SunQM-5s1: White Dwarf, Neutron Star, and Black Hole Explained by Using {N,n//6} QM (Drafted in Apr. 2018)

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The major part of this work was finished before Apr. 2018.

Abstract

In the previous paper (SunQM-5), we developed a brand new nuclear {N,n//6} QM. In current paper, we used the nuclear {N,n//6} QM to analyze how a (Sun-like) star quantum collapses from {0,2} to a black hole {-5,1} QM structure. Two different atom-based models have been proposed and analyzed. In the "atom shrink model", a Sun {0,2} quantum collapse to {-5,1}, shrink by ΔN = -5 plus Δn = -1, was explained as directly caused by the shrink of hydrogen atom {-12,1}o (or e1{0,1}o) orbital shell by ΔN = -5 plus Δn = -1 to a quark-sized virtual atom {-17,1} (or e1{-5,1}), with fixed (or unchanged) total number of (virtual) atoms. In the "atom fusion model", a celestial body's quantum collapse was explained as that it was caused by the fusion of atoms, from H, to He, C, O, Ne, Fe, Og, then to the (pseudo) Z number = 3E+5, 1.2E+13, 1.25E+21, up to 4.5E+56, until all protons are merged with electrons, so that the whole Sun become a single gigantic atom with a single nucleus containing 1.19E+57 neutrons (= Sun mass / proton mass), and with zero proton or electron left. Our {N,n} QM analysis revealed that the super heavy elements (Z >> 118) are formed during the quantum collapse of {-1,1} white dwarf to {-2,1} sized celestial bodies. So on a pre-neutron star (like a {-2,1} = {-3,6} sized celestial body) that right before quantum collapse (or explode) into a {-3,2} sized neutron star, the atoms in the out-edge shell within the {-3,6} sized (solid) celestial body are all super heavy atom with Z ≥ 118. This is because under the super high G-pressure, the equilibrium reaction of "nuclear fusion <=> nuclear fission" shifted to the fusion side. During the neutron star explosion, part of these (super heavy) atoms in the out-edge shell is exploded away. Then these (exploded away) super heavy atoms start to fission into smaller atoms (after the super high G-pressure is released, and the equilibrium reaction shifted to the fission side). If this model's result is meaningful, then most (if not all) of heavy atoms in our daily-world (from Co (Z=27) to U (Z=92) or even heavier) are the product of nuclear fission (rather than the nuclear fusion) reaction of the previous Z > 118 atoms right after the neutron star explosion.

Introduction

The {N,n//6} QM has successfully described the structure of Solar system [1 ~ 9]. In the previous paper SunQM-5 [10], we analyzed atom's nucleus-electron system by using the interior {N,n//6} QM structure with the ground state electron's orbit as e1{0,1}. The result revealed that nucleus of hydrogen (Z=1), He (Z=2), Li (Z=3), Ne (Z=10), Og (Z=118) atoms have the interior QM structure of e1{-3,1//6}, e1{-3,2//6}, e1{-3,3//6}, e1{-3,6//6} = e1{-2,1//6}, and e1{-1,1//6}, respectively. In the current paper, we used that result to explain how a star collapses into a white dwarf, a neutron star, a black hole on the atom basis. Note: for {N,n} QM nomenclature and the general notes for {N,n} QM model, please see SunQM-1's section VII. All {N,n} without prefix and without //6 means Sun{N,n//6}, i.e., using Sun core as the r_1 for the interior {N,n}. 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 = $5.6*10^{-9}$. The reading sequence for SunQM series papers is: SunQM-1, 1s1, 1s2, 1s3, 2, 3, 3s1, 3s2, 3s3, 5, 5s1. 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: This paper is the spin-off section of SunQM-5's section VI, so you need to read SunQM-5 before understanding the nomenclatures in this paper. The minimum revise has been made after April 2018 for this paper. Note: I am a {N,n} QM scientist, not an astrophysicist. All I did here is to use {N,n//6} QM to re-explain part of the astrophysics.

I. White dwarf, neutron star, and black hole analyzed as the shrink of atom (or virtual atom), with the total number of atoms (in a Sun) unchanged

In this section, through the interior {N,n} QM analysis, the quantum collapse of a star (from Sun, to white dwarf, neutron star, black hole, etc.) is directly correlated to the quantum collapse of atom's size (to become a shrunk and virtual atom), or to the quantum shrink of its electron orbit's super-shell (to become a shrunk and virtual electron orbital shell). From Table 3 of paper SunQM-5, we know that the electron orbit's ground state is in {-12,1//6}o orbital shell space under Sun{0,1}. So all (atoms') electron orbits are in {-12,n=1..7//6}o super-shell under Sun{0,1}. Here we call it the normal electron orbit super-shell. In Figure 1, we plotted the interior {N,n//6} QM analysis for Sun core's atom under e1{0,1//6}, (i.e., using n=1 electron orbit as the interior {0,1//6}), and presented the result using Schrodinger equation's probability radial distribution. Although, in theory, electron shells from n=1 to n=7 should occupy e1{0,n=1..7//6}o orbit spaces, but due to the "atom size n=2 effect" (see Table-2's result/discussion-5 in SunQM-5), the actual size of a normal atom is only at around {-12,2//6} in size, (i.e., in the size of the uncompressed e1{0,2//6}, or 4× of r_{e1}, or 4 × 5.29E-11 meters). In Figure 1, we used the red solid line for e1{0,1//6}o probability density curve to represent that the electrons occupy n=1..7 orbits with the actual size of n=2. (Notice that in this representation, only the Z=1 element is well represented; all Z > 1 elements should have $r_{e1} = r_1/Z$ and those r_{e1} are ignored in the red curve representation in Figure 1. For example, the Z=36 element should have $r_{e1} = r_1/Z = r_1/36$ and it is ignored in the Figure 1's red curve representation. Part of reasons for the ignorance is that Figure 1 needs to represent Z = 1..118 at one time). Also we used the blue solid line for e1{0,1//6}o probability density curve to represent that the n=1 ground state electron has its actual outer edge at n=2.

Here is the explanation of each super shell curve in Figure 1: according to the nuclear {N,n//6} QM description (see SunQM-5's Table 2 and Table 3), the e1{-1,n=1..5//6}o orbital super shell space correlates to {-13,n=1..5//6}o orbital super shell space, and it is the empty (nucleon orbit) super shell for a normal atom (because this super shell is for Z > 118 atom's nucleons); the e1{-2,n=1..5//6}o orbital super shell space correlates to {-14,n=1..5//6}o orbital super shell space, and it is the (nucleon orbit) super shell for a normal atom with Z > 10 through Z ≤ 118; the e1{-3,n=1..5//6}o orbital super shell space correlates to {-15,n=1..5//6}o orbital super shell space, and it is the (nucleon orbit) super shell space for a normal atom with Z = 2 through Z ≤ 10; the e1{-4,n=1..5//6}o orbital super shell space correlates to {-16,n=1..5//6}o orbital super shell space, and it is the (nucleon orbit) super shell for a normal atom with Z = 1, and it is the size of a proton (or neutron), and it is also the outer orbital super-shell space for the three quarks (that doing orbital movement to form a proton); the e1{-5,n=1..5//6}o orbital super shell space correlates to {-17,n=1..5//6}o orbital super shell space, and it is the inner orbital super-shell space of the three quarks (that doing orbital movement to form a proton); the e1{-6,n=1..5//6}o orbital super shell space correlates to {-18,n=1..5//6}o orbital super shell space, and it is the size of a single quark at {-17,1//6}.

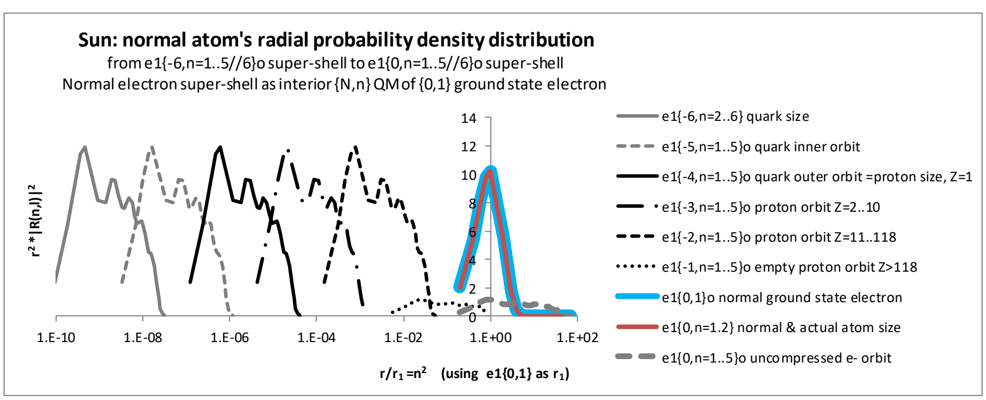

Figure 1. A normal atom's probability density r-distribution (for the current Sun). Note: the y-axis is not on scale. Note: the solid red (and blue) line means that the outer edge of this n shell is at n=2 (not n=1).

