PHYSICS BASED MODEL OF UNIVERSE AND ITS EXPANSION

Introduction:

Welcome to the Si2Gh Universe discrete model site! On this site, a physics based discrete model of the expansion of the universe related to or after the Big Bang, called the "Si2Gh" model is explained. The Si2Gh is modelled based on solutions from non-recursive, non-iterative, close form equations which is much simpler & reliable to current existing modelling. The close form of equations enabled us to calculate values related to total universe (observed and unobserved) unlike the state of the art model that limits its calculations to only observed universe. A simple comparison of our model (Fig. 1A) with the existing model (Fig. 1B) in terms of number of inputs required and the outputs that can be calculated in each model is illustrated.

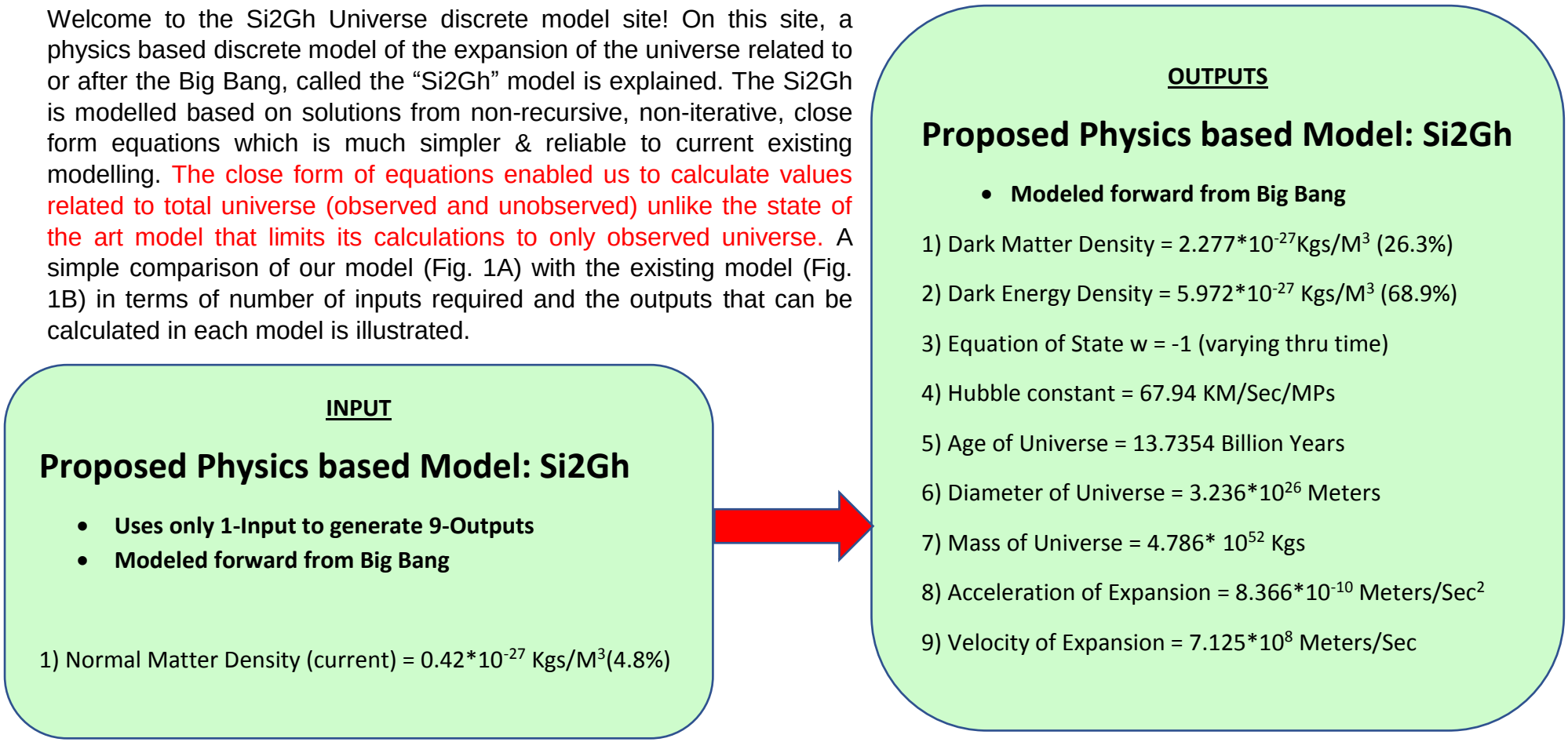

Fig. 1A – Si2Gh Model

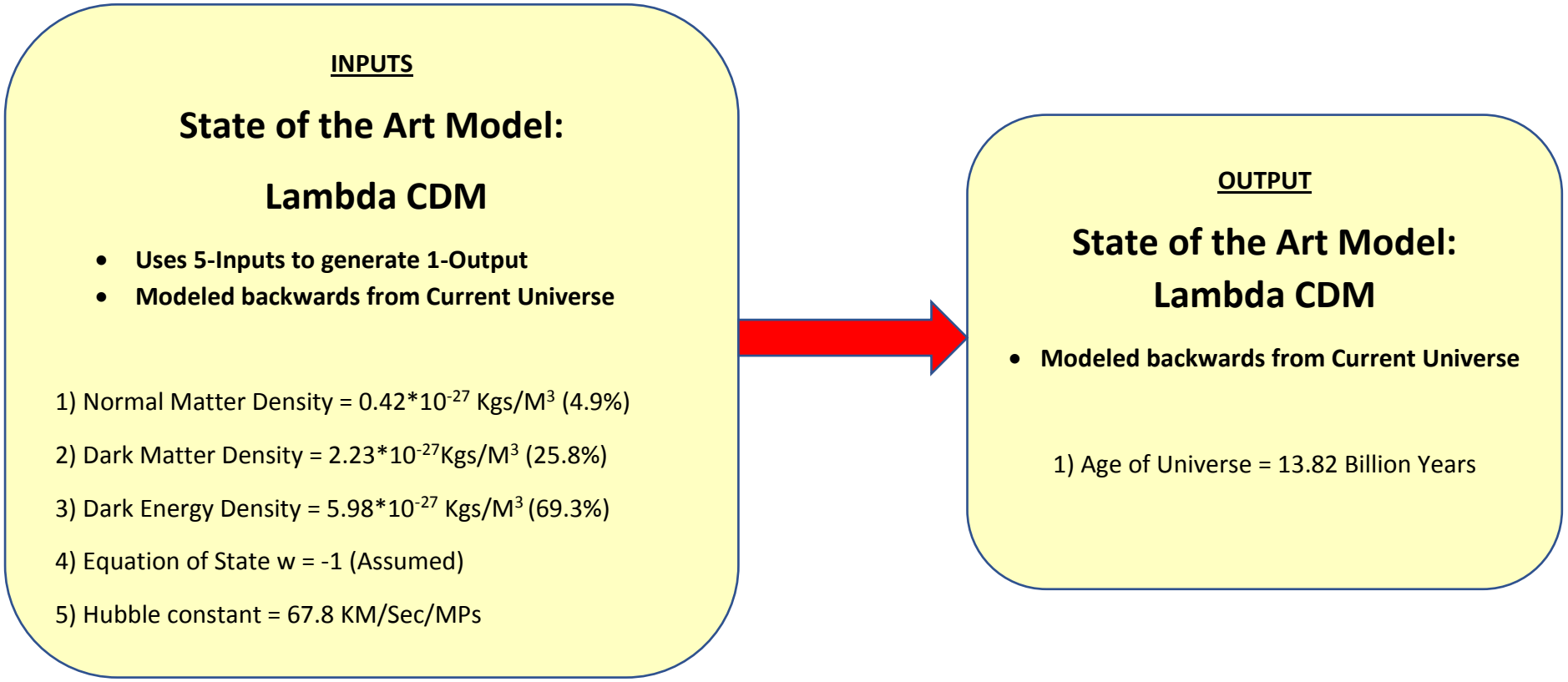

Fig. 1B - Lambda CDM Model

Si2Gh Discrete model basis:

Universe manifested itself due to an unknown event from a dimensionless point with zero acceleration & velocity (Hubble constant). This is a zero state. In the next discrete state at time=0, a mass of ~$4.8*10^{52}$ Kgs emerged in a space modeled as a close packing of 12 spheres surrounding a central sphere [Fig-2]. According to our model termed as Si2Gh model, this 13-sphere configuration is the universe's beginning. Each of the 13 spheres represent a volume of dark matter surrounded by voids which represent dark energy [Fig-3]. In addition to this, the 12 sphere centers form a strong tetrahedral network leaving a small void gap where a 14^{th} sphere cannot be included. This space represents occupation of normal visible matter.

In summary, the total volume of universe at time t=0, is occupied by normal or visible matter volume, dark matter volume and dark energy volume. Currently our model excludes radiation volume which is proportionally included in visible and dark matter volumes.

From basic physics, we can model the void (zero space or dark energy volume) as an originator of virtual energy. This is analogous to a small ball of material dropped into a jar of enclosed volume. The pressure inside the jar increases. Suppose, we compare the jar with and without the ball as separate states, then we can conclude virtual energy associated with both the states as:

$$\frac{\rho_{\text{Total matter (Visual+dark)}}}{\rho_{\text{Dark energy}}} = \frac{\frac{1}{Volume_{\text{Total matter (Visual+dark)}}}}{\frac{1}{Volume_{\text{Dark Energy}}}} = \frac{Volume_{\text{Dark Energy}}}{Volume_{\text{Total matter (Visual+dark)}}}$$

