SunQM-3s2: Using {N,n} QM model to calculate out the snapshot pictures of a gradually disk-lyzing pre-Sun ball

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Abstract

In this paper, by using {N,n} QM structure model, combining with Schrodinger equation solution, and the first order spin-perturbation solution, and the multiplier n' theory, I calculated out the ring thickness vs. orbit-r curve for a gradually disk-lyzing pre-Sun ball. From it, I constructed a series of snapshot pictures of pre-Sun disks. I also developed a very useful new rule for {N,n} QM structure: all mass between r_n and r_{n+1} belong to orbit n.

Introduction

From my previous paper SunQM-1, SunQM-1s1, SunQM-1s3, and SunQM-3 [1], we know that the birth, growth, and death of a star can be described by a series of quantum collapse of a pre-Sun ball's {N,n} structure. Following description is based on Wikipedia "Stellar evolution", combined with my Solar {N,n} QM structure model:

1) In a vast nebula, there are many local mass concentrated regions with clear local mass centers.
2) An orphan Jupiter-sized planet (or even a red dwarf) flew by pass the nebula and was captured by one of these local mass centers.
3) Spiraled in and then super positioned to the local mass center, this orphan planet seeded a formation of our pre-Sun ball, and determined our Solar system's spin axis direction and angular momentum. Note: although our Solar system is formed from a single seed, most other stars were formed from multi-seeds (see paper SunQM-1s2 for detailed discussion).
4) At the early stage, this pre-Sun ball (formed by one seed's single point G-force field) had an initial size at {6,1} (r ≈ 2E+6 AU) or larger, with low (radial) differentiation of mass density, slow spin.
5) Continues G-force action concentrated mass to form a smaller ball core, the core had the higher mass density, outer shells had lower mass density, and the core's spin became faster due to angular momentum conservation
6) The cooling of temperature and weakening of thermal pressure causes collapse of the outer super-shell (i.e., {N+1,1}), and the collision of inward flying matter increases temperature and thermal pressure in the {N,1} core, therefore prevent it from immediate further collapse. Thus this core become a new (and smaller) stable QM {N,1}RF structure.
7) The faster spin of core increases the centrifugal force and its tangential component F_t, causing the residue objects in outer super-shell moving to the equator orbits (under the nLL effect), and start to form pre-Sun disk.
8) Process continue, it formed a Saturn-like {N,n} QM structure, with disk at outside.
9) Then the whole process repeated, the initial {6,1} QM structure of pre-Sun ball quantum collapsed down to the current size of {0,1}, it formed the current Solar system (Sun & planets).
10) At the stage of {2,1}RF, the hydrogen fusion was ignited at the center of the pre-Sun ball. It quickly expanded its size from smaller than {-5,1} to {-2,1}. When pre-Sun ball collapsed from {2,1} to {0,1}, the hydrogen fusion ball expanded from {-2,1} to {0,1}. Then, a {0,1} sized hydrogen fusion ball provides the exact thermal pressure for a {0,1} sized Sun ball, to prevent it from collapse under G-force. So this is a super stable {N,n} QM structure, it will last for 10 billion years.
11) The process continue, after burning out hydrogen fuel (and He fuel), the anti-G-force run out, the Sun core collapses further to a White Dwarf at size of {-1,1}.
12) For a star bigger than Sun, process continue, the core collapses to a pre-neutron star {-2,1}, then to a neutron star {-3,2}.

13) For a even bigger star, this process continue, the core collapses to black hole through size of {-3,1}, and stabilized at size of {-5,1}.

In theory, we can describe the whole process using time-dependent Schrodinger equation and solution. But in reality, it is out of our capability at this time (at least for me). In paper SunQM-3 and SunQM-p3s1, I have used time-independent Schrodinger equation and solution to describe the individual stage of this process. Now in this paper, I am going to use the result of paper SunQM-3s1 to construct a series of (snapshot) pictures for a disk-lyzing pre-Sun ball at different stage of evolution. Note-1: for {N,n} QM nomenclature as well as the general notes for {N,n} QM model, please see my paper SnQM-p1 section VII. Note-2: 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 = $5.6*10^{-9}$.

I. Try to calculate the thickness (±θ') of pre-Sun rings directly from $|\Psi_{nLL}|^2$ which is proportional to $|Y_{LL}|^2$

First here let us define that the ring's thickness (±θ') is in θ dimension, and ring's width (r+Δr) is in r-dimension. From paper SunQM-3s1, we know that for each collapsed n shell (at the outside of a spinning pre-Sun ball), only nlm = nLL (like 211, 322, 433, 544, etc.) orbits have the highest probability density (or mass density). In the real pre-Sun ball, the mass density distribution near the equator is complicated by the factor that besides the majority contributor nLL state, it also includes the minority contributors (like states of |n, *l*=L, *m*=L-1>, |n, *l*=L, *m*=L-2>, etc.). In a simplified model, let us suppose all minority states make zero contribution. So in disk-lyzing the outer n shell of pre-Sun ball, we need only to calculate the contribution of nLL state for the mass density near equator.

$|\Psi_{nLL}|^2$ = <nLL|nLL> = <nL|nL> <LL|LL> = $|R_{nL}|^2\ |Y_{LL}|^2$ Eq-1

In my first try, for each n, I determined the ±θ' value based on $|Y_{LL}|^2$ = 90% of total probability within ±θ', then calculated the vertical variation = 2* r_n sin(θ'), and plot it against r_n. But the plot diverse as r_n increases (data not shown here). So the method did not work. After several this kind of tries and fails, I realized:

1) Using <Y_{LL}|Y_{LL}> to calculate probability is not a problem (even with spin), because for the lowest energy nLL state, the 1st order spin-perturbation still uses the same state function of unperturbed.