Our current Sun is formed by these normal (sized) atoms. Notice that the Sun has a size of {0,2//6}, and the normal atom has the actual size at around {-12,2//6}, or, both of them have the size of n=2 (not n=1, or size of r = 4× of r_1, not r = r_1). From paper SunQM-1 we learned that the white dwarf has a size of {-1,1//6} and Sun has a size of {0,2//6}, so the change (or the quantum collapse) of ΔN is: ΔN = -1 plus Δn = -1, or |ΔN| >≈ 1, with the radius decreasing about 4*36 = 144 folds. Because the normal atom (in the Sun) has size of e1{0,2//6}, it is reasonable to explain that the quantum collapse of Sun to white dwarf by |ΔN| >≈ 1 comes from the equivalent quantum collapse (or shrink) of its atom size, or its electron orbit from e1{0,1//6}o orbital shell space (with the actual size of e1{0,2//6}) to e1{-1,1//6} size (as shown in Figure 2). Notice that the former one (e1{0,1//6}o) has the electron orbital shell thickness from r_{e1} to 4× of r_{e1} (so we used the solid red or blue line to represent in Figure 1), while the later one (e1{-1,1//6} size) has the very thin electron orbital shell (thickness → 0) at the new r_1 (so we used a *dashed* red line to represent in Figure 2). Now we call the shrunk atom as "virtual atom" because its size (of r) is decreased to 1/4/36 = 1/144 of the normal atom.

Because the e1{-1,n=1..5//6}o super-shell was not occupied by nucleons for a normal (Z ≤ 118) atom (see Table 1 of paper SunQM-5, and Figure 1 above), this electron super-shell shrink does not cause any electron to merge with proton to form neutron in super-shell space of e1{-1,n=1..5//6}o, besides the virtual atom size (of r) is decreased. As the result, a white dwarf {-1,1} is composed with the same number of atoms as that in Sun, each of these shrunk (virtual) atoms (with mass number up to 293) has up to 118 protons in each nucleus. Due to the atom size is decreased, its electron's orbital velocity will pass the light speed c. To avoid that, these electrons may no longer orbit their own nuclides, they may have to be shared by all other neighboring virtual atoms to form kind of "electron sea" and to generate the "electron degeneracy pressure" (this is a citizen scientist-leveled explanation, and also see wiki "white dwarf").

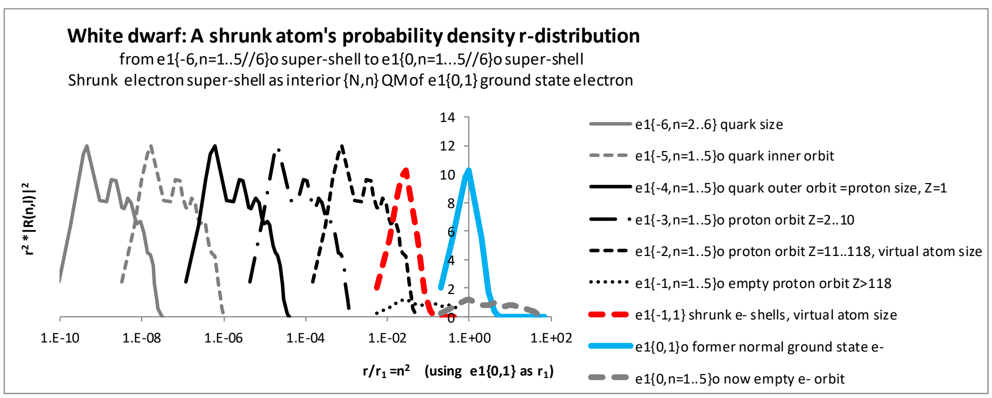

Figure 2. A shrunk atom's probability density r-distribution (for a white dwarf). Note: the y-axis is not on scale. The red dash line represents the electron orbital shell (or the virtual shell) is very thin, with the outer edge at e1{-1,1//6}.

From paper SunQM-1 we learned that there is an undiscovered celestial body {-2,1} which is ΔN = -1 smaller than white dwarf's size {-1,1}. Using the same explanation as that for white dwarf, we attributed that the quantum collapse of white dwarf to {-2,1} QM structure by ΔN = -1 comes from the second quantum collapse (or shrink) of its virtual atom size, or its (virtual) electron orbits from the e1{-1,1//6} size to e1{-2,1//6} size, and with a thin (virtual) electron orbital shell (see Figure 3). Because the e1{-2,n=1..5//6}o super-shell was originally occupied by nucleons (of a normal atom) with Z from 118 down to ~11 (see SunQM-5's Table 1, and Figure 1 above), this electron super-shell shrink thus causes electrons to merge into protons to form neutron in super-shell space of e1{-2,n=1..5//6}o, besides the virtual atom size (of r) is decreased again to 1/36. As the result, atoms in celestial body {-2,1} are composed of double-shrunk (virtual) atoms with size of 1/144/36 of the normal atom (in r), plus all of its e1{-2,n=1..5//6}o super-shell's protons (from Z > 10 to Z =118) are merged with electrons to become neutrons, and only e1{-3,n=1..5}o super-shell's protons (Z = 2 … 10) are left. In other words, a {-2,1} celestial body is composed of double-shrunk atoms, each of them (with mass number up to 293) has only 2 ~ 10 protons located at the center of each nucleus, and each virtual atom provides 2 ~ 10 electrons to share with other (double-shrunk) virtual atoms, and to form electron sea in the {-2,1} celestial body.

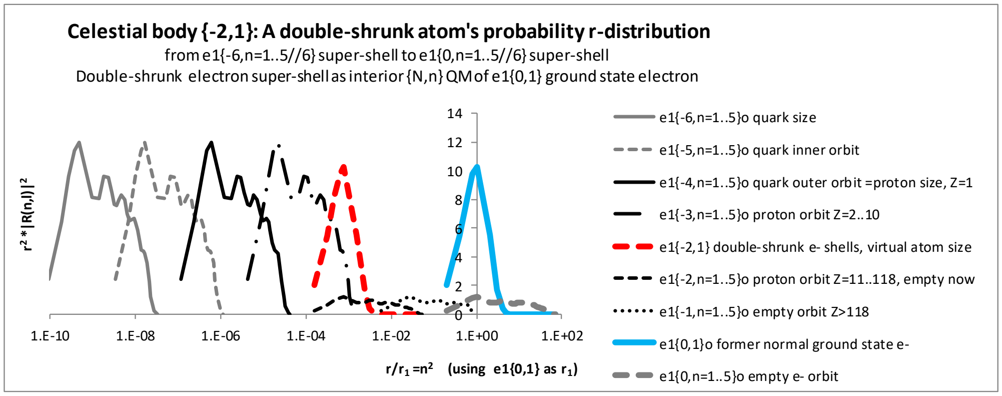

Figure 3. Celestial Body {-2,1} explained by using a double-shrunk atom's probability r-distribution. Note: the y-axis is not on scale. The red dash line represents the electron orbital shell (or the virtual shell) is very thin, with the outer edge at e1{-2,1//6}.

From paper SunQM-1 we learned that a neutron star is a {-3,2} QM structure which is |ΔN| ≤ 1 smaller than the celestial body {-2,1}. Using the same explanation as that for the white dwarf and for the celestial body {-2,1}, we attributed that the quantum collapse of {-2,1} QM structure to {-3,2} comes from the further shrink of its virtual atom size, or its electron orbits from the size of e1{-2,1//6} = e1{-3,6//6} to e1{-3,1//6}o orbital shell (with the size of e1{-3,2//6}, see Figure 4). Because the e1{-3,n=2..5//6}o super-shell was originally occupied by nucleus (of a normal atom) with Z from 3 to ~10 (see Figure 1), this electron orbital shell shrink causes electrons to merge into protons to form neutrons in super-shell space of e1{-3,n=2..5//6}o, besides the atom size (of r) is decreased to 1/9. As the result, the atom e1{-3,1//6}o in neutron star's {-3,2} sized QM structure is a triple-shrunk virtual atom with size of 1/144/36/9 (= 1/36^3) of the normal atom (in r), plus its e1{-3,n=2..5//6}o super-shell's protons are all become neutrons, and only at its center (within size of e1{-3,2//6}) has two protons. In other words, a neutron star is composed of triple-shrunk atoms, each of these nuclides (with mass number up to 293) has up to two protons at the center of each nucleus, and each of these nuclides contributes all of two electrons to share with all other (triple-shrunk) atoms to form electron sea in the neutron star's {-3,2} QM structure.