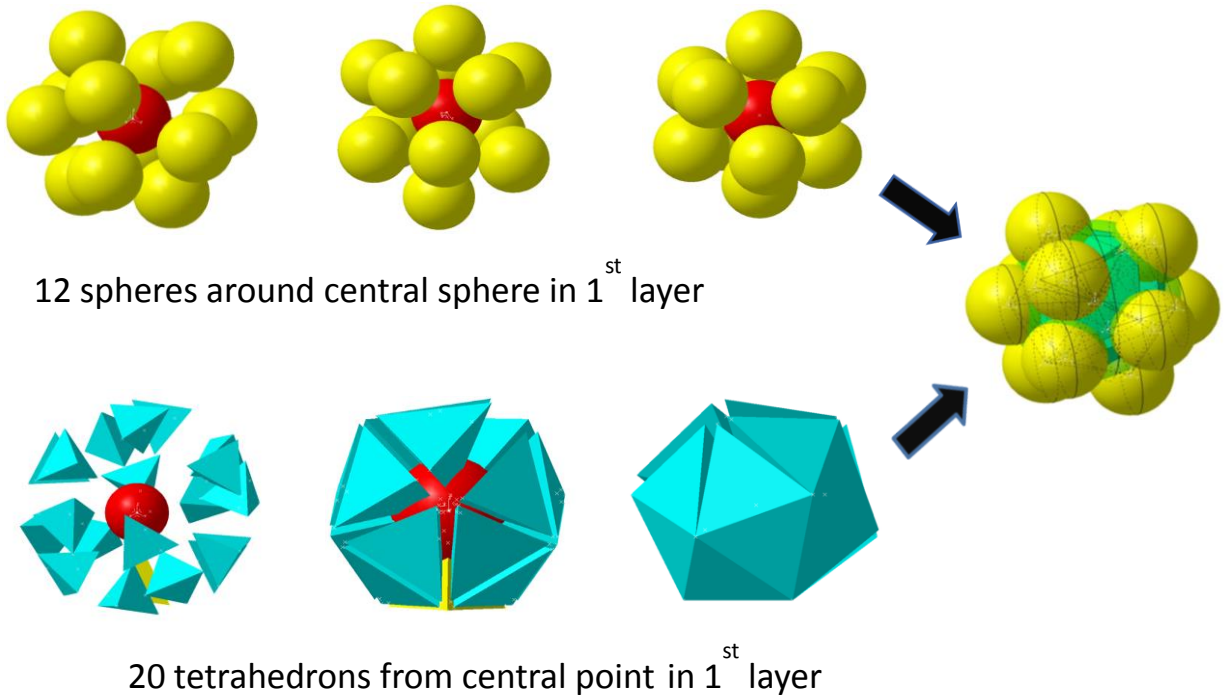

Figure 2: Spheres and Tetrahedral Relationship – 1st layer (12 spheres) & Central Red sphere (Original sphere)

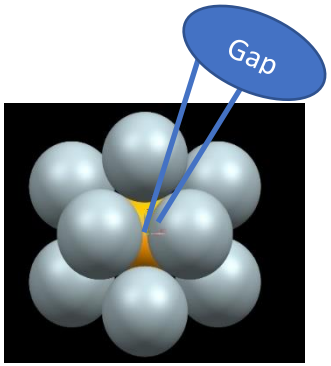

Figure 3: Spheres (Dark Matter) with Gap (Dark Energy)