2) Saturn ring's thickness is ≤ 1000 meters (see wiki "Saturn"). If fit to $|Y_{LL}|$^2, it needs n to be as high as around 1E+11 to get ~70% probability within ±θ' (calculation not shown here). So the extremely thin Saturn ring cannot be formed by nLL disk-lyzation effect if only use the base-frequency n. However, the high-frequency multiplier n' (see paper SunQM-2) is possible to do this job. The reason is that the higher the n' the thinner the *m* layer, and the *m* = L-1 layer always has $E^{(1)}$ three times higher than the *m* = L layer (shown in paper SunQM-3s1), so there is always F_t force to push the mass in *m* = L-1 layer into *m* = L layer at equator, as long as *m* = L-1 layer still has mass! **When the n' goes high enough, there is no mass in *m* = L-1 layer, all mass is in *m* = L layer, then there is no driving force to further compress mass towards to the equator**. So how high the n' will go, is total depends on how much the mass it has in n shell. The less the mass, the higher n' it will go. For Saturn's ring, because its mass is so low, that n' needs to go to 1.88E+11 to make all mass fill in only *m* = L layer, with no mass left in *m* = L-1 layer, so that the ring is only ~1000 meter thick. Any mass beyond that will be in *m* = L-1 (or smaller) layer, which has higher (or excited) spin-perturbed $E_{nlm}^{(1\theta)}$, and will be forced to go back to the lowest nLL state.

3) This is also applicable to the pre-Sun ball disks and rings: the paper SunQM-3s1 tells us that in each n shell, if mass occupancy < 1 %, the mass will stay in the lowest orbit energy state nLL to form rings. The classical physics tells us that as orbit r increase, the pre-Sun disk's ring should become thinner. This means that as n (or r_n) increase, there is too low mass to fill in the n-shell space, so that the ring become thinner and thinner. From discussion 2), we know that the low thickness of ring can be formed by the high-frequency multiplier n' (of the base-frequency n).

4) The high-frequency n' not only make *m* layer become thinner in θ-dimension, but also make ring width narrower in r-dimension.

5) In my paper SunQM-1s1, I estimated out the (original) mass of each (base-frequency) n shell for the pre-Sun {N,n} structure (at space with $r_n \geq$ Sun{1,2}). It is described by the formula D = 4.37E+28 / r^3.279 (kg/m^3). From it, I can calculate the total (original) mass in each n shell. If we know the mass density for the ring, then we can calculate back the volume of the ring, that is, the width and thickness of the ring. Then we can plot the ring thickness vs. the n (or r_n) to view the pre-Sun disk.

6) We can assume that the mass density of the pre-Sun's ring is equal to that of Saturn's ring.

Using above discussion 5) and 6), I calculated the thickness of pre-Sun's ring at each (base-frequency) n shell and it is shown in the next section.

II. Using Saturn ring's mass density to back calculate the pre-Sun's disk ring thickness at each n shell

In this section, I will present

1) Calculate Saturn ring's mass density
2) Use pre-Sun's D = 4.37E+28 / r^3.279 (kg/m^3) to calculate out the total mass in each n shell.
3) Assuming pre-Sun's ring mass density equals to Saturn's ring mass density, calculate out the ring volume for each n shell of pre-Sun.
4) Manually try several multiplier n'(s), find a one that produces the expected ring volume (using the spherical shell volume integration, see below).
5) From the ring volume, calculate out the ring thickness.
6) Plot ring thickness vs. r_n to get pre-Sun disk plot.

I-a. Calculate Saturn ring's mass density

From wiki "Rings of Saturn", "*The dense main rings extend from 7,000 km to 80,000 km away from Saturn's equator, whose radius is 60,300 km*", with estimated thickness from 10 m to 1000 m. "*Based on Voyager observations, the total mass of the rings was estimated to be about 3 × 10^19 kg*". Recent modeling based on Cassini's data show that 3× of mass. So I assume Saturn ring's total mass = 1E+20 kg. Assume the averaged thickness = 200 m. The ring's (simplified into a hollow cylinder) volume is V= (πR^2 - πr^2) *thick = 3.14*[(8E+7 + 6.03E+7)^2 - (7E+6 + 6.03E+7)^2] * 200 = 9.52E+18 m^3. Saturn ring's mass density D= 1E+20 / 9.52E+18 = 10.5 kg/m^3. It is about 1% of water's mass density (=1 kg/dm^3 =1000 kg/m^3).

II-b. For each n shell of pre-Sun, calculate out the total mass, and then the ring volume of this mass occupied

Here I only calculate from {0,1} current Sun to {3,1} pre-Sun ball, so I only listed Solar {N,n} structure model from {0,1} to {2,6} in Table 1. I only use {N,n, Cold-G} system, so that I can directly expand the result to larger pre-Sun ball {3,1}, {4,1}, {5,1}. Therefore the radius of Sun surface {0,2} is scaled down by ~79.4%, from r=6.96E+8 m to r=5.52E+8 m, and Sun core's r scaled down from 1.74E+8 m to 1.38E+8 m. In this model, I only need to use Sun core {0,1} 's r (=1.38E+8 m). All planets and theirs orbit-r are not needed. However, I still keep them in column 2 of Table 1 for comparison. In other words, this (probably over simplified) pre-Sun disk QM model is built on:

1) Gravity-r only, suppose no hydrogen fusion, so no rock-evap-line or ice-evap-line, therefore the (rock and ice) mass in orbits of {0,n=2…5}o and {1,n=1..5}o is (supposed) still there.

2) Ring only, so that the accretion of ring to form planet is not included.

In column 8 of Table 1, for n shell volume calculation, the inner border is r_n, the outer border r_{n+1} = r_1 * [(total-n) + (period-factor)^N]^2, so for {2,4} 's outer border, r_{n+1} =1.38E+8 * (144+6^2)^2 =4.47E+12 m. For each n shell of pre-Sun, the

Mass = ∫ D dV = ∭ D r^2 sin(θ) dr dθ dφ = 4π ∫ D r^2 dr = 4π *4.37E+28 *∫ r^2/r^3.28 dr Eq-2
or
M = 5.49E+29 *∫ (1/r^1.28) dr Eq-3

In column 9 of Table 1, I calculate out the mass (M) per each n shell using this formula. In column 10, the ring volume (V) of this mass occupied in each n shell of pre-Sun is calculated out by using V=M/D, where D=10.5 kg/m^3 is Saturn ring's mass density.