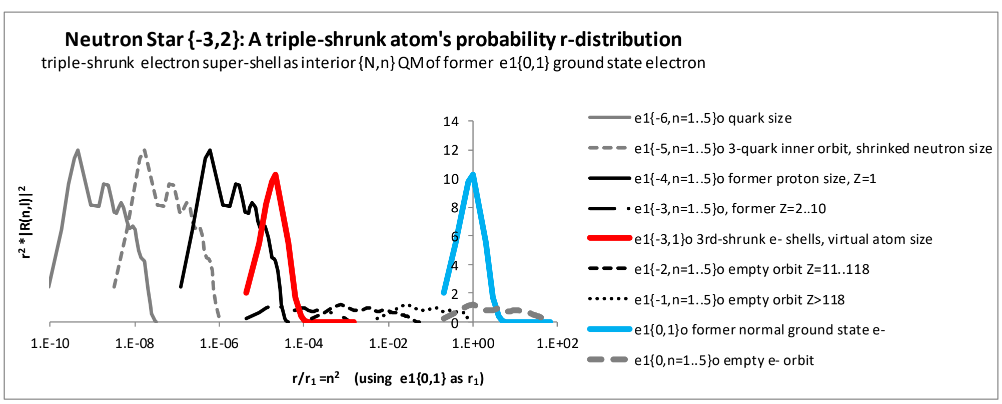

Figure 4. Neutron Star {-3,2} explained by using the triple-shrunk atom's radial probability distribution. Note: the y-axis is not on scale. Notice that the solid red line means that the outer edge of this n shell is at n=2 (not n=1).

From paper SunQM-1 we learned that a black hole is a {-3,1} QM structure which is Δn = -1 smaller than the {-3,2} neutron star. Similar as before, we attributed that the quantum collapse of {-3,2} QM structure to {-3,1} by Δn = -1 comes from the further shrink of its virtual atom size, or its electrons from e1{-3, 1//6}o orbit to e1{-3,1//6} size (with a very thin orbital shell). Inside the e1{-3,2//6} there were two protons (see Figure 4's explanation), then this electron shell shrink causes the one proton in e1(-3,1//6}o orbital shell to merge with one electron and to form a neutron, besides the atom size (of r) is decrease to 1/4. Consequently, the radius of black hole (r ≈ 2.95E+3 meters) is 1/4 of that of neutron star (r ≈ 10E+3 ~ 12E+3 meters), simply due to its virtual atom's r decreased to 1/4. Thus the atom in a black hole of {-3,1//6} QM structure has a 4th-shrunk atom with size of 1/144/36/36 of the normal atom (in r), plus all of its protons in both e1{-3,n=1..5//6}o and e1{-2,n=1..5//6}o orbit super-shells have become neutrons. In other word, a black hole is composed of 4th-shrunk atoms, each of them (with mass number up to 293) have only one proton (inside e1{-4,n=1..5//6}o orbit super shell space).

At {-3,1} black hole stage, we assumed that the triple-quark's outer orbit super-shell e1{-4,n=1..5//6}o has collapsed, and only the inner orbit super-shell e1{-5,n=1..5//6}o still exists. Therefore, the size of a neutron also shrunk from e1{-3,1//6} to e1{-4,1//6}, and shrunk neutrons occupy e1{-5,n=1..5//6}o orbit space. So, at {-3,1} black hole stage, not only the (virtual) atom size shrinks to 1/144/36/36 in r (relative to the normal size of an atom), but also the (virtual) neutron size shrinks to 1/36 in r (relative to the normal size of a neutron).

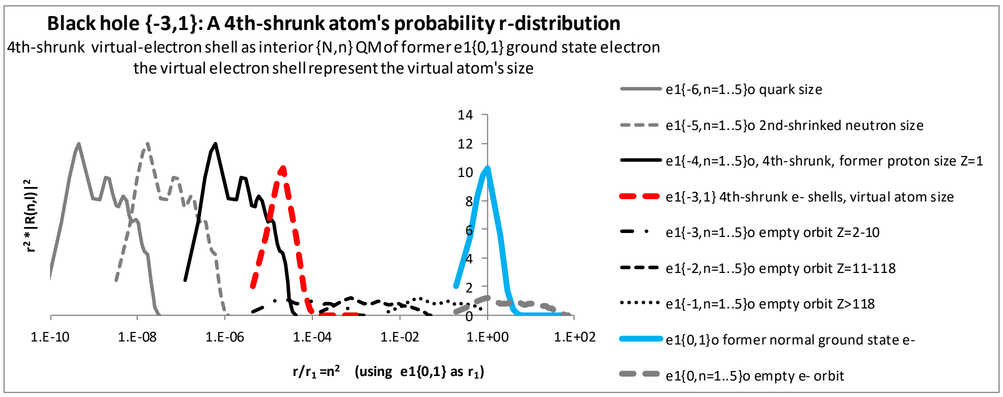

Figure 5. Black hole {-3,1} explained by using the 4th-shrunk atom's radial probability distribution. Note: the y-axis is not on scale. The red dash line represents the electron orbital shell (or the virtual shell) is very thin, with the outer edge at e1{-3,1//6}.

According to {N//6,n//6} QM structure theory, the black hole {-3,1} is not a super-super stable QM structure, it will further quantum collapse to a super-super stable {-5,1} QM structure. So what is the celestial body {-5,1} QM structure in terms of shrunk (virtual) atom? From Figure 5, we see that the black hole {-3,1} is made of 4th-shrunk atoms (now with size of a proton at e1{-3,1}). Therefore, a celestial body {-4,1} can be assigned as it is made of the 5th-shrunk atoms with size of e1{-4,1//6}, and the celestial body {-5,1} can be assigned as it is simply made of 6th-shrunk atoms with size of quark at e1{-5,1//6} (see Figure 6). When a 4th-shrunk atom quantum collapsed into a 5th-shrunk atom, its last proton inside e1{-4,n=1..5//6}o orbit super shell is merged with the last electron in the virtual atom. So in this hypothetic description, a 5th-shrunk (virtual) atom is composed of pure neutrons, with (almost) zero proton or electron. (Note: although proton in e1{-4,n=1..5//6}o orbit super shell is merged with electron, but there could be residue among of "partial proton" in the e1{-4,1//6} sized QM structure, which means many 5th-shrunk atoms share one proton). Although there is (almost) zero electron at this stage, but we can still call it "virtual electron shell". This should also be true for a 6th-shrunk (virtual) atom.

Then, why a 6th-shrunk (virtual) atom formed {-5,1} celestial body, but not a 5th-shrunk (virtual) atom formed {-4,1} celestial body, become super-super stable? It is explained in the section II of this paper: it is a 6th-shrunk (virtual) atom (but not a 5th-shrunk (virtual) atom) that contains true zero proton. Thus a celestial body {-5,1} is made of quark sized (6thshrunk) virtual atoms at size of e1{-5,1//6}, with all protons become neutrons, and no (orbital, or sea of) electron left for this virtual atom.

We hypothesized that the quark is made of the {-20,1} sized string (a next level of the super-super stable QM structure, and named as str{-20,1}, see SunQM-5's Figure 7): a (unknown) number of {-20,1} sized strings doing orbit movement in the super-shell orbital spaces of {-20,n=1..5//6}o = e1{-8,n=1..5//6}o, and {-19,n=1..5//6}o = e1{-7,n=1..5//6}o, and {-18,n=1..5//6}o = e1{-6,n=1..5//6}o, to form a quark at size of {-17,1//6} = e1{-5,1//6}. When a 6th-shrunk (virtual) atom become a size of quark, we guessed that the str{-20,1} 's orbital space also shrunk from {-18,n=1..5//6}o and {-19,n=1..5//6}o super-shell spaces to within {-20,n=1..5//6}o super-shell space.

