7 atom's electron outer shell unshrunk orbit					
		-11					{-10,1} max atom theoretical size							
		-10												
		-9												
		-8												
		-7												
		-6					black hole stable size {-5,1}							
		-5												
G/RFg force	collapsed Sun size	-4					**black hole** orbit {-4,5}o, size {-3,1}							
		-3	**neutron star** orbit {-3,1}o, size {-3,2}				possible star size {-2,1}							
		-2					**white dwarf** orbit {-2,5}o, size {-1,1} **Earth** size ≈ {-1,1}	Sun's Ag, Au, Pb core size {-1,1}	Sun's Fe shell	Sun's Fe shell	Sun's Fe shell	Sun's Fe shell	Sun's Fe shell	
	Sun size, Sun internal shell	-1	Sun's Fe shell {-1,1}o	Sun's C, O, Ne, Si, S shell {-1,2}o, Uranus, Neptune size ≈ {-1,2.5}	Sun's He shell {-1,3}o, Jupiter, Saturn size {-1,4}	Sun's He shell {-1,4}o	Sun's H-fusion shell {-1,5}o, Sun core size {0,1}	Sun's Radiative zone {-1,6}o	Sun's Radiative zone {-1,7}o	Sun's Radiative zone {-1,8}o	Sun's Radiative zone {-1,9}o	Sun's Convective zone {-1,10}o	Sun's Convective zone {-1,11}o	Sun surface size {0,2}
	Planet size	0	**Sun** {0,1}o orbit, size {0,2}	corona shell {0,2}o	corona shell {0,3}o	corona shell {0,4}o	corona shell {0,5}o, size {1,1}, initial rock-evap-line {1,1}							
	Solar system, Planet orbit	1		burned out planet {2,1}o, current rock-evap-line {1,3}	**Mercury**	**Venus**	**Earth**, initial ice-evap-line {2,1}	**Mars**		**Asteroid belt**, Ceres	current ice-evap-line {1,9}		Jupiter, {1,11}o merged with {1,12}o	Jupiter, {1,12}o merged with {1,11}o
		2		**Jupiter**	**Saturn**	**Uranus**	**Neptune**, Solar wind stop, Methane-evap-line {3,1}	**Pluto, Kuiper belt** {2,6}o	SDO	SDO	SDO	SDO	SDO	
		3		**{3,2} planet/Belt**	**{3,3} planet/Belt**	**{3,4} planet/Belt**	**{3,5} planet/Belt**, nLL-force stop {4,1}	inner Oort	inner Oort	inner Oort	inner Oort	inner Oort	inner Oort	inner Oort
		4	**inner Oort**	**inner Oort**	**inner Oort**	**outer Oort**	**outer Oort**, Solar system size {5,1}, Sun bound G-force stop {5,1}							
	between stars	5					Sun's unbound G-force stop {6,1}							
		6												
"+1" force	Galaxy	7					Milky way galaxy orbit {7,5}o, size {8,1} r=5~9E+4 ly							
		8	Halo of a galaxy, orbit {8,1}o, size {8,2}, r=2E+5 ly											
	Super Cluster	9					Virgo SupClst orbit {9,5}o, size {10,1}, r=5.5E+7 ly							
		10	Laniakea orbit {10,1}o, size {10,2} r=2.6E+8ly											
	observable universe	11				observ Univ r=4.4E+26 m, size up to {11,5}	{12,1} sized universe?							
	Universe	12												
		13												
		14					{15,1} sized universe?							
		15												