II-c. Search for both multiplier n' value and θ' value that produces the right ring volume, and then calculate the ring thickness

Here there are three variables: 1) the mass density of the ring, so it gives the total volume of the ring; 2) the n' value, which gives the width of the ring, 3) the Δθ' of the ring, which gives the thickness of the ring. For example, orbit {1,3} has base frequency n =3, multiplier n'= n*6^N, or 18, 108, 648, 388, …, so I need to try $r_{n'+1}$ with n'+1 = 19, 109, 649, 389, … etc. The higher the n', the narrower the Δr for integration. Therefore n' adjust the width of the ring. Meanwhile, I need to try different θ' (< π/2) in the integration at the same time (so θ' adjust the thickness of the ring), to make V value matching the expected value in column 10. The criteria for the search is that for a {N,1}RF ball's disk, the calculated thickness of ring at {N,2} should be smaller but close to the diameter of {N,1}RF ball. After many tries, I decided to use the following parameters:
1) The ring mass density D for {0,1}RF Sun disk is equals to that of Saturn's D. For {1,1}RF pre-Sun disk the ring mass density is =D/36^3. For {2,1}RF pre-Sun disk the ring mass density is =D/36^6.

2) The multiplier n' is chosen as n’ = n * 6^2 for all pre-Sun disk, from {0,1} to {2,1}.

3) Use these two parameters to determine the third parameter Δθ' and the ring thickness value.

The final obtained ring thickness values are listed in Table 1 for each pre-Sun {N,1}RF ball's disk. In Figure 1, the ring thickness is plotted against r_n in the log-log format for each pre-Sun {N,1}RF ball's disk from {0,1} to {2,1}. For the calculation of current Sun {0,1}RF ball's disk (columns 11 through 22), the ring volume is calculated as

V = ∭r^2 sin(θ) dr dθ dφ, with r= [$r_{n'}$, $r_{n'+1}$], θ= [π/2 -θ', π/2 +θ'], φ=[0, 2π] Eq-4

where $r_{n'}$ = r_1*n'^2 /36^2 = r_1 * n^2 = r_n , $r_{n'+1}$ = r_1 * (n'+1)^2 /36^2 (see column 13 and 14). So for each n', with known $r_{n'}$, $r_{n'+1}$ (in column 13, 14), I test several θ' (= 3.14/x) values to make the integrated V to match the value in column 10. The best θ' is listed in column 17. Then the ring thickness (=2*r_n*sin(θ')) for each n' is calculated in column 18. Finally, calculation from column 10 to 22 is for the current Sun {0,1}RF ball's disk, from column 23 to 34 is for the pre-Sun {1,1}RF ball's disk, from column 35 to 46 is for the pre-Sun {2,1}RF ball's disk. Following is one example of how I calculated volume matching through integration: in Table 1 line #17, for {2,5} (Neptune) shell, at pre-Sun {1,1}RF ball’s disk (columns 23-34), it has n=30, n'=30*6^2=1080, I need to integrate its shell volume to get V=2.43E+29 m^3 (column 23) under known $r_{n'}$ = 4.459E+12 m (column 27) and $r_{n''}$ = 4.468E+12 m (column 27). After trying different Δθ' values for a few time in the integration, the final fitted ±Δθ' =3.1416 / 29200000 = 1.08E-7 (arc).

$$\int_0^{2\times 3.1416}\int_{\frac{3.1416}{2}-\frac{3.1416}{29\,200000}}^{\frac{3.1416}{2}+\frac{3.1416}{29\,200000}}\int_{4.459\times 10^{12}}^{4.468\times 10^{12}} x^2 \sin(y)\,dx\,dy\,dz = 2.42422\times 10^{29}$$

Table 1. Calculation of ring thickness for the pre-Sun ball disk-lyzation.

	Sun's body-r, planets' orbit-r	N, Sun{0,1}	n	period factor	total n (base-freq)	gravity r-track, $r_{n\text{-orbit}} = n^2 r_{1\text{-orbit}}$	$r_{n+1,\text{border}} = (n+1)^2 r_{1\text{-orbit}}$	calc. Mass per shell
unit	m					m	m	kg
{0,1} Sun core		0	1	6	1	1.38E+08	5.51E+08	3.31E+27
{0,2} Sun surface		0	2	6	2	5.51E+08	1.24E+09	1.42E+27
		0	3	6	3	1.24E+09	2.20E+09	8.27E+26
		0	4	6	4	2.20E+09	3.44E+09	5.59E+26
		0	5	6	5	3.44E+09	4.95E+09	4.06E+26
		0	6	6	6	4.95E+09	6.74E+09	3.13E+26
{1,2}		1	2	6	12	1.98E+10	4.46E+10	5.22E+26
Mercury	5.79E+10	1	3	6	18	4.46E+10	7.93E+10	3.04E+26
Venus	1.08E+11	1	4	6	24	7.93E+10	1.24E+11	2.05E+26
Earth	1.49E+11	1	5	6	30	1.24E+11	1.78E+11	1.48E+26
Mars	2.28E+11	1	6	6	36	1.78E+11	2.43E+11	1.16E+26
Jupiter	7.78E+11	2	2	6	72	7.14E+11	1.61E+12	1.92E+26
Saturn	1.43E+12	2	3	6	108	1.61E+12	2.85E+12	1.11E+26
Uranus	2.97E+12	2	4	6	144	2.85E+12	4.46E+12	7.52E+25
Neptune	4.51E+12	2	5	6	180	4.46E+12	6.42E+12	5.46E+25
Kuiper	5.91E+12	2	6	6	216	6.42E+12	8.74E+12	4.21E+25