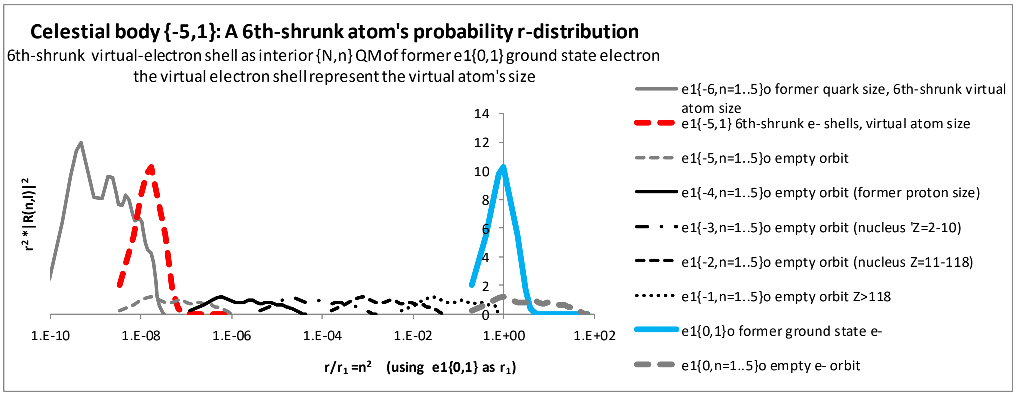

Figure 6. Celestial body {-5,1} explained as the 6th-shrunk atom's radial probability distribution. Note: the y-axis is not on scale. The red dash line represents the electron orbital shell (or the virtual shell) is very thin, with the outer edge at e1{-5,1//6}.

The advantage of using the virtual-electron shell is that now a celestial body {-5,1} is the same as a {-3,1} black hole, a {-3,2} neutron star, a celestial body {-2,1}, and a {-1,1} white dwarf, in the way that they all caused by a series of quantum collapses of electron super-shell (or virtual-electron shell), and this electron shell (or the virtual electron shell) determines the actual size of an atom (or a virtual atom). A more straightforward table-formatted view of the correlation between celestial {N,n//6} structure and atomic {N,n//6} structure is presented in Table 1. It clearly showed that the collapse of celestial body's size can be described as the direct result of the collapse of its atom (or virtual atom)'s size. So the (G-force driven) collapse of a celestial body (like Sun or other stars) from {0,2} QM structure to {-5,1} QM structure (a complete ΔN =5 plus Δn =1), is perfectly correlated to its atom's size (represented by its n=1 electron shell) collapse from H-atom's {-12,1}o with size of {-12,2} to quark size {-17,1}, also a complete ΔN =5 plus Δn =1. Therefore, this analysis supports the validity that there is an (irregular) super-super stable span of ΔN =5 from {-12,1} to {-17,1} as shown in SunQM-5's Table 1 column 17. It also linked micro-structure to macro-structure to support that {-5,1} is the super-super stable structure of a black hole. We named this model as the "**atom shrink model**".

Alternatively, we can further simplify the "atom shrink model" by assuming that the Sun is made of pure hydrogen atoms, and there are total (Sun's mass / proton's mass = 1.99E+30 kg / 1.67E-27 kg =) 1.19E+57 of H-atoms in a Sun. After all these H-toms shrunk to the size of quark (and the keep the total virtual H-atom number 1.19E+57 unchanged), the Sun collapsed to a {-5,1} sized block hole. In comparison, in the original "atom shrink model", Sun has ~75% hydrogen, ~23% helium, and ~2% of Z = 3 ~ 118 elements. Thus, the original atoms are mixed of Z = 1 to Z = 118, and the final shrunk (virtual) atoms are the same number of mixed of (pseudo) Z = 1 to (pseudo) Z = 118.

Table 1. Correlation of celestial {N,n} QM structure to the electron shell (or virtual electron shell)'s {N,n} QM structure, using Sun{0,1}. Read in rows.

			size of atom (or virtual atom) in collapsed celestial body					
			Normal e- super-shell	1st-shrunk e- super-shell	2nd-shrunk e- super-shell	4th-shrunk virtual e- shell, proton size	5th-shrunk virtual e- shell	6th-shrunk virtual e- shell, quark size
		in e1{0,1}	e1(0,1}o	e1{-2,n=1..5}o	e1{-3,n=1..5}o	e1{-4,n=1..5}o	e1{-5,n=1..5}o	e1{-6,n=1..5}o
		in Sun{0,1}	{-12,2} size	{-13,1}	{-14,1}	{-15,1}	{-16,1}	{-17,1}
Celestial	{0,2}	Sun	p+ = 1~118			proton		quark
structure	{-1,1}	white dwarf		p+ = 1~118		proton		quark
	{-2,1}				p+ = 1~10	proton		quark
	{-3,1}	black hole				p+ = 1		quark
	{-4,1}			empty orbit			p+ = 0.1	quark
	{-5,1}							p+ = 0

II. White dwarf, neutron star, and black hole analyzed as the nuclear fusion of atom, with the total number of atoms (in a Sun) decreased to one

Although in the "atom shrink model", the quantum collapse of Sun {0,2} to white dwarf {-1,1} by ΔN = -1 plus Δn = -1 was attributed to the (equivalent) shrinking of its atom size, or its electron orbits from e1{0,1//6}o to e1{-1,1//6} size (in section I), according to the standard stellar evolution theory (see wiki "Stellar evolution" figure "The onion-like layers of a massive evolved star just before core collapse"), the actual collapse of a giant star is achieved by fusion of H element into He element, then to C, Ne, O, Si, and Fe elements. In this section, we want to combine above two models under the nuclear {N,n} QM, i.e., purely based on the nuclear quantum number n_{nuc} in an atom's nucleus-electron system (see SunQM-5's Table 2 column 11 for a complete set of n_{nuc} for all elements). Because the Sun is made of normal atoms (that is represented by H atom), and an H atom has n_{nuc} = 1, and also because that a Sun {0,2//6} quantum collapse to a white dwarf {-1,1//6} has its |ΔN| >≈ 1, we believed that a white dwarf should have n_{nuc} = 6 (as an average) for all of its fused atoms. To achieve that, we believed that a white dwarf {-1,1} is made of (from the outer to inner) shells with Carbon (n_{nuc} = 4.5) shell, followed by Oxygen (n_{nuc} = 5.5) shell, Ne (n_{nuc} = 6.4) shell, Mg (n_{nuc} = 7.2) shell, Si (n_{nuc} = 8.0) shell, S (n_{nuc} = 8.7) shell, then Fe (n_{nuc} = 12.2) shell, plus a tiny center core with Z ≈ 118 elements (n_{nuc} ≈ 36). The total (weighted) averaged n_{nuc} of the whole white dwarf is expected close to 6, and it is expected to be a super stable {-1,1//6} sized celestial body. We named this as the nuclear {N,n//6} QM based "**atom fusion model**". (Note: "atom fusion model" had been proposed by other scientists long time ago, here we only re-explained it under the nuclear {N,n//6} QM).

Similarly, in the "atom shrink model", the quantum collapse of white dwarf to {-2,1} QM structure by ΔN = 1 comes from the further shrink of its atom size, or its electron orbits from the e1{-1,1//6} size to the e1{-2,1//6} size (see Figure 3). In the nuclear {N,n//6} QM based "atom fusion model", the (equivalent) 2nd shrink of atom size is expected by the fusion of the averaged n_{nuc} = 6 atoms into the averaged n_{nuc} = 36 atoms. However, in our daily-life-world, the heaviest nucleus Og has n_{nuc} =34.3 (note: here we only use {N,n//6}, not {N,n//7}) and it has very short life time. Then, it must be the super high G-pressure at the surface of {-2,1} celestial body makes Og118 become stable (due to the equilibrium reaction of "nuclear fusion ↔ nuclear fission" now favors the fusion side under the high G-pressure). So a {-2,1} celestial body most likely has its outer shells made of Og (or other elements with Z close to 118) super heavy nuclei, and has its inner shells made of the super heavy nuclides with Z > 118.

The even higher G-pressure push the equilibrium reaction of "nuclear fusion ↔ nuclear fission" further leftward, and causes the celestial body {-2,1} ={-3,6} quickly collapse into {-3,5}, {-3,4}, {-3,3}, then to {-3,2} neutron star. While more proton-electron merged as neutron, more and more nuclides also merged with each other to form super large nuclides. Finally, at neutron star {-3,2}, the averaged atom become a super large nucleus (with only two protons left, and all rest nucleon are neutrons? If here we can use the shrunk atom's result (in section I) to represent the fused atom's result). The averaged n_{nuc} for a {-3,2} neutron star's each single super heavy atom is expected to be 6*6*5 = 180. Similarly, the averaged n_{nuc} for a {-3,1} black hole's each single super heavy atom is expected to be 6*6*6 = 216.