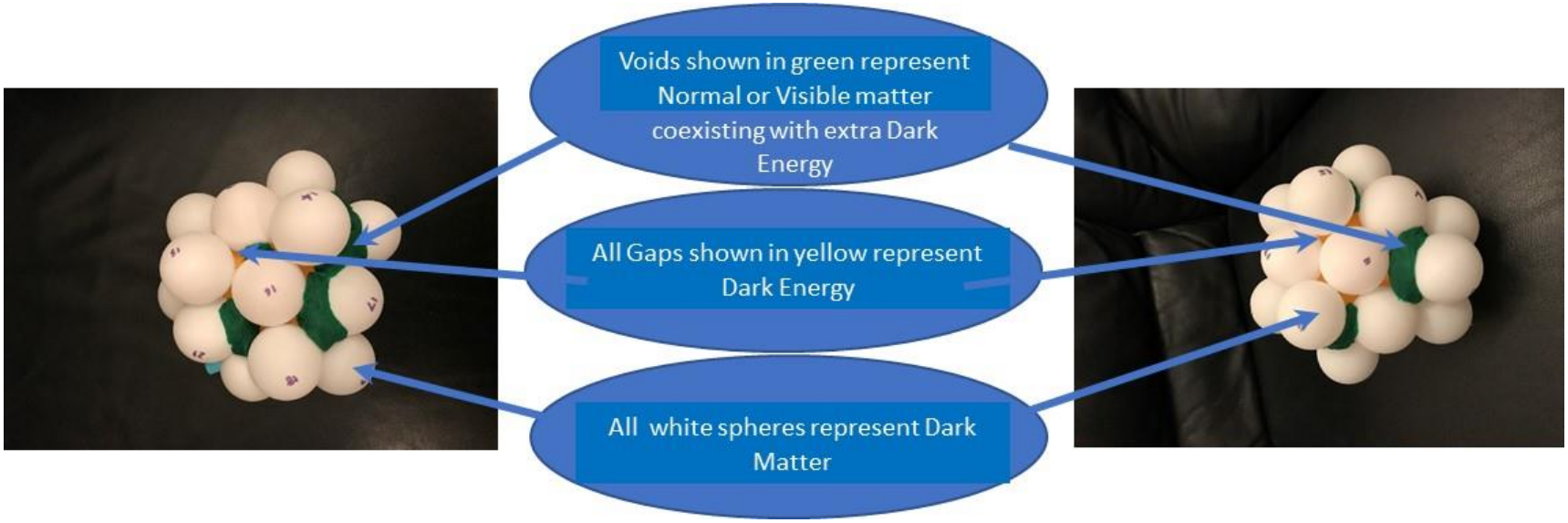

Figure 4: Spheres – 2nd layer (Total 42 spheres) – Positioned in tetrahedral (not shown) vertices[1]

Note 1: White spheres represent Dark Matter Volume, Green space represents Normal matter and Dark Energy Volume, Voids that see through to the yellow represent Dark Energy Volume or its occupation

Gravitational Wave Propagation

- Astronomical observations show that dark matter is invisible but could be assessed by gravitational effects.
- From the proposed “Si2Gh” discrete model, we notice that the white spheres (dark matter) have only, a point contact with adjacent spheres unlike the space where normal matter is present (the space where we live now that is represented by green in Fig-4).
- So, the gravitational wave propagation is carried through point contacts or one dimension to travel. At the same time dark matter invisibility shows that point contact is insufficient for light or any other electromagnetic spectrum for travel. So, we can postulate that electromagnetic waves require at least three dimensions for propagation as in the place, we live.

“Si2Gh model” basis Formulae and Values:

In the following pages, several equations have been developed using the above “Si2Gh model” basis of the Big Bang Scenario. The formulae and calculations of values follow the sequence flow shown below:

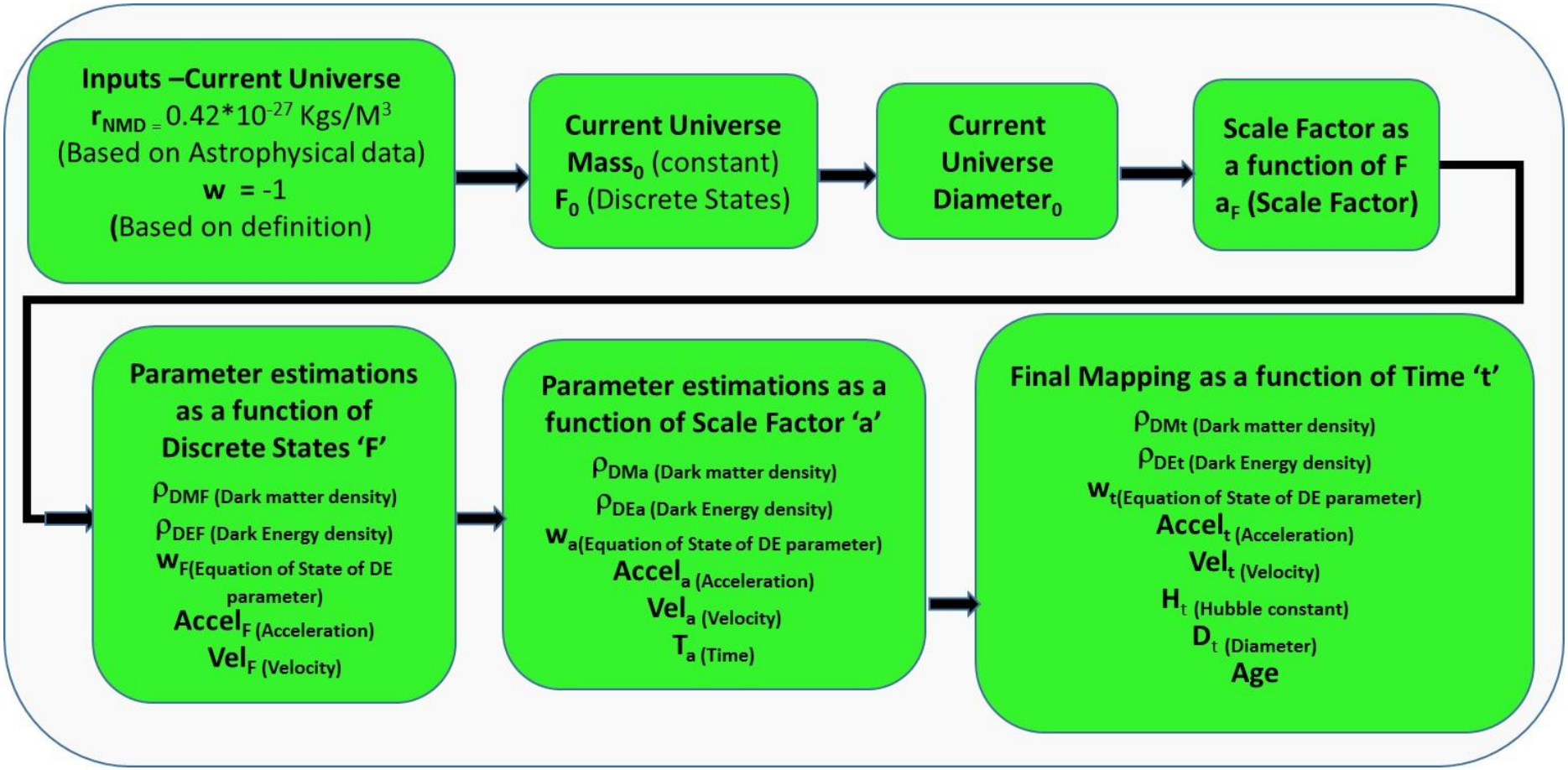

Figure 5 - Si2Gh model formulae & calculations flow chart

Fundamental Equations of 'Si2Gh' model:

1.1 *Sphere Packing Density at Big Bang – Based on Dodecahedral conjecture*

$$p = \rho dodec = \frac{\pi(1+\sqrt{5})^6}{96(15+7\sqrt{5})\left[3-\frac{1+\sqrt{5}}{2}\right]^{1.5}} \approx 0.754697;$$

1.2 *Sphere Packing Density at Infinite Curvature of Universe – Based on Kepler's conjecture*

$$q = \rho kepler = \frac{\pi}{3\sqrt{2}} \approx 0.740480;$$

1.3 *Volumetric Packing gap ratio*

$$r = 1 - \frac{(3+\sqrt{5})}{4\sqrt{2}} \approx 0.0744;$$

1.4 *Universe Volume factor for dark matter =20 times tetrahedral volume*

$$s = \frac{20P_d^3}{6\sqrt{2}}$$; where $P_d is\ sphere\ diameter\ representing\ 1 - Plank\ length$

1.5 *Scale Factor*

$$a = \text{Scale Factor} = \frac{Universe\ Diameter\ @time\ t}{Current\ Universe\ Diameter} = \frac{Dt}{D_0}$$

1.6 *Definition of "F"*

F = No. of Discrete States of Space = No. of Layers of Sphere Packings around a central sphere @Big bang

1.7 *Universe Diameter*

$$\text{Universe Diameter} = D = F\left[6\frac{(1+p-q-\frac{p-q}{F^2}+r\sum_1^F\frac{1}{F^2})*s}{\pi}\right]^{\frac{1}{3}}$$

1.8 *Normal Matter Density*

$$\text{Normal matter density } \rho_{NM} = \frac{M}{sF^3}*\frac{1}{\left[1+p-q-\frac{p-q}{F^2}+r\sum_1^F\frac{1}{F^2}\right]}*\frac{(p-q-\frac{p-q}{F^2}+r\sum_1^F\frac{1}{F^2})}{\left[(p+r\sum_1^F\frac{1}{F^2})\right]}$$ *where 'M' is Mass of Total Universe (includes Unobserved & Observed)*

1.9 *Dark Matter Density*

$$\text{Dark Matter density } \rho_{DM} = \frac{M}{sF^3}*\frac{1}{\left[1+p-q-\frac{p-q}{F^2}+r\sum_1^F\frac{1}{F^2}\right]}*\frac{\left[q+\frac{p-q}{F^2}\right]}{\left[(p+r\sum_1^F\frac{1}{F^2}\right]}$$

2.0 Total Matter Density

$$\text{Total matter density } \rho_{TM} = \frac{M}{sF^3}*\frac{1}{\left[1+p-q-\frac{p-q}{F^2}+r\sum_1^F\frac{1}{F^2}\right]}$$

2.1 Dark Energy Density

$$\text{Dark Energy density } \rho_{DE} = \frac{M}{sF^3}*\frac{\left[(p+r\sum_1^F\frac{1}{F^2})\right]}{(1+p-2q-2\frac{p-q}{F^2}+r\sum_1^F\frac{1}{F^2})}\frac{1}{(1+p-q-\frac{p-q}{F^2}+r\sum_1^F\frac{1}{F^2})}$$

2.2 Dark Energy equation of state factor W

$$\text{'W'} = \frac{1}{3}\frac{\log\frac{\rho DE_0}{\rho DE_t}}{\log\frac{a_t}{a_0}} - 1 = \frac{1}{3}\frac{\log\frac{\frac{1}{F_0^3} * \left[(p + r\sum\frac{1}{F_0{}^2})\right]}{(1+p-2q-2\frac{p-q}{F_0^2}+r\sum\frac{1}{F_0^2})(1+p-q-\frac{p-q}{F_0^2}+r\sum\frac{1}{F_0^2})}}{\log\frac{\frac{1}{F_t^3} * \left[(p + r\sum\frac{1}{F_t{}^2})\right]}{(1+p-2q-2\frac{p-q}{F_t^2}+r\sum\frac{1}{F_t^2})(1+p-q-\frac{p-q}{F_t^2}+r\sum\frac{1}{F_t^2})}} - 1$$

$$\log \text{Ft}\left[6\frac{(1+p-q-\frac{p-q}{F_t^2}+r\sum\frac{1}{F_t^2}) * s}{\pi}\right]^{\frac{1}{3}}$$