	current Sun {0,1}RF ball's disk. Saturn disk mass density.									r1={0,1}, D		r1={0,1}, D/10	r1={0,1}, D*10
	calc. ring Vol per shell V=M/D	- total n, for plot	n'=n*6^2	rn'= r1*n'^2/36^2	r(n'+1)= r1*(n'+1)^2/36^2	Δr =	Δr [(n'+1)-n'] / Δr [(n+1)-n]=	±θ' =	ring thickness =2*rn*sin(θ')=	log (thick)	-LOG (thick), for plot	fit to D=D/10, log (thick)	fit to D=D*10, log (thick)
unit	m^3			m	m	m		arc	m	log(m)	log(m)	log(m)	log(m)
{0,1} Sun core	3.15E+26	-1	36	1.38E+08	1.45E+08								
{0,2} Sun surface	1.35E+26	-2	72	5.51E+08	5.66E+08								
	7.88E+25	-3	108	1.24E+09	1.26E+09	2.30E+07	0.0239	0.176404	4.35E+08	8.6383	-8.6383	9.6383	7.6383
	5.32E+25	-4	144	2.20E+09	2.23E+09	3.07E+07	0.0248	0.028036	1.23E+08	8.0915	-8.0915	9.0915	7.0915
	3.87E+25	-5	180	3.44E+09	3.48E+09	3.83E+07	0.0253	0.006709	4.62E+07	7.6644	-7.6644	8.6644	6.6644
	2.98E+25	-6	216	4.95E+09	5.00E+09	4.60E+07	0.0031	0.002079	2.06E+07	7.3140	-7.3140	8.3140	6.3140
{1,2}	4.97E+25	-12	432	1.98E+10	1.99E+10	9.19E+07	0.0037	0.000109	4.32E+06	6.6353	-6.6353	7.6353	5.6353
Mercury	2.90E+25	-18	648	4.46E+10	4.47E+10	1.38E+08	0.0040	8.4E-06	7.49E+05	5.8744	-5.8744	6.8744	4.8744
Venus	1.95E+25	-24	864	7.93E+10	7.95E+10	1.84E+08	0.0041	1.35E-06	2.14E+05	5.3298	-5.3298	6.3298	4.3298
Earth	1.41E+25	-30	1080	1.24E+11	1.24E+11	2.29E+08	0.0042	3.17E-07	7.86E+04	4.8953	-4.8953	5.8953	3.8953
Mars	1.10E+25	-36	1296	1.78E+11	1.79E+11	2.75E+08	0.0005	1.53E-07	5.46E+04	4.7375	-4.7375	5.7375	3.7375
Jupiter	1.83E+25	-72	2592	7.14E+11	7.14E+11	5.51E+08	0.0006	5.19E-09	7.41E+03	3.8696	-3.8696	4.8696	2.8696
Saturn	1.06E+25	-108	3888	1.61E+12	1.61E+12	8.26E+08	0.0007	4.08E-10	1.31E+03	3.1170	-3.1170	4.1170	2.1170
Uranus	7.16E+24	-144	5184	2.85E+12	2.86E+12	1.10E+09	0.0007	6.41E-11	3.66E+02	2.5634	-2.5634	3.5634	1.5634
Neptune	5.20E+24	-180	6480	4.46E+12	4.46E+12	1.38E+09	0.0007	1.5E-11	1.33E+02	2.1252	-2.1252	3.1252	1.1252
Kuiper	4.01E+24	-216	7776	6.42E+12	6.42E+12	1.65E+09		4.55E-12	5.85E+01	1.7670	-1.7670	2.7670	0.7670

	pre-Sun {1,1}RF ball's disk										r_1={1,1}, D/36^3	
	calc ring Vol per shell V=M/(D/36^3)	total n=	- total n, for plot	n'=n*6^2	rn'= r1*n'^2 /36^2	r(n'+1)= r1*(n'+1)^2 /36^2	Δr =	Δr [(n'+1)-n'] / Δr [(n+1)-n]=	±Δθ' =	ring thickness =2*rn*sin (θ')=	log (thick)	-LOG (thick), for plot
unit	m^3				m	m	m		arc	m	log(m)	log(m)
{0,1} Sun core												
{0,2} Sun surface												
	3.67E+30											
	2.48E+30											
	1.80E+30											
	1.39E+30	1	-1	36	4.95E+09	5.23E+09	2.79E+08	0.0188				
{1,2}	2.32E+30	2	-2	72	1.98E+10	2.04E+10	5.54E+08	0.0224	1.00E+00	3.34E+10	10.52	-10.52
Mercury	1.35E+30	3	-3	108	4.46E+10	4.54E+10	8.30E+08	0.0239	6.46E-02	5.76E+09	9.76	-9.76
Venus	9.11E+29	4	-4	144	7.93E+10	8.04E+10	1.10E+09	0.0248	1.03E-02	1.64E+09	9.21	-9.21
Earth	6.58E+29	5	-5	180	1.24E+11	1.25E+11	1.38E+09	0.0253	2.41E-03	5.97E+08	8.78	-8.78
Mars	5.15E+29	6	-6	216	1.78E+11	1.80E+11	1.66E+09	0.0031	7.97E-04	2.84E+08	8.45	-8.45
Jupiter	8.53E+29	12	-12	432	7.14E+11	7.17E+11	3.31E+09	0.0037	4.02E-05	5.73E+07	7.76	-7.76
Saturn	4.93E+29	18	-18	648	1.61E+12	1.61E+12	4.96E+09	0.0040	3.05E-06	9.79E+06	6.99	-6.99
Uranus	3.34E+29	24	-24	864	2.85E+12	2.86E+12	6.61E+09	0.0041	4.65E-07	2.66E+06	6.42	-6.42
Neptune	2.43E+29	30	-30	1080	4.46E+12	4.47E+12	8.26E+09	0.0042	1.08E-07	9.60E+05	5.98	-5.98
Kuiper	1.87E+29	36	-36	1296	6.42E+12	6.43E+12	9.91E+09		4.00E-08	5.13E+05	5.71	-5.71