From above discussion, we realized that (with the help of the nuclear {N,n//6} QM), the collapse of Sun to black hole can be explained as atom fusion from H (Z=1, n_{nuc} =1) to Ne (Z=10, n_{nuc} ≈6), then to Og (Z=118, n_{nuc} ≈6^2), then to even heavier atoms with pseudo Z correlates to n_{nuc} = 6^3, 6^4, 6^5, etc., up to 6^x where the whole Sun mass (with total of 1.19E+57 neutrons/protons, obtained from Sun mass / proton mass) fused into a single nucleus in a single gigantic atom, then this quantum collapse will stop (and, this is the "atom fusion model").

One alternative way to describe this process (we named it as the "**single nucleus expansion model**") is to assume that the current Sun has a big single (virtual) atomic nucleus with the size of {-11,5//6} at the center. When Sun quantum collapsed from size of {0,2} to {0,1}, then to {-1,1}, {-2,1}, {-3,1}, {-4,1} and {-5,1}, Sun core's big single (virtual) atomic nucleus will expand the size from {-11,5//6} to {-10,1}, then to {-9,1}, {-8,1}, {-7,1}, {-6,1} and {-5,1}. When the size of collapsed Sun body (now the black hole) and the size of the single nucleus meet at {-5,1}, it becomes a super stable QM state (as a {-5,1} sized black hole). This is more or less like the pre-Sun ball quantum collapsed from {5,1} to {0,1}, and its interior H-fusion ball increased from {-5,1} to {0,1}, when the size of Sun core and the size of H-fusion ball meet at {0,1}, it becomes a super stable QM state (see SunQM-1s1's Table 7a).

Now we try to see if we can describe the nuclear {N,n//6} QM based "atom fusion model" in a little bit more quantitative way. Method-1: When fused atom from H to Ne to Og, or from n_{nuc} = 6^0 =1 to 6^1 =6, to ~6^2 =36, the number of nucleons in a nucleus increased from 1 to ~20 to ~20^2. If keep this trend, then at 20^44 = 1.76E+57, or when the current Sun collapsed to around {-44,1} in size, all Sun's 1.19E+57 nucleons will be fused into one nucleus. Obviously, this result is not correct. Method-2: Based on $r_n = r_1 * n^2$, assuming when n_{nuc} = 6^0 =1 to 6^1, to ~6^2, r_{nuc} increased from (relative) (6^0)^2 =1 to (6^1)^2 = 36, to (6^2)^2 = 1296, and (relative) volume increased from 1 to 36^3 = 46656, to 1296^3 = 2.18E+9, then at (36^3)^12 = 1.06E+56, or when the current Sun collapsed to around {-12,1} in size, all Sun's 1.19E+57 nucleons will be fused into around one nucleus. This result also does not look good.

Method-3: Table 2 gave another way to calculate out (by a very rough estimation) how a Sun's collapse correlates to the atom fusion, up to the point where all atoms in Sun are fused into a single gigantic atom. In Table 2, we had assumed that the Sun is made of pure hydrogen atoms, and there are total (Sun's mass / proton's mass = 1.99E+30 kg / 1.67E-27 kg =) 1.19E+57 of H-atoms in a Sun. After all these H-toms fused to a single super gigantic nucleus (with Z# = 1.19E+57 / 2.5 = 4.8E+56), the Sun collapsed to a {-5,1} sized block hole. Now let us explain the meaning of each column in Table 2. Column-1 is the sizes of a collapsed star under Sun{0,1}. Column-2 is the (rough) corresponding shrunk electron orbital shell size under e1{0,1//6}. Column-3 is the estimated Z# (or pseudo Z# if >118) for a (averaged) fused atom. Column-4 is M# with the assumption that M = Z *2.5 for all fused (averaged) atoms (up to the whole Sun fused into a single gigantic atom with a single nucleus). Column-5 is the final number of (fused) atoms per Sun, started with 1.19E+57 H-atoms, ended as a single fused atom.

Column-6 is the "max allowed proton #" per shrunk atom (or virtual atom), estimated according to SunQM-5's Figure 4 through Figure 6, and also from Figure 1 through 5 in the current paper. For e1{-1,n=5..1//6}o orbits (i.e., from e1{0,1} size down to e1{-1,1} size), all of them have maximum allowed protons up to =118 (because the shrunk electron shell does not cause the proton-electron merge). For e1{-2,n=5..1//6}o orbits (i.e., from e1{-1,1} size down to e1{-2,1} size), each orbit (from e1{-2,5//6}o down to e1{-2,1//6}o) has maximum allowed proton # = 97, 70, 46, 26, 10 (due to more and more protons in e1{-2,n//6} merged with the shrunk electrons), this set of numbers was estimated from paper SunQM-5's Table 2. For e1{-3,n=5..1//6}o orbits (i.e., from e1{-2,1} size down to e1{-3,1} size), each orbit (from e1{-3,5//6}o down to e1{-3,1//6}o) has maximum allowed proton # =7, 5, 3, 2, 1 (also estimated from paper SunQM-5's Table 2, due to that more and more protons in e1{-3,n//6} merged with shrunk electrons). Then, we assumed that for e1{-4,n=5..1//6}o orbital shells (i.e., from e1{-3,1} size down to e1{-4,1} size), the maximum allowed proton # = 0.7, 0.5, 0.3, 0.2, and 0.1 (meaning more and more shrunk virtual atoms share one proton). For e1{-5,n=5..1//6}o orbital shells (i.e., from e1{-4,1} size down to e1{-5,1} size), the maximum allowed proton # (was assumed to be) = 0.07, 0.05, 0.03, 0.02, and 0.01. For e1{-6,1//6} size, the maximum allowed proton # was assumed to be 0.001. For e1{-7,1//6} size, the maximum allowed proton # was assumed to be 0.0001. For e1{-8,1//6} size, the maximum allowed proton # was assumed to be 0.00001. What we really wanted was the "max allowed proton #" per (averaged) fused atom, not the shrunk atom. However, we don't know how to obtain that number, so, here we made a big assumption that the "max allowed proton #" per (averaged) fused atom equals to the "max allowed proton #" per shrunk atom. (Note: because of this assumption, Table 2 is only a citizen scientist leveled estimation).

Column-7 is the "original expected Z" of the (averaged) fused atom for the collapsed celestial body {N,n}, like C, O, Ne, Fe, etc. (see column-8). Column-9 is the "true proton # Z' ", that is the smaller value between column-6 and column-7. It is assumed to be the true (averaged) proton number in a (averaged) fused atom. It showed that e1{-1,n=5..1//6}o orbital shells do not have proton-electron merge (because Z' = Z), while e1{-2,n=5..1//6}o and e1{-3,n=5..1//6}o do have proton-electron merge (because Z' < Z, see the blue colored cells in Table 2).

Column-10 is the (theoretically) "expected total n_{nuc}" of those fused atoms' nuclides, based on H-atom's n_{nuc} =1, Ne's $n_{nuc} \approx 6$, Og's $n_{nuc} = 34.2 \approx 36$. It is calculated as n_{nuc} = n*6^N, where N=0, 1, 2, 3, etc. Notice that the nuclear fusion causes the size of a celestial body decreases (see column-1, from n = 2, to n = 1 (= 6/6), 5/6, 4/6, 3/6, etc., or from {0,2}, to {0,1}={-1,6}, to {-1,5}, {-1,4}, {-1,3}, etc.), however, at the same time, it causes the fused nucleus to increase its n_{nuc} (see column-10, from n_{nuc} = 1, to n_{nuc} = 2, 3, 4, 5, 6, 2*6 = 12, 3*6 = 18, 4*6 = 24, etc.).

Columns 11-15 are the calculations of n_{nuc} based on formula

$$r_{nuc} = 1.25E\text{-}15 * M^{(1/3)} \qquad \text{eq-1}$$

(see Table 2 of SunQM-5 for explanation). Column-11 used Z' value from column-9, and column-12 used M value from column-4.

