Section F:

CFLE Theory Applied to Unified Science

"*The Beginning of Science is the End of Religion, and the End of Science is the Beginning of Religion*"

Chapter 16

Applying CFLE Theory to Thermodynamics

16.1 Disclosing the Identity of Heat by CFLE Theory

Mechanical energy and heat energy can change each other and change the same kind of energy, with the sum of the energies being conserved. Such fact was proven by T.P. Joule (1818−1884). In 1845, for his quantitative experiment, Joule used a simple experimental apparatus, shown in Figure 16-1-1.

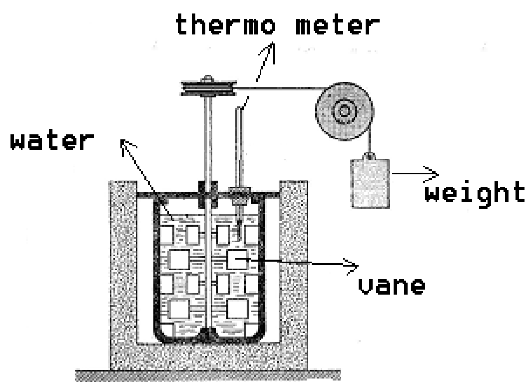

Figure 16-1-1

In the apparatus, when the weight falls, the water churn rotates, whereupon the vane works on the friction of the water and the water temperature is then measured by a thermometer. Surprisingly, the results were always the same (1 J = 4.186 J/kcal), regardless of the property of the fluid, volume of fluid, and work quantity of the weight. These results were called the "mechanical equivalent of heat," and the experiment confirmed the equivalence of heat energy and mechanical energy. CFLE theory can easily analyze and obtain this value theoretically. That is, the relation between gravitational work and heat work is only the force line curve g = 4.1860, although the force line curve of the particle that the experiment used is g = 6.545979. Because the correspondence number is c_c = 1.5, the real difference is

$$g = \frac{6.545979}{1.5}$$

$= 4.363986$ 16-1-1

Because the electrical permittivity of air at $g = 6.545979$ is

$Q_{e1} = (0.000589)\ (6.545979) = 0.003856$

$x_{e1} = 1.003856, \qquad x_{e1}^2 = 1.007726$

the gravitational permittivity of air at $g = 1$ is

$Q_g = 0.016774$

$x_g = 1.016774, \qquad x_g^2 = 1.033829$

and the electrical permittivity of air is

$x_{e2} = 1.000589$

the total effect of the three permittivity values is

$x_g^2 x_{e1}^2 x_{e2} = (1.033829)\ (1.007726)\ (1.000589)$

$= 1.042430$ 16-1-2

Therefore, the theoretical expectations value is

$g = \frac{4.363986}{1.042430}$

$= 4.186359$ 16-1-3

This theoretical value agrees well with the experimental value, and we obtain assurance about the postulate that the physical reason for the mechanical equivalence of heat is the force line curve of CFLE theory.

Under constant pressure with change of temperature only, the change in the volume of a gas is $\frac{1}{273.15}$ per degree. Therefore, the results of this experiment show that the temperature of absolute zero is $T = -273.15$ K. Namely, when $T = -273.15$ K, the volume of gas is in the V_o state ($\frac{273.15}{273.15} = 1$; of course, over the −273.15 K, all gases liquefy). CFLE theory postulates that volume change is a result of the change of force line curves. The volume is $V = \frac{4\pi}{3} R^3$, thus, the radius is

$$R = \sqrt[3]{\frac{3V}{4\pi}} \qquad 16\text{-}1\text{-}4$$

Because the change of the radius is given by

$$\Delta R = \sqrt[3]{\frac{3\Delta V}{4\pi}} = \sqrt[3]{K\Delta V} = \sqrt[3]{K\Delta 273.15} \qquad 16\text{-}1\text{-}5$$

hence,

$$\Delta R = 4.0251 \qquad 16\text{-}1\text{-}6$$

Therefore, the change in radius (ΔR) is 4.0251 according to CFLE theory. Of course, ΔR = 4.0251 is a force line curve. The difference of the force line curve between Joule's experiment and this experiment is

$$d = \frac{4.1864}{4.0251} = 1.0401$$

The one-dimensional difference is

$$d = \sqrt[3]{1.0401} = 1.0132$$

This difference is caused by the gravitational permittivity of air and the electrical permittivity by different experiments.

The gravitational permittivity of air is x_g = 1.016774, and the electrical permittivity of air at g = 6.545979 and $\frac{1}{C_c^2} = \frac{1}{(1.5)^2}$ is

$$Q_e = (0.000589)(6.545979)$$

$$= 0.003856$$

$$x_e = 1.003856$$

$$Q_e = \frac{0.000589}{(1.5)^2}$$

$$= 0.000262$$

$$x_e = 1.000262$$

The net difference is

$$d = \frac{(1.016774)(1.000262)}{1.003856}$$

$$= 1.0132$$

Therefore, the expected force line curve obtained is

$$g = \frac{4.1864}{(1.0132)^3}$$

$$= 4.0251 \qquad 16\text{-}1\text{-}7$$

This theoretical value agrees quite well with the experimental value.