	pre-Sun {2,1}RF ball's disk										r1={2,1}, D/36^6		
	calc ring Vol per shell V=M/(D/36^2^3)	total n=	- total n, for plot	n'=n*6^2	rn'= r1*n'^2 /36^2	r(n'+1)= r1*(n'+1)^2 /36^2	Δr =	Δr [(n'+1)-n'] / Δr [(n+1)-n]=	±Δθ' =	ring thickness =2*rn*sin(θ')=	log (thick)	-LOG (thick), for plot	log(rn)
unit	m^3				m	m	m		arc	m	log(m)	log(m)	log(m)
{0,1} Sun core													8.139
{0,2} Sun surface													8.741
	1.71E+35												9.093
	1.16E+35												9.343
	8.42E+34												9.537
	6.49E+34												9.695
{1,2}	1.08E+35												10.297
Mercury	6.30E+34												10.649
Venus	4.25E+34												10.899
Earth	3.07E+34												11.093
Mars	2.40E+34	1	-1	36	1.78E+11	1.88E+11	1.00E+10	0.0188					11.251
Jupiter	3.98E+34	2	-2	72	7.14E+11	7.33E+11	2.00E+10	0.0224	0.30501	4.29E+11	11.63	-11.63	11.853
Saturn	2.30E+34	3	-3	108	1.61E+12	1.64E+12	2.99E+10	0.0239	0.02327	7.47E+10	10.87	-10.87	12.206
Uranus	1.56E+34	4	-4	144	2.85E+12	2.89E+12	3.98E+10	0.0248	0.00377	2.15E+10	10.33	-10.33	12.455
Neptune	1.13E+34	5	-5	180	4.46E+12	4.51E+12	4.97E+10	0.0253	0.0009	8.01E+09	9.90	-9.90	12.649
Kuiper	8.73E+33	6	-6	216	6.42E+12	6.48E+12	5.96E+10		0.00029	3.67E+09	9.56	-9.56	12.808

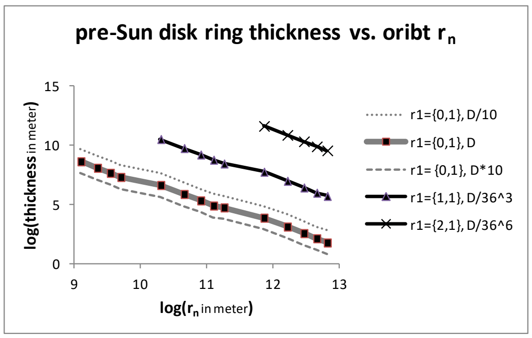

Figure 1, log-log plot of ring thickness vs. r_n for each pre-Sun {N,1}RF ball's disk from r_1 = {2,1}, {1,1}, to {0,1}.

Now let me explain the data in Table 1 and Figure 1.

1) First let us look the {0,1}RF Sun ball disk curve (columns 10 through 22). The result says that after pre-Sun collapsed from {2,1}RF ball to {0,1}RF ball, the < 1% mass left over in space between {0,1} to {2,6} was disk-lyzed, and it formed separated rings at each {N,n} orbit, with the thickness of the ring decreases as orbit r_n increases. For example, at Earth's orbit {1,5}, the total mass was 25× of Earth mass (24/25 is ice, see paper SunQM-1s1 Table 3b), it formed ring with inner edge at r of {1,5}, ring width = 2.29E+8 m (≈ 0.4% of maximum Δr between {1,5}and {1,6}), ring thickness ≈ 78.6 km, and with current Saturn ring's mass density. And this Solar ring can be described by a {1,5} Solar QM structure with multiplier n'=1080. Or, at Venus' orbit {1,4}, the total mass was 34× of Earth mass (mostly ice, see paper SunQM-1s1 Table 3b), it formed ring with inner edge at r of {1,4}, ring width = 1.8E+8 m (≈ 0.4% of maximum Δr between {1,4}and {1,5}), ring thickness ≈ 214 km, and with current Saturn ring's mass density. And this Solar ring can be described by a {1,4} Solar QM structure with multiplier n'=864. Or, at Jupiter's orbit {2,2}, the total mass was 32× of Earth mass (or only 10% of current Jupiter mass, see paper SunQM-1s1 Table 3b), it formed ring with inner edge at r of {2,2}, ring width = 5.5E+8 m (≈ 0.06% of maximum Δr between {2,2}and {2,3}), ring thickness ≈ 7.4 km, and with 1/36^3 of current Saturn ring's mass density. And this Solar ring can be described by a {2,2} Solar QM structure with multiplier n' = 2592. So from {1,4} to {1,5} to {2,2}, the ring thickness of the pre-Sun {0,1}RF ball disk (if no hydrogen fusion) is getting thinner and thinner (214 km, 78.6 km, 7.4 km) as expected.

2) The dashed-line in Figure 1 is the thickness of rings under the same {0,1}RF ball disk, but with (supposed) mass density =10× of Saturn's ring (so it about 1/10 of the water mass density). While the dotted-line is the ring thickness with (supposed) mass density equals 1/10 of that of Saturn ring.