Table 2. Estimated calculation of the pseudo Z# of the fused atoms (with the assumption that M# / Z# ≡ 2.5).

collapsed star size	shrunk electron orbit shell size	fused atom Z# (or pseudo Z# if >118)	true mass # M=2.5 *Z	final atom # per Sun	max allowed proton #	original expected Z	correlate to known atom	true proton # =Z'	expected total n_{nuc}	$r_{e1}=r_1/Z'$ m	r_{nuc}= 1.25E-15 *M^(1/3) m	r_{nuc}/r_{e1} m/m	$(r_{nuc}/r_{e1})/(H\text{-}r_{nur}/H\text{-}r_{e1})$	n_{nuc} = sqrt(r_n/r_1)
{0,2}	e1{0,1}o	1	1	1.19E+57	118	1	H	1	1	5.29E-11	*8.4E-16*	1.59E-05	1.00E+00	1.0
{0,1}	e1{0,1}	1	1	1.19E+57	118	1	H	1	1	5.29E-11	*8.4E-16*	1.59E-05	1.00E+00	1.0
{-1,5}		2	4	2.98E+56	118	2	He	2	2	2.65E-11	*1.92E-15*	7.26E-05	4.57E+00	2.1
{-1,4}		3	7	1.70E+56	118	3	Li	3	3	1.76E-11	2.39E-15	1.36E-04	8.54E+00	2.9
{-1,3}		5	11	1.08E+56	118	5	B (& C)	5	4	1.06E-11	2.78E-15	2.63E-04	1.65E+01	4.1
{-1,2}		7	14	8.51E+55	118	7	N (& O)	7	5	7.56E-12	3.01E-15	3.99E-04	2.51E+01	5.0
{-1,1}	e1{-1,1}	9	19	6.27E+55	118	9	F (&Ne)	9	6	5.88E-12	3.34E-15	5.67E-04	3.57E+01	6.0
{-2,5}		26	56	2.13E+55	97	26	Fe	26	12	2.03E-12	4.78E-15	2.35E-03	1.48E+02	12.2
{-2,4}		47	117.5	1.01E+55	70	47	Ag	47	18	1.13E-12	6.12E-15	5.44E-03	3.43E+02	18.5
{-2,3}		300	750	1.59E+54	46	70	Yb (Au, Pb	46	24	1.15E-12	1.14E-14	9.88E-03	6.22E+02	24.9
{-2,2}		5000	12500	9.53E+52	26	97	Bk	26	30	2.03E-12	2.90E-14	1.43E-02	8.98E+02	30.0
{-2,1}	e1{-2,1}	3.00E+05	750000	1.59E+51	10	118	Og	10	36	5.29E-12	1.14E-13	2.15E-02	1.35E+03	36.8
{-3,5}		5.00E+07	1.25E+08	9.53E+48	7			7	72	7.56E-12	6.25E-13	8.27E-02	5.21E+03	72.2
{-3,4}		1.50E+09	3.75E+09	3.18E+47	5			5	108	1.06E-11	1.94E-12	1.84E-01	1.16E+04	108
{-3,3}		4.50E+10	1.13E+11	1.06E+46	3			3	144	1.76E-11	6.03E-12	3.42E-01	2.16E+04	147
{-3,2}		5.00E+11	1.25E+12	9.53E+44	2			2	180	2.65E-11	1.35E-11	5.09E-01	3.21E+04	179
{-3,1}	e1{-3,1}	1.20E+13	3.00E+13	3.97E+43	1			1	216	5.29E-11	3.88E-11	7.34E-01	4.62E+04	215
{-4,5}		2.30E+15	5.75E+15	2.07E+41	0.7			0.7	432	7.56E-11	2.24E-10	2.96E+00	1.87E+05	432
{-4,4}		7.00E+16	1.75E+17	6.81E+39	0.5			0.5	648	1.06E-10	6.99E-10	6.61E+00	4.16E+05	645
{-4,3}		1.90E+18	4.75E+18	2.51E+38	0.3			0.3	864	1.76E-10	2.10E-09	1.19E+01	7.50E+05	866
{-4,2}		2.50E+19	6.25E+19	1.91E+37	0.2			0.2	1080	2.65E-10	4.96E-09	1.88E+01	1.18E+06	1087
{-4,1}	e1{-4,1}	5.10E+20	1.28E+21	9.35E+35	0.1			0.1	1296	5.29E-10	1.36E-08	2.56E+01	1.61E+06	1270
{-5,5}		1.08E+23	2.70E+23	4.41E+33	0.07			0.07	2592	7.56E-10	8.08E-08	1.07E+02	6.73E+06	2595
{-5,4}		3.35E+24	8.38E+24	1.42E+32	0.05			0.05	3888	1.06E-09	2.54E-07	2.40E+02	1.51E+07	3887
{-5,3}		8.75E+25	2.19E+26	5.45E+30	0.03			0.03	5184	1.76E-09	7.53E-07	4.27E+02	2.69E+07	5186
{-5,2}		1.12E+27	2.80E+27	4.26E+29	0.02			0.02	6480	2.65E-09	1.76E-06	6.66E+02	4.19E+07	6477
{-5,1}	e1{-5,1}	2.68E+28	6.70E+28	1.78E+28	0.01			0.01	7776	5.29E-09	5.08E-06	9.60E+02	6.04E+07	7774
{-6,1}	e1{-6,1}	1.25E+36	3.13E+36	3.81E+20	0.001			0.001	46656	5.29E-08	1.83E-03	3.45E+04	2.18E+09	46643
{-7,1}	e1{-7,1}	6.00E+43	1.50E+44	7.94E+12	0.0001			0.0001	2.80E+05	5.29E-07	6.64E-01	1.26E+06	7.91E+10	2.81E+05
{-8,1}	e1{-8,1}	2.70E+51	6.75E+51	1.77E+05	0.00001			0.00001	1.68E+06	5.29E-06	2.36E+02	4.47E+07	2.81E+12	1.68E+06
{-9,5}		5.10E+53	1.28E+54	934.6	0.000007			0.000007	3.36E+06	7.56E-06	1.36E+03	1.79E+08	1.13E+13	3.36E+06
{-9,4}		1.60E+55	4.00E+55	29.8	0.000005			0.000005	5.04E+06	1.06E-05	4.27E+03	4.04E+08	2.54E+13	5.04E+06
{-9,3}		**4.15E+56**	**1.04E+57**	**1.1**	0.000003			0.000003	**6.72E+06**	1.76E-05	1.27E+04	7.18E+08	4.52E+13	**6.72E+06**
{-9,2}		5.50E+57	1.38E+58	0.087	0.000002			0.000002	8.40E+06	2.65E-05	2.99E+04	1.13E+09	7.13E+13	8.44E+06
{-9,1}	e1{-9,1}	1.30E+59	3.25E+59	0.004	0.000001			0.000001	1.01E+07	5.29E-05	8.59E+04	1.62E+09	1.02E+14	1.01E+07

The whole design of Table 2 is: by manually adjusting Z# (in column 3, yellow cells), to make the calculated n_{nuc} (in column 15, equivalent to the model's adjustable result) to match to the expected n_{nuc} value (in column 10, equivalent to the model's target n_{nuc}), so that we can find at what size of celestial body (in column-1), the "true mass #" in column 4 (closely) matches to 1.19E+57 (= Sun mass / proton mass). The result is {-9,3} size, which means (under this model) when a Sun {0,2} collapsed to the size of {-9,3}, all Sun's protons (max pseudo Z# = 4.8E+56 = 1.19E+57 / 2.5) will have merged with electrons to become neutrons, and the whole Sun become a single super gigantic atom with a single nucleus (with the maximum pseudo Z# = 4.8E+56). (Note: even though this is a citizen scientist leveled calculation, we still prefer to present a semi-quantitative model rather than a purely qualitative model. It is better to explain the model by using "true" numbers, even we know that these numbers may deviate from the real true numbers significantly).

Result and discussion (of Table 2):

1) In Table 2, when a Sun {0,2} collapsed to white dwarf {-1,1}, the whole {-1,1}RF ball's (averaged) n_{nuc} is increased from n_{nuc} =1 to (averaged) n_{nuc} = 6. So while {-1,1} white dwarf may have the outer most layer composed with C (n_{nuc} =4.5), beneath it is O (n_{nuc} =5.5), then Ne (n_{nuc} =6.4), then Mg, Si, S, Fe, … etc. with (averaged) n_{nuc} = 6. Thus this model says that for a white dwarf {-1,1}, although its surface shell is composed of Carbon atom, its inner shells are made of heavier elements, so that it has (weighted) averaged n_{nuc} close to =6. There is no proton-electron merge in this step.