2.3 Universe expansion rate (Acceleration)

Acceleration (A) = $-\frac{4}{3}\pi\, G\,(\frac{\rho_{NM0}+\rho DM_0}{a^2} + (1+3w)\frac{\rho_{DE0}}{a^{3w+2}})$ - *Λ-CDM model of Einstein/ Friedmann based on General relativity & 'G' is Gravitational constant*

2.4 Velocity (Hubble Constant)

Velocity (v) = $\sqrt{\frac{8}{3}\pi\, G\,(\frac{\rho NM0+\rho DM0}{a} + \frac{\rho DE0}{a^{3w+1}})}$ -- *General relativity + Newton's Fundamental Laws of motion*

Hubble constant = v (*M/sec*)/(1000/3.0856776/10^22) --- *Km/Sec/Mparsec*

2.5 Age of Universe to current size

Age of universe from Big Bang to current Size of Universe:

$$T_0 = \int_{a=0}^{1} \frac{da}{v} + 0 = \int_{a=0}^{1} \frac{da}{\sqrt{\frac{8}{3}\pi\, G\left(\frac{\rho NM0 + \rho DM0}{a} + \frac{\rho DE0}{a^{3w+1}}\right)}} = \left(\frac{2}{3}\right) * \frac{2HYPG1\left(\frac{1}{2}, \frac{1}{2}; \frac{3}{2}; -\frac{\rho DE0}{\rho TM0}\right)}{\sqrt{\frac{8}{3}\pi\, G\, \rho TM0}}$$

Where $2HYPG1$ *is the Hypergeometric function*

2.6 Age of Universe from Big Bang to any time

Age of universe from Big Bang to any time:

$$T_t = \frac{2a^{\frac{3}{2}}\ 2HYPG1\left(\frac{1}{2}, -\frac{1}{2w}; 1 - \frac{1}{2w}; -\frac{\rho DE0\, a^{-3w}}{\rho TM0}\right)}{3\sqrt{\frac{8}{3}\pi\, G\, \rho TM0}}$$