3) Now let us compare the pre-Sun's disk at different stage of its {N,1}RF ball collapse, and let us use orbit {2,5} as the example. According to this model, After pre-Sun collapsed from {3,1}RF ball to {2,1}RF ball, the Neptune orbit {2,5}o is formed. The (< 1% of leftover) mass in this {2,5}o orbit space was about 0.54× of the current Neptune mass (see paper SunQM-1s1 Table 3b). According to Table 3b of SunQM-1s1, the averaged (or the quantized) mass density was 5.46E+25/[4/3 π[(6.42E+12)^3 - 4.46E+12)^3]]= 7.4E-14 kg/m^3 before disk-lyzation. This mass shell disk-lyzed and formed a ring, at one stage with the inner ring edge at r of {2,5}, ring width = 4.97E+10 m (≈ 2.5% of maximum Δr between {2,5}and {2,6}), ring thickness ≈ 8.0E+9 m, and with 1/36^6 of current Saturn ring's mass density (final D = 4.8E-9 kg/m^3). And this Solar ring can be described by a {2,5} Solar QM structure with multiplier n'=180. Then after pre-Sun collapsed from {2,1}RF ball to {1,1}RF ball, the {2,5} ring concentrated to 1/36^3 of current Saturn ring's mass density (final D = 2.3E-4 kg/m^3), with ring width Δr = 8.26E+9 m and ring thickness = 9.60E+5 m. It can be described by a {2,5} Solar QM structure with multiplier n' = 1080. At this stage, the {2,5} ring should be in accreting to form a planet. Then after pre-Sun further collapsed from {1,1}RF ball to {0,1}RF ball, the {2,5} ring concentrated to 1× of current Saturn ring's mass density (final D=10 kg/m^3), with ring width Δr = 1.38E+9 m and ring thickness = 133 m. It can be described by a {2,5} Solar QM structure with multiplier n' = 6480. At this time, the {2,5} ring should have finished the accretion as a planet Neptune.

So the process of pre-Sun {N,n} QM disk-lyzation and the ring evolution can be described in general as following: After {N+1,1}RF pre-Sun ball collapsed to {N,1}RF pre-Sun ball, the shell mass of {N,n=2…6} started to disk-lyze (driven by the spin-perturbation caused nLL effect). The initial ring was formed with very high thickness (or ±θ'), the rings between each n-shell are linked together (so it was described by the base-frequency n), and with very low mass density. Then, these rings decrease their volume by decreasing the thickness (±θ'), and decreasing the width of each ring so that the ring of one n shell is separated from rings of other n shells. This was achieved by increasing the multiplier n', and increasing the mass density of the ring. This ring evolution process continues, and to a certain point that the mass density increased high enough to trig the accretion.

The curve in Figure 1 can be directly used to construct a (pretended) pre-Sun disk. A plot of n vs. log(thickness) is shown in Figure 2 (a, b). A plot of log(r_n) vs. log(thickness) is shown in Figure 2 (c, d, e). Note: in Figure 2, the size of Sun is only relative.

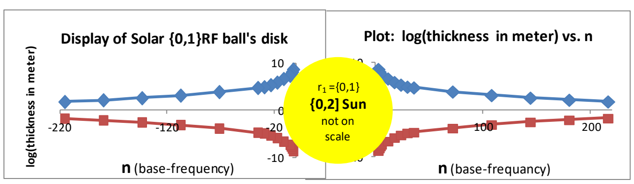

Figure 2a. A plot of n vs. log(thickness) display of Solar {0,1}RF ball's disk.

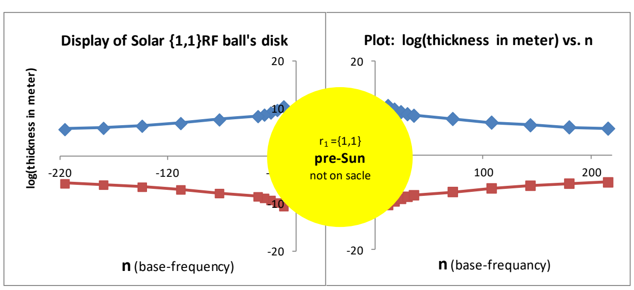

Figure 2b. A plot of n vs. log(thickness) display of Solar {1,1}RF ball's disk.

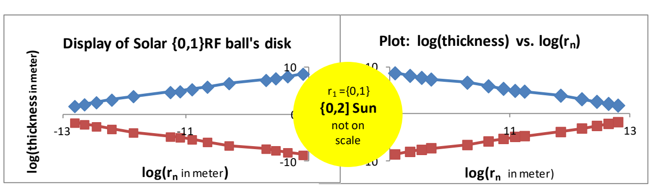

Figure 2c. A plot of log(r_n) vs. log(thickness) display of Solar {0,1}RF ball's disk.

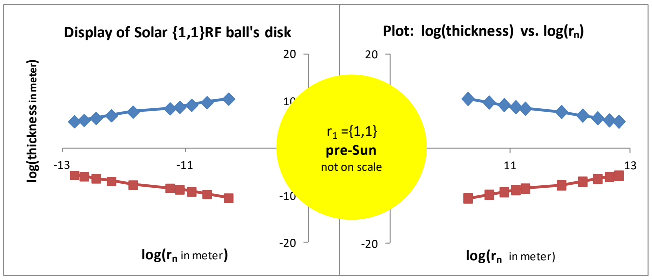

Figure 2d. A plot of log(r_n) vs. log(thickness) display of Solar {1,1}RF ball's disk.

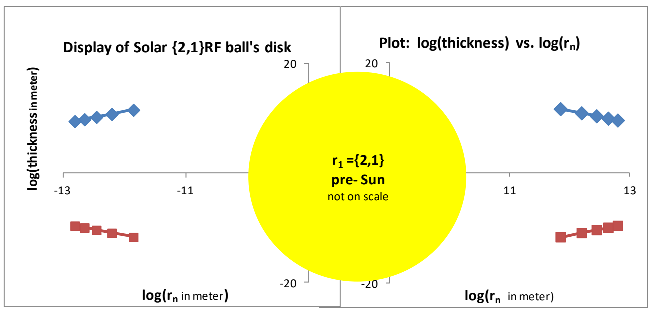

Figure 2e. A plot of log(r_n) vs. log(thickness) display of Solar {2,1}RF ball's disk.

Result and discussion:

1) By using Solar {N,n} QM structure, plus Schrodinger equation solution, plus spin-perturbation, plus multiplier n' theory, I am able to construct a pre-Sun disk-lyzation picture at different stage, with (close to) the true values of Solar system's r, and ring mass density. The pre-Sun disk pictures in Figure 2 (calculated by using QM) are similar to those what I saw on text books (or online, calculated by using classical physics method and simulation).