2) When a {-1,1} white dwarf collapsed to a {-2,1} celestial body, the whole {-2,1}RF ball's (averaged) n_{nuc} is increased from n_{nuc} = 6 to (averaged) n_{nuc} = 6^2 = 36. Under the "atom shrink model", the {-2,1} celestial body has the outer most layer composed (probably) with Pb (Z = 82, n_{nuc} = 27), beneath it is Og118 (n_{nuc} = 34.2), then pseudo Z = 360, 670, 1020, 1420, 1870, with (averaged) n_{nuc} = 36 (see Table 2b column 3 in paper SunQM-5). Under the "atom fusion model" (see Table 2), the {-2,1} celestial body has the outer most layer composed with pseudo Z# = 5000 (n_{nuc} = 6^1 * 5 = 30), then 3E+5 (n_{nuc} = 6^1 * 6 = 36), then 5E+7 (n_{nuc} = 6^2 * 2 = 72), then pseudo Z# = 1.5E+9, 4.5E+10, 5E+11, 1.2E+13, … etc. with the (weighted) averaged n_{nuc} = 36. There is proton-electron merge because electrons shrink from e1{-1,1} to {e1{-2,1} (see Figure 3). Inside the {-2,1}RF ball, the merge of proton-electron causes Z to become pseudo Z and the "true proton# = Z' " to decrease from 118 to 10 for each (averaged) fused atom. Meanwhile, it avoids electron's v > c by delocalizing electrons and forming electron sea. Notice that the original expected Z (= averaged protons per atom) for e1{-2,3}, e1{-2,2}, e1{-2,1} is 70, 97, 118 (see column 6), but to make the calculated n_{nuc} (in column 15) to fit to the expected n_{nuc} = 24, 30, 36 (in column 10), we need to manually adjust their Z# (in column 3) to 300, 5000, 3E+5 (so now they are pseudo Z#). So according to this model, at the size of e1{-2,1}, the averaged atoms have pseudo Z# = 3E+5, each of this super large (virtual) atom has a nucleus containing ~3E+5 * 2.5 = 7.5E+5 neutrons, but with only ~10 proton (and ~10 electrons).

3) When a {-2,1} celestial body collapsed to a {-3,2} neutron star, the whole {-3,2}RF ball's (averaged) n_{nuc} is increased from n_{nuc} =36 to (averaged) n_{nuc} = 5* 6^2 =180. Table 2's calculation showed that a {-3,2} neutron star has the outer most layer composed with pseudo Z = 4.5E+10 (n_{nuc} = 4* 6^2 =144), then beneath it is pseudo Z= 5E+11 (n_{nuc} = 5* 6^2 =180), then pseudo Z=1.2E+13 (n_{nuc} = 6* 6^2=216), then pseudo Z= 2.3E+15, 7E+16, … etc. with (weighted) averaged n_{nuc} =180. There is proton-electron merge because electrons shrink from e1{-2,1} size shell to e1{-3,2} size shell (see Figure 4). Inside the {-3,2}RF ball, the proton-electron merge caused Z become pseudo Z, and decreased "true proton # Z' " from 10 to 2. Meanwhile, it avoids electron's v > c by delocalizing electrons and forming electron sea. So according to this model, at e1{-3,2}, the averaged atoms have pseudo Z# = 5E+11, each of this super large (virtual) atom has a nucleus containing ~5E+11 * 2.5 = 1.25E+12 neutrons, but with only 2 protons (and 2 electrons).

4) When a {-3,2} neutron star collapsed to {-3,1} black hole, the whole {-3,1}RF ball's (averaged) n_{nuc} increased from n_{nuc} =180 to (averaged) n_{nuc} =6^2 *6 =216. Table 2's calculation showed that a {-3,1} black hole has the most out layer composed with pseudo Z = 5E+11 (n_{nuc} =180), then beneath it is pseudo Z= 1.2E+13 (n_{nuc} =6^2*2 =216), then pseudo Z = 2.3E+15, 7E+16, 1.9E+18, … etc. with (weighted) averaged n_{nuc} =216. There is proton-electron merge because an electron shrinks to e1{-3,1} sized shell (see Figure 5). Inside the {-3,1} RF ball, the proton-electron merge decreased "true proton # Z' " from 2 to 1. Thus each (averaged) Z =1.2E+13 super large atom contains only one proton in its nucleus. Meanwhile, it avoids electron's v > c by delocalizing electrons and forming electron sea. So according to this model, at e1{-3,1}, the averaged

atoms have pseudo Z# = 1.2E+13, each of this super large (virtual) atom has a nucleus containing ~1.2E+13 * 2.5 = 3E+13 neutrons, but with only 1 proton (and one electron).

5) When a {-3,1} black hole collapsed to a {-5,1} black hole, the whole {-5,1}RF ball's (averaged) n_{nuc} is increased from n_{nuc} = 6^3 = 216 to (averaged) n_{nuc} = 6^5 = 7776, so a {-5,1} black hole has the outer most layer composed with pseudo Z = 1.1E+27 (n_{nuc} = 6480), then beneath it is pseudo Z = 2.6E+28 (n_{nuc} =7776), then pseudo Z= 1.3E+36, … etc. with (weighted and averaged) n_{nuc} =7776. Thus according to this model, at e1{-5,1}, the averaged super large atoms have pseudo Z# = 2.6E+28, each of this super large atom (virtual) has a nucleus containing ~2.68E+28 * 2.5 = 6.7E+28 neutrons, and 100 of this super large (virtual) atoms share one proton (and one electron).

6) When a {-5,1} black hole collapse to a {-9,3} black hole, the whole {-9,3}RF ball's n_{nuc} increased from (averaged) n_{nuc} = 7776 to (averaged) n_{nuc} = 4 * 6^8 = 6.72E+6, so that the Sun (M# =1.19E+57) contains only one fused atom (M# =1.04E+57 and it closely equals to 1.19E+57). There is average 0.000003 proton per this super-super large (virtual) atom, so practically zero proton. Thus Table 2's calculation showed that under this model, when Sun {0,2} (with r = 4 *1.74E+8 meters) collapse to a {-9,3} sized celestial body (with r = 1.74E+8 / (4 * 6^8)^2 ≈ 3.85E-6 meters), all protons in Sun merged with electron to become neutrons, and all 1.19E+57 neutrons (= Sun mass / proton mass) fused into a single nucleus, so that the whole Sun become a single super gigantic (virtual) atom, and this (virtual) atom has a single nucleus, no electron.

7) We know that eq-1 is only an approximation, at high Z'# (>1E+6) it is not accurate at all. The actual r_{nuc} is expected to be smaller than that calculated with eq-1. For example, in Table 2 at {-9,3}, at total M# = 1.04E+57 (column4, a number close to Sun's total nucleon # = 1.19E+57), eq-1 calculated r_{nuc} = 1.27E+4 meters (column 12), and manually calculated {-9,3} sized celestial body r = 3.85E-6 meters (see SunQM-5's Table 1). So this means that during Sun {0,2} collapse and atoms fusion, the pseudo Z increases much faster (than that in Table 2 column 3). Using our physical sense, we predicted that when it collapsed to {-5,1} black hole, all Sun's 1.19E+57 proton/neutrons have fused into a single nucleus with all protons merged with electrons. Thus, the whole Sun-mass becomes a single atom (or nucleus) with zero proton or electron left.

8) Currently people believe that the heavy elements in universe were fused during the neutron star explosion [11]. Our {N,n} QM analysis in Table 2 suggests that there may exist an alternative way. When a {0,2} Sun collapsed into a {-1,1} white dwarf, it has (weighted) averaged Z = 9, and with the surface atom at Z = 6. When a {-1,1 } = {-2,6} white dwarf further collapsed into a {-2,3} celestial body, it has (weighted) averaged pseudo Z ≈ 300, with the surface atom's Z probably at ~100. When a {-2,3} celestial body further collapsed into a {-2,1} celestial body, it has (weighted) averaged pseudo Z ≈ 3E+5, with the surface atoms from Z ~118 to pseudo Z ≈ 1E+3. The high Z is stabilized by the high gravity pressure at {-2,1} surface. During a {-2,1} celestial body finally collapsed into a {-3,2} neutron star, (most?) part of its {-2,1} surface mass is exploded out. After exploded out, these Z ≥ 118 elements lost the stabilizing factor (i.e., the super high G-pressure), so now the equilibrium reaction of "nuclear fusion ↔ nuclear fission" shifts to the right direction under the lower G-pressure. Therefore our {N,n} QM analysis revealed that all heavy atoms (Z >> 118) in our universe are created inside the collapsed celestial bodies when they collapsed to smaller than {-1,1} white dwarf. Part of these heavy atoms (Z ≥ 118) are released from the celestial bodies through the neutron star explosion. Most of (if not all) heavy atoms in our world (from Co (Z=27) to U (Z=92) or even higher) are the product of nuclear fission (rather than the nuclear fusion) reaction of Z ≥ 118 atoms right after the neutron star explosion.