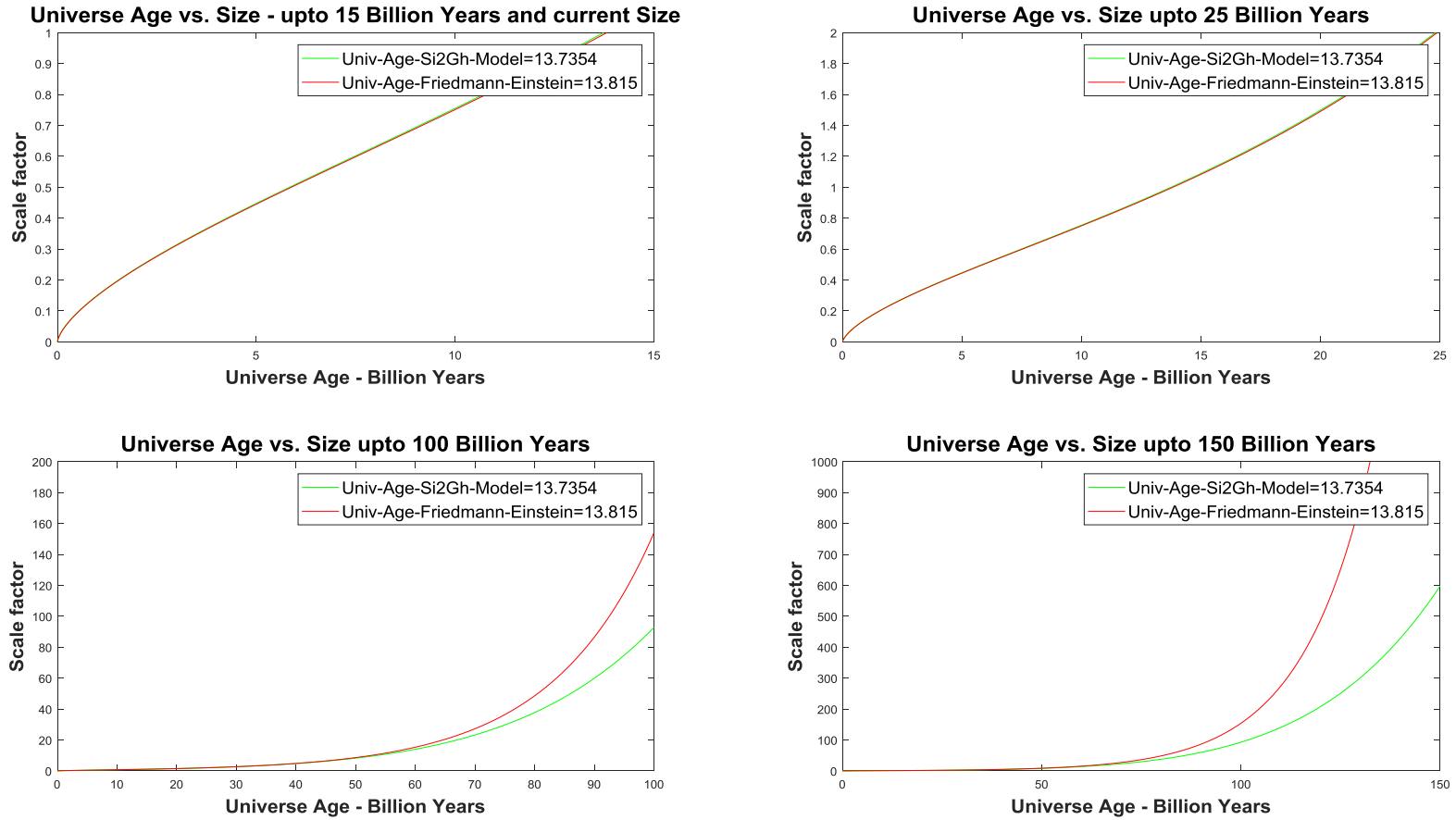

Figure 5 – Universe age & size – Lambda-CDM (Einstein-Friedmann) model and Si2Gh model graphic representation

Event	Time	Time	Discrete event	Eq. of State	Density Normal Matter	Density Dark Matter	Density Total Matter	Density Dark Energy	Diameter of Universe	Scale Factor	% Normal Matter	% Dark Matter	% Total Matter	% Dark Energy
	Billion years	Seconds	Nos.	w	Kgs/M^3	Kgs/M^3	Kgs/M^3	Kgs/M^3	Mts		%	%	%	%
At Big Bang	0	0	1	-5883.17	4.02E+155	4.07E+156	4.48E+156	1.16E+157	2.733E-35	8.45E-62	2.50	25.33	27.83	72.17
2nd Discrete event	1.21E-90	3.82E-74	2	-193.757	6.66E+154	4.78E+155	5.45E+155	1.28E+156	5.516E-35	1.70E-61	3.64	26.14	29.79	70.21
10th Discrete event	1.37E-89	4.32E-73	10	-60.0282	6.33E+152	3.63E+153	4.26E+153	9.53E+153	2.779E-34	8.59E-61	4.59	26.29	30.88	69.12
1-Planck time	1.71E-60	5.39E-44	1.19E+02	-60.0285	6.27E+152	3.63E+153	4.26E+153	9.55E+153	3.325E-33	1.03E-59	4.54	26.30	30.84	69.16
10-Planck times	1.71E-59	5.39E-43	1.10E+03	-60.0285	6.27E+152	3.63E+153	4.26E+153	9.55E+153	3.075E-32	9.50E-59	4.54	26.30	30.84	69.16
1000-Planck times	1.71E-57	5.39E-41	1.09E+05	-60.0285	6.27E+152	3.63E+153	4.26E+153	9.55E+153	3.047E-30	9.42E-57	4.54	26.30	30.84	69.16
1/10th Second	3.17E-18	0.1	2.03E+44	-60.0285	6.27E+152	3.63E+153	4.26E+153	9.55E+153	5.652E+09	1.75E-17	4.54	26.30	30.84	69.16
1 Second	3.17E-17	1	2.03E+45	-60.0285	6.27E+152	3.63E+153	4.26E+153	9.55E+153	5.652E+10	1.75E-16	4.54	26.30	30.84	69.16
1 Hr	1.14E-13	3600	7.31E+48	-60.0285	6.27E+152	3.63E+153	4.26E+153	9.55E+153	2.035E+14	6.29E-13	4.54	26.30	30.84	69.16
1-Day	2.74E-12	86400	1.75E+50	-60.0285	6.27E+152	3.63E+153	4.26E+153	9.55E+153	4.883E+15	1.51E-11	4.54	26.30	30.84	69.16
1-Year	1.00E-09	31557600	6.40E+52	-60.0281	6.27E+152	3.63E+153	4.26E+153	9.55E+153	1.784E+18	5.51E-09	4.54	26.30	30.84	69.16
10-Years	1.00E-08	315576000	6.40E+53	-60.0252	6.27E+152	3.63E+153	4.26E+153	9.55E+153	1.784E+19	5.51E-08	4.54	26.30	30.84	69.16
100-Years	1.00E-07	3.156E+09	6.40E+54	-59.9960	6.26E+152	3.63E+153	4.26E+153	9.55E+153	1.783E+20	5.51E-07	4.54	26.30	30.84	69.16
Acceleration Begin	7.627	2.407E+17	7.08E+60	-1.0035	1.854E-27	1.005E-26	1.191E-26	2.636E-26	1.973E+26	6.10E-01	4.84	26.27	31.11	68.89
Current Universe	13.735	4.335E+17	1.16E+61	-1.0000	4.200E-28	2.277E-27	2.697E-27	5.972E-27	3.236E+26	1.00E+00	4.84	26.27	31.11	68.89
100 Billion Yrs	100.00	3.156E+18	1.08E+63	-0.9688	5.256E-34	2.850E-33	3.375E-33	7.474E-33	3.003E+28	9.28E+01	4.84	26.27	31.11	68.89
150 Billion Yrs	150.00	4.734E+18	6.95E+63	-0.9565	1.965E-36	1.065E-35	1.262E-35	2.793E-35	1.935E+29	5.98E+02	4.84	26.27	31.11	68.89