2) The calculation of {0,1}, {1,1}, and {2,1} pre-Sun ball disk can be extended to {3,1}, {4,1}, {5,1}, {6,1} (or higher), where the initial pre-Sun ball start to form.

3) A pre-Sun {N,1}RF structure collapse is a evolution process. At a fixed r, the earlier the evolution stage, the thicker the ring (or the larger the ±θ') will be. Or at a later stage Sun will have very thin disk. For example, at orbit of {2,5}, the thickness is 8.0E+9 meters in {2,1}RF pre-Sun disk, or 9.6E+5 meters in {1,1}RF pre-Sun disk, or 1.3E+2 meters in {0,1}RF pre-Sun disk. So it may be possible to estimate the evolution stage of a star simply from its ring shape.

4) A galaxy is also a central G-force formed (self-spinning) system. The morphology shows galaxies have different shapes (see wiki "Galaxy"). Same as the Solar system disk, it is reasonable to guess that a thin disk shaped galaxy is in its matured stage, while a thick (oval) shaped galaxy is in its early stage of development. For example, Andromeda Galaxy (see wiki "Andromeda Galaxy") has a supermasive black hole (SMBH) with ~ 1.1E+8 of Sun mass, so its Schwarzschild radius =2.95E+3 * 1.1E+8 =3.24E+11 meters, or about {2,1} in size (according to Table 1 of SunQM-1s2). Comparing to Andromeda Galaxy's total mass (~1.5E+12 M_{sun}), Milky way galaxy's total mass is about 0.5× to 1× (~0.8 to 1.5E+12 M_{sun} , see wiki "Milky way galaxy"). However, the current data shows its SMBH mass = 4.1E+6 of M_{sun} , so r_s =1.21E+10 m, or > ≈ {1,1} in size (according to Table 1 of SunQM-1s2). One possible explanation is that Milky way probably is a pre-matured galaxy with SMBH only ΔN = -1 smaller than the relative more matured Andromeda Galaxy. If this explanation is correct, then Andromeda Galaxy's disk thickness should be thinner than that of Milky way's disk thickness (≈ 2000 lys). So far I am not able to find out the disk thickness data for Andromeda Galaxy.

5) Likewise, a stellar black hole is also a central G-force formed (self-spinning) system. So it is also possible to estimate its evolution stage by its outside ring (if observable).

6) The results in Table 1 and Figure 2 depends on the assumed values for some parameters (e.g., ring's mass density, the multiplier n', etc.). If these parameters are changed to be different values, the resulted values will be different, but the disk-lyzation shape of a Solar {N,n} structure will be similar.

7) The kinetic difference between disk |n*l*L> and rings |nLL> is not considered here.

III. Use the same theory to calculate the {N,n} QM structure of Saturn ring

The calculation in section II can be used to determine the {N,n} QM structure of Saturn ring. For details, see paper SunQM-3s4.

IV. New concept: for {N,n} QM structure, all mass between r_n and r_{n+1} belong to orbit n!

Where is the exact position of mass in each n-shell? This is the question confused me for a long time. The study of how multiplier n' affect the ring width in this paper makes me understand the question. In paper SunQM-3 figure 2a, for n=3 shell, the most inner *l* sub-shell |3,2,m> state has r/r_1 max = 9 (or n^2 = 3^2), and the most outer *l* sub-shell |3,0,0> has r/r_1 max =14 (or < ≈ (n+1)^2 = 4^2 = 16). So for an orbit n = 3 state, in a simplified description (by ignoring the overlap between neighboring n(s) and *l*(s)), its mass actually fills all spherical shell space between n = 3 (or {N,3})and n =4 (or {N,4}), if all three *l* states (|32m>, |31m>, |300>) have degenerated orbit energy.

Now let us to apply this result to the Solar {N,n} QM structure's mass (radial) distribution analysis:

1) For the shell space between {0,2} to {6,1}, the mass occupancy in each n shell is < 1%. If Sun had not spin, for each n shell this (< 1% occupancy) mass would have evenly filled space between {N,n} and {N,n+1} (or shell space between r_n and r_{n+1}) even there is too little mass. When Solar system spins, this (< 1% occupancy) mass will all stay at the lowest orbit energy nLL state of each n shell, it forms a very thin shell at exactly n (or $r_n + \delta r$), and now the space between $r_n + \delta r$ and r_{n+1} is empty ! The thickness (δr) of this thin shell is determined by the multiplier n' (the higher the n', the thinner the δr). After disk-lyzation, the (thin) shell become ring, and the δr become the width of the ring. Now the higher the n', ("the thinner the δr" is replaced by) the narrower the ring width. (Note: kinetically, the disk-lyzation ($m \to L$) process may be faster than *l* sub-shell thinner process ($l \to L$)).

2) For inside the Sun, or shell space within {0,2}, the mass occupancy in each n shell is equal (or close to) 100%. If Sun had not spin, for each n shell this (100% occupancy) mass would have evenly filled space between {N,n} and {N,n+1} (or shell space between r_n and r_{n+1}) so that it has a perfect sphere. When Solar system spins, this (100% occupancy) mass will still fill space between r_n and r_{n+1}, although the nLL effect will add disk-lyzation force so that the ball shape become flattened at equator. This is what happened to Jupiter, Saturn, Earth, etc. For Sun, its hydrogen fusion heat cancelled out the spin-induced nLL effect. The spin-perturbation induced flatten can be described by the multiplier n' (see paper SunQM-3s4).

3) For n = 2, the integration of r^2 *|R(2,*l*)|^2 generates probabilities 0.293, 0.622, and 0.072 for regions of r/r_1 = [1 to 4], and [4 to 9], and [9 to 16] respectively. So from the radial wave function calculation, and from the fact that Sun's mass in the shell space between {0,1} and {0,2} is mainly belong to Sun orbit {0,1}o, we can simplify the radial probability distribution as "all mass between r_n and r_{n+1} is belong to orbit n". This rule will greatly simplify our analysis for the mass in Solar QM {N,n} structure (and in all other {N,n} QM structure). However we need to keep in mind that this rule maybe over simplified in some situation.