III. More discussions

1) According to Table 2, a {-3,1} black hole has many (the number could be up to 1.19E+57 / 3E+13 = 3.97E+43, see column-5 of Table 2) super heavy atoms (with pseudo Z = 1.2E+13), each of them has one proton and one electron. The (collectively) large amount of (the left-over un-merged) protons and electrons (in a {-3,1} black hole) may be able to produce an active interior dynamo for this {-3,1} black hole (under certain condition). However, both "fused atom model" and

"shrunk atom model" assumed that a {-5,1} black hole has zero proton or electron in its single super gigantic atom. So if these models are meaningful, then it may suggest that a super-super stable {-5,1} black hole is not able to produce any active interior dynamo. If so, we hope this difference can make us to be able to distinguish between a {-3,1} black hole and a {-5,1} black hole, and ultimately to confirm the existence of a {-5,1} black hole.

2) A red giant star with {1,1} sized QM structure may can be treated as that its virtual atoms expanded to e1{1,1//6}o orbital space (from the normal atom's e1{0,1//6}o orbital space). Similarly, when a {0,2} sized star collapsed to a neutron star {-3,2}, part of its outer shell mass is exploded to be a {5,2} sized nebula (like that of the Crab Nebula). The exploded shell may can be treated as that its virtual atoms expanded to e1{5,1//6}o orbital space (from the normal atom's e1{0,1//6}o orbital space).

3) Similar as that a Sun collapsed from {0,1}o to {-5,1} is due to its atom size collapse from {-12,1}o to {-17,1}, a nebula collapse from {5,1} to Sun {0,1}o may can be treated as a virtual H-atom at size of{-7,1} (~2 mm, does it correlate to the free length of H-atom's thermal motion?) decreased to a regular H-atom at size of {-12,1}o {~5E-11 m).

Conclusion

In the first atom-based "atom shrink model", Sun {0,2} quantum collapse to {-5,1}, shrink ΔN = -5 plus Δn = -1, can be directly attributed to the shrink of hydrogen atom from {-12,1}o (or e1{0,1}o) orbital shell by ΔN = -5 plus Δn = -1 to a quark-sized virtual atom {-17,1} (or e1{-5,1}), with the total number of atoms unchanged. In the second atom-based "atom fusion model", a celestial body's quantum collapse can be attributed to the fusion of atoms, from H, to He, C, O, Ne, Fe, then to the (pseudo) Z number = 3E+5, 1.2E+13, 1.25E+21, up to 4.5E+56, and the whole Sun become a single gigantic atom with a single nucleus containing 1.19E+57 neutrons, and with zero proton or electron.

References

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[9] Yi Cao, SunQM-3s3: Using QM calculation to explain the atmosphere band pattern on Jupiter (and Earth, Saturn, Sun)'s surface. http://vixra.org/pdf/1805.0040v1.pdf （submitted on 2018-05-01）

[10] Yi Cao, SunQM-5: Using the Interior {N,n//6} QM to Describe an Atom's Nucleus-Electron System, and to Scan from Sub-quark to Universe (Drafted in April 2018). https://vixra.org/pdf/2107.0048v1.pdf （submitted on 2021-07-06）

[11] wiki "Chemical element", "*Nuclear fusion inside stars produces elements through stellar nucleosynthesis, including all elements from carbon to iron in atomic number. Elements higher in atomic number than iron, including heavy elements like uranium and plutonium, are produced by various forms of explosive nucleosynthesis in supernovae and neutron star mergers*".

[12] A series of my papers that to be published (together with the current paper):
SunQM-5s1: White dwarf, neutron star, and black hole re-analyzed by using {N,n} QM.
SunQM-7: Using {N,n} QM and Simultaneous-Multi-Eigen-Description (SMED) to describe our universe.
SunQM-7s1: Relativity and {N,n} QM.
SunQM-9s1: Addendums, Updates and Q/A for SunQM series papers.

[13] Major QM books, data sources, software I used for this study are:
Douglas C. Giancoli, Physics for Scientists & Engineers with Modern Physics, 4th ed. 2009.
David J. Griffiths, Introduction to Quantum Mechanics, 2nd ed., 2015.
John S. Townsed, A Modern Approach to Quantum Mechanics, 2nd ed., 2012.
Stephen T. Thornton & Andrew Rex, Modern Physics for scientists and engineers, 3rd ed. 2006.
James Binney & David Skinner, The Physics of Quantum Mechanics, 1st ed. 2014.
Wikipedia at: https://en.wikipedia.org/wiki/
(Free) online math calculation software: WolframAlpha (https://www.wolframalpha.com/)
(Free) online spherical 3D plot software: MathStudio (http://mathstud.io/)
(Free) offline math calculation software: R
Microsoft Excel, Power Point, Word.
Public TV's space science related programs: PBS-NOVA, BBC-documentary, National Geographic-documentary, etc.
Journal: Scientific American.

Appendix. Using the pseudo Z# to describe a rhodopsin-type model of our universe (Note: newly added after Apr. 2018)

We had used the pseudo Z# concept to describe a rhodopsin-type model of our universe in SunQM-6's section V (note: there we forgot to mention that the pseudo Z# concept came from SunQM-5s1's Table 2). After made some minor modifications, we rephrased this model here:

Step-1 (the initial steady state, or the QM ground state): The "rhodopsin-type" universe model is a class of universe model that is characterized as a (relative) static (or steady state, not a big bang type) universe with a (functional) event-trigged time-zero point, and this event is a repeated process (like a rhodopsin's function is trigged by absorbing a photon). We used the atomic number (Z) formed spectrum to describe the statics and the (functional) dynamics of the "rhodopsin-type" universe. The initial static state Z-spectrum of the "rhodopsin-type" universe is: 0% mass/energy in Z < 1 (note: we used pseudo Z < 1 to represent the massless energy), 75% mass in Z = 1 (as hydrogen element), 23% in Z = 2 (as helium element), 1% mass in 2 < Z ≤ 118, 1% mass in 118 < Z < 3.59E+77 (note: here we used pseudo Z# concept), and 0% mass in (pseudo) Z = 3.59E+77 (calculated as: assuming that the observable universe's mass 1.5E+53 kg (see wiki "observable universe") equals to our universe's total mass, then 1% of it generated a single super-super-super gigantic (virtual) atom's nucleus will have a pseudo Z = 1.5E+53 kg *0.01 / 1.67E-27 kg / 2.5 = 3.59E+77).

Step-2 (the beginning of a functional process, or the QM's state transition to the excited state): A super-super-super gigantic "photon" with 1% of our universe's total mass/energy (and with 0 < Z < 1) is absorbed by our universe, causing its Z-spectrum changed to: 1% mass/energy in Z < 1, 75% mass in Z = 1, 23% mass in Z = 2, 1% mass in 2 < Z ≤ 118, 1% mass in 118 < Z < 3.59E+77, and 0% mass in Z = 3.59E+77.

Step-3 (the beginning of QM de-excitation transition): The 1% of newly absorbed (Z < 1) mass/energy quickly transformed into 0.75% Z = 1 mass (hydrogen) and 0.25% Z = 2 mass (helium, accommodated to the big-bang theory). Thus, our universe's Z-spectrum now become: 0% mass/energy in Z < 1, 75.75% mass in Z = 1, 23.25% mass in Z = 2, 1% mass in 2 < Z ≤ 118, 1% mass in 118 < Z < 3.59E+77, and 0% mass in Z = 3.59E+77. Then, the Stellar nucleosynthesis (see wiki "Stellar nucleosynthesis") gradually shifts our universe's Z-spectrum from low Z to high Z. (Note: here we try to accommodate the "big-bang model", although down-scaled it to a "small-bang").

Step-4 (the ending of QM de-excitation transition): At the end of the Stellar nucleosynthesis, our universe's Z-spectrum becomes: 0% mass/energy in Z < 1, 75% mass in Z = 1, 23% mass in Z = 2, 1% mass in 2 < Z ≤ 118, 1% mass in 118 < Z < 3.59E+77, and 1% mass in Z = 3.59E+77. The last item of Z = 3.59E+77 with 1% of universe's mass becomes a single super-super-super gigantic (virtual) atom's nucleus (or a super-super-super large black hole). It has a too large mass and too heavy mass density for our universe to hold. So, it is spitted-out by our universe (to the outside of the universe). Then, our universe returned to the initial QM ground state (as shown in the Step-1). The net result of this cycle is: our universe takes in the fresh 1% mass/energy and transformed it into the new low Z mass (Z=1) of our university, and dumps out the pre-existing high Z mass (118 < Z < 3.59E+77) in our universe to the outside.

Alternatively, many citizen scientists believe that our universe is a biological entity (citations?). The above rhodopsin-type universe model can also be modified for that purpose: 1) during each cycle, some mass is retained so that the total mass of the universe keep increasing after each cycle; 2) after the total mass of the universe has grown to too big, a split of one universe into two identical but smaller entities is allowed.