Therefore, CFLE theory postulates that heat is also essentially a force line fragments. A force line that has order will be emitted and absorbed as photons in the form of force lines bundles. When such photonic force lines bundle is absorbed by a particle of gas, the photonic force lines become a part of the force lines of the particle gas. When the force lines elongate, the particle becomes bigger and volume is changed. This phenomenon is the ratio of volume change by unit increase of temperature. CFLE theory concludes that the ratio of radius change is the change of the force line curve of g = 6.545979. When force line elements cannot form as force lines, the force line elements or fragments of force lines become work in the form of heat. What Joule's experiment showed is that when the vane was moved by the weight, the force lines of the fluid particle were broken and cut off. Consequently, the force line fragments of the fluid particles became heat. CFLE theory therefore essentially says that heat is composed of disordered force line elements or fragments of force lines.

16.2 Corrections of the Second Law of Thermodynamics and Solving Problem of Arrow of Time by CFLE Theory

The second law of thermodynamics rules the direction of heat flow. That is, heat flows from high temperature to low temperature only, and it is impossible for any process to absorb heat energy to produce work energy. Such process can be expressed by entropy (the degree of disorder). That is, in every process within the universe, entropy is never decreased but only increased. As a result, the universe can only be expected to expand, because under classical entropy condition, contraction of the cosmos is prohibited. Therefore, in the classical cosmos, only an expanded universe is possible by the second law of thermodynamics.

In CFLE theory, however, the maximum expansion state can be changed to a minimum contraction state by the universal inertia of force lines arrangements. Therefore, CFLE theory stands in direct contradiction to the second law of thermodynamics. Looking at the second law of thermodynamics, there exists in the law tacit destructive infinity in the same way as the inconsistencies of previous theories discussed in this book. Essentially, the second law of thermodynamics defines entropy, and the change of entropy describes the second law of thermodynamics. In statistical mechanics, entropy is defined as

$$S = -K_B \sum_i P_i \ln P_i \qquad 16\text{-}2\text{-}1$$

where $P_i = \frac{1}{\Omega}$, K_{B} is the Boltzmann constant, summation is over all the possible microstates of the systems, and P_i is the probability that the system is the *i*th microstate.

When $p_i = \frac{1}{\Omega}$ is

$$S = K_b In\Omega \qquad 16\text{-}2\text{-}2$$

where, Ω is possible number of microstate.

In quantum statistical mechanics, von Neumann entropy is

$S = -K_{\mathrm{B}}\ Tr(\rho \ln \rho)$, where ρ is the density matrix and Tr is the trace operator.

Black hole entropy or Bekenstein-Hawking entropy is

$$S = \frac{k_B c^3}{4G\hbar} \cdot A \qquad 16\text{-}2\text{-}3$$

However, because black hole cannot have microstate (only mass, charge and angular momentum), we cannot believe general relativity that has serious defects and results of this theory that are physically meaningless. Namely existence of such black hole cannot be accepted as doubtless physical existence by view point of quantum mechanics that can describe microstate.

In classical thermodynamics, when temperature (T) moves heat by as much as dQ as a reversible process, $\Delta S = \int \frac{dQ}{T}$ is the defined change of entropy. When $T_1 \neq T_2$ for an ideal gas, $dE = nC_v dT$, $PV = nRT$, and the change of entropy is

$$\int \frac{dQ}{T} = \int \frac{dE+PdV}{T} = \int \frac{nC_v dT}{T} + \frac{nRdV}{V} = nC_v \ln(\frac{T_f}{T_i}) + nR\ln(\frac{V_f}{V_i}) \qquad 16\text{-}2\text{-}4$$

Because $dQ = 0$ in an adiabatic process, there is no change of entropy. In isothermal expansion, $\Delta S_1 = \frac{Q_1}{T_1}$, where ΔS_1 is positive (viz., $\Delta S_1 > 0$), because heat is absorbed. In isothermal compression, $\Delta S_2 = \frac{Q_2}{T_2}$, and because heat of Q_2 is emitted, ΔS_2 becomes negative. Therefore, because $\frac{Q_1}{T_1} = \frac{Q_2}{T_2}$ is, we can obtain$\Delta S = \Delta S_1 + \Delta S_2 = 0$.

Namely, there is no entropy change. But, if in reality (i.e., between heat sources of different temperatures running into each other) the same heat Q_1 is absorbed, and then more heat of Q_2 should be emitted.