4) The G-force's QM effect is to increase the local mass occupancy (at the reduced mass center) towards maximum (or to 100% occupancy). For example, the collapse of N super-shell in pre-Sun ball is driven by G-force to increase center's mass occupancy. Or, the reduction of ring volume and accretion of ring mass into a planet is driven by G-force's QM effect to increase the local mass occupancy (at the reduced mass center). Those orbits with 100% mass occupancy are QM's ground state (or low excited states), and they are formed by G-force potential.

In summary, for < 1% mass occupancy, we observe n-shell mass at r_n (+ δr) orbit, but for ~100% mass occupancy, we observe n-shell mass up to r_{n+1} orbit!

Now let me use this result to explain the real situation:

1) Earth is on {1,5}o orbit in Solar {N,n} QM structure. It collected all (< 1% occupancy) mass in n = 5 shell space between {1,5} and {1,6}. Under spin-induce nLL effect, the mass shell between $r_{n=5}$ to $r_{n=6}$ become thinner to $r_{n=5}$ + δr, meanwhile the shell disk-lyzed to a ring. The mass occupancy is still too low in the ring (even the high n' narrowed the ring), so the G-force's QM effect maximized the local mass occupancy of this ring to a planet (called Earth) by a process called accretion. If the mass is PECFECT evenly distributed in the ring, then the reduced mass center is at the center of the circle (of the ring), so G-force's QM effect cannot accrete the mass to a single point. Only there is a (quantum) fluctuation of mass distribution in the ring, then G-force's QM effect can accrete the mass to a local reduced mass center point.

2) Sun has surface at {0,2}. Due to its ~50% occupancy (it become ~100% occupancy at high temperature), its true orbit is {0,1}o. The mass fills all orbit {0,1}o space makes its surface at {0,2}. In the N = -1 super shell, previously I wrote {-1, n=2..6}, the mass actually fills orbit of {-1,n=1..5}o, although it has the surface at {-1,6} because the last shell (n=5) mass fills up to n = 6. However, for the convenience of orbit calculation, a lot of times I still use the old writing {-1, n=2..6}.

3) Jupiter's surface at p{0,5} (using Jupiter's Earth-sized core as p{0,1}). Its true orbit is p{0,4}o. When you look the Figure 2a in paper SunQM-3, there is significant amount of |544> state probability density at r/r_1 = 25. So even n = 4 state fills r/r_1 from 16 to 25, there is a very thin |544> state layer at Jupiter surface with r/r_1 = 25. It is this |544> thin shell that produces the Jupiter's famous cloud band pattern (see paper SunQM-3s3)!

4) Earth's surface at p{0,1} (in Earth-Moon sytem), the mass is actually belong to p{-1,1}o orbit ! The mass fills all p{-1,1}o orbit's space between p{-1,1} and p{-1,2}, so it ends at p{-1,2}=p{0,1}.

5) White dwarf has size of {-1,1}, but its true orbit is {-2,n=1..5}o. Neutron start has size at {-3,2}, but its true orbit at {-3,1}o. Black hole has size of {-3,1}, but its true orbit is {-4,n=1..5}o.

6) For EM-force in an atom, the n state electron (can also be simplified as roughly) covers r_n to r_{n+1} shell space (see paper SunQM-5 for details).

Conclusion

1) By using Solar {N,n} QM structure, plus Schrodinger equation solution, plus spin-perturbation, plus multiplier n' theory, I am able to construct a pre-Sun disk-lyzation picture at different stage, with the true value of Solar system's r, and close to the true value of ring mass density.

2) Developed a new concept: for {N,n} QM structure, all mass between r_n and r_{n+1} belong to orbit n. For <1% mass occupancy, we observe n-shell mass at r_n (+ δr), for ~100% mass occupancy, we observe n-shell mass ball's surface at r_{n+1} !

References

[1] A series of my papers that to be published (together with current paper):
SunQM-1: Quantum mechanics of the Solar system in a {N,n//6} QM structure.
SunQM-1s1: The dynamics of the quantum collapse (and quantum expansion) of Solar QM {N,n} structure.
SunQM-1s2: Comparing to other star-planet systems, our Solar system has a nearly perfect {N,n//6} QM structure.
SunQM-1s3: Applying {N,n} QM structure analysis to planets using exterior and interior {N,n} QM.
SunQM-2: Expanding QM from micro-world to macro-world: general Planck constant, H-C unit, H-quasi-constant, and the meaning of QM.
SunQM-3: Solving Schrodinger equation for Solar quantum mechanics {N,n} structure.
SunQM-3s1: Using 1st order spin-perturbation to solve Schrodinger equation for nLL effect and pre-Sun ball's disk-lyzation.
SunQM-3s2: Using {N,n} QM model to calculate out the snapshot pictures of a gradually disk-lyzing pre-Sun ball.
SunQM-3s3: Using QM calculation to explain the atmosphere band pattern on Jupiter (and Earth, Saturn, Sun)'s surface.
SunQM-3s6: Predict radial mass density distribution for Earth, planets, and Sun based on {N,n} QM probability distribution.
SunQM-5: C-QM (a new version of QM based on interior {N,n}, multiplier n', |R(n,l)|^2 |Y(l,m)|^2 guided mass occupancy, and RF) and its application from string to universe.
SunQM-5s1: White dwarf, neutron star, and black hole re-analyzed by using C-QM.

[2] The citation of wiki "Solar core" means it is obtained from the Wikipedia online searching for "Solar core". Its website address is: https://en.wikipedia.org/wiki/Solar_core. This website address can be generalized for all other searching items.

[3] Major QM books, data sources, software I used for this study are:
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Free software: R
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Journal: Scientific American.