Table 1A: Simulation values of the model[2]

Note 2: At the time of release of information on this site, due to limitations of computing resources available with us, the tables are based on an approximate simulated mass value of $4.786*10^{52}$ Kgs of total universe (observable & unobservable).

Event	Time	Time	Discrete event	Diameter of Universe	Acceleration	Velocity	Scale Factor	Scale Factor Accel	Scale Factor Velocity	Hubble Constant
	Billion years	Seconds	Nos.	Mts	Mts/Sec^2	Mts/Sec		Sec^{-2}	Sec^{-1}	Kms/Sec/ Mparsecs
At Big Bang	0	0	1	2.733E-35	-3.42E+112	1.367E+39	8.45E-62	-1.06E+86	4.23E+12	1.30E+32
2nd Discrete event	1.21E-90	3.82E-74	2	5.516E-35	-8.40E+111	9.626E+38	1.70E-61	-2.60E+85	2.97E+12	9.18E+31
10th Discrete event	1.37E-89	4.32E-73	10	2.779E-34	-3.31E+110	4.288E+38	8.59E-61	-1.02E+84	1.33E+12	4.09E+31
1-Planck time	1.71E-60	5.39E-44	1.19E+02	3.325E-33	-3.31E+110	4.288E+38	1.03E-59	-1.02E+84	1.33E+12	4.09E+31
10-Planck times	1.71E-59	5.39E-43	1.10E+03	3.075E-32	-3.31E+110	4.288E+38	9.50E-59	-1.02E+84	1.33E+12	4.09E+31
1000-Planck times	1.71E-57	5.39E-41	1.09E+05	3.047E-30	-3.31E+110	4.288E+38	9.42E-57	-1.02E+84	1.33E+12	4.09E+31
1/10th Second	3.17E-18	0.1	2.03E+44	5.652E+09	-3.31E+110	4.288E+38	1.75E-17	-1.02E+84	1.33E+12	4.09E+31
1 Second	3.17E-17	1	2.03E+45	5.652E+10	-3.31E+110	4.288E+38	1.75E-16	-1.02E+84	1.33E+12	4.09E+31
1 Hr	1.14E-13	3600	7.31E+48	2.035E+14	-3.31E+110	4.288E+38	6.29E-13	-1.02E+84	1.33E+12	4.09E+31
1-Day	2.74E-12	86400	1.75E+50	4.883E+15	-3.31E+110	4.288E+38	1.51E-11	-1.02E+84	1.33E+12	4.09E+31
1-Year	1.00E-09	31557600	6.40E+52	1.784E+18	-3.31E+110	4.288E+38	5.51E-09	-1.02E+84	1.33E+12	4.09E+31
10-Years	1.00E-08	315576000	6.40E+53	1.784E+19	-3.31E+110	4.288E+38	5.51E-08	-1.02E+84	1.33E+12	4.09E+31
100-Years	1.00E-07	3.156E+09	6.40E+54	1.783E+20	-3.31E+110	4.286E+38	5.51E-07	-1.02E+84	1.32E+12	4.09E+31
Acceleration Begin	7.627	2.407E+17	7.08E+60	1.973E+26	2.166E-12	6.232E+08	6.10E-01	6.69E-39	1.93E-18	59.42
Current Universe	13.735	4.335E+17	1.16E+61	3.236E+26	8.366E-10	7.125E+08	1.00E+00	2.59E-36	2.20E-18	67.94
100 Billion Yrs	100.00	3.156E+18	1.08E+63	3.003E+28	6.254E-08	4.439E+10	9.28E+01	1.93E-34	1.37E-16	4232.63
150 Billion Yrs	150.00	4.734E+18	6.95E+63	1.935E+29	2.623E-07	2.330E+11	5.98E+02	8.11E-34	7.20E-16	22219.78

Table 1B: Simulation values of the model[2]

Important Conclusion:

All modeled parameters including Dark energy, Dark matter, Hubble Constant & Age closely matched with the astronomical observations.

Hope you liked the contents of the website, we appreciate your frank and valuable comments, reviews and feedback! Please feel free to contact: Si2GhUniverse@gmail.com

Disclaimer:

The derivation of the formulae and the simulation code in this material are yet to be released due to intellectual property limitations.

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