Therefore,

$$\Delta S \geq 0 \qquad 16\text{-}2\text{-}5$$

This is in essence the second law of thermodynamics. The meaning of this result is that in every process of the universe, entropy is never decreased, as stated before. However, when considering this formula from the viewpoint of CFLE theory, we find that this conclusion is not always true, because in CFLE theory, the degree of disorder is always related to the volume of space.

First, according to statistical mechanics, the entropy S of an isolated system at thermodynamic equilibrium is defined as the natural logarithm of Ω, the number of distinct microscopic states available to the system given the macroscopic constraints (such as a fixed total energy E)

$$S = K_B In\, \Omega \qquad 16\text{-}2\text{-}6$$

This equation, which relates the microscopic details, or microstates, of the system (via Ω) to its macroscopic state (via the entropy S), is the central idea of statistical mechanics. The constant of proportionalityK_B

serves to make the statistical mechanical entropy equal to the classical thermodynamic entropy of Clausius:

$$\Delta S = \int \frac{dQ}{T} \qquad 16\text{-}2\text{-}7$$

One could choose instead rescaled dimensionless entropy in microscopic terms such that

$$S' = In\Omega, \quad \Delta S' = \int \frac{dQ}{k_B T} \qquad 16\text{-}2\text{-}8$$

This is a rather more natural form; and this rescaled entropy exactly corresponds to Shannon's subsequent information entropy.

The characteristic energy $k_B T$ is thus the heat required to increase the rescaled entropy by one nat.

$$k_B = 1.3806488(13) \times 10^{-23}\, JK^{-1} \qquad 16\text{-}2\text{-}9$$

Boltzmann's grave in the Zentralfriedhof, Vienna, Austria.

Figure 16-2-1

However, entropy to calculate we have to accept microstate of physical entities of the same kind that are in thermal equilibrium at temperature$T$. In such microstates(distribution) energy of any physical entities is restricted one of the values $\mathcal{E}_i = 0{,}1\Delta\mathcal{E}, 2\Delta\mathcal{E}, 3\Delta\mathcal{E}, 4\Delta\mathcal{E}, \ldots.$

According to quantized energy $E = hf$ possible energy of physical entities is

$$\Delta \mathrm{E}_{0,1,2,3,\ldots} = h\Delta f_{0,1,2,3\ldots} = hc\frac{1}{\Delta\lambda_{0,1,2,3,\ldots}} \qquad 16\text{-}2\text{-}10$$

According to assertion of Einstein and de Broglie

$$\Delta E_{0,1,2,3,\dots} = h\Delta f_{0,1,2,3\dots} = hc\frac{1}{\Delta\lambda_{0,1,2,3,\dots}} \leftrightarrow hc\frac{1}{\Delta x_{0,1,2,3,\dots}} \qquad 16\text{-}2\text{-}11$$

This result means that degree of disorder must be related definitive volume of isolated system according to quantum theory.

$$[m\lambda = \frac{\hbar}{c} \rightarrow mx = \frac{\hbar}{c}] \rightarrow [\ mx = \frac{\hbar}{c} \rightarrow m_w\lambda = \frac{\hbar}{c}] \qquad 3\text{-}3\text{-}19$$

Without such concept we cannot calculate the degree of disorder, because an infinitive physical entities or oscillator can exist in a definitive volume of universe. In the quantum cosmology of CFLE theory, however, universe has finite physical entities or oscillator and thus there exists a finite degree of disorder. CFLE theory can find the finite physical entities or oscillator and the related degree of disorder by volume change (cf.§13). This means that any disorder of a real system cannot occur without a change of volume, because without a definitive given volume, physical entities or oscillator cannot oscillate and any disorder of physical entities or oscillator cannot occur.

Second, the important point of the two laws of thermodynamics is that both are postulates and neither of them is a fundamental law. Therefore, in order to perfectly explain phenomena using these two laws, another fundamental postulate has to be introduced. That is, when only one of a possible reversible process of the cosmos is in progress, an observer in such a system should be able to observe any irreversible process according to the definition of entropy. Thus, if expansion is under way in the current cosmos, an observer should be observing only an increase of entropy according to the definition of entropy, even though it is defined by the observer himself. However, because CFLE theory permits a Big-Crunch of the cosmos by a quantized cosmotomic inertial force, the process of decreasing entropy according to a related decreasing volume should occur.

Because in CFLE theory $\Delta S = \int \frac{dQ}{T}$, which is the change of disorder from heat in a given space, ΔS should be related to given volume. According to the CFLE theory, it is not always true that

$$\Delta S \geq 0 \qquad 16\text{-}2\text{-}12$$

Such relation is right only in the expanding universe.

Heat can flow only from high temperature to low temperature and entropy change always bigger and bigger in this expanding universe.

Because of an expected negative volume change by CFLE theory,

$$\Delta S \leq 0 \qquad 16\text{-}2\text{-}13$$

can exist.

Such relation is right only in the collapsing universe.

Heat can flow only from low temperature to high temperature and entropy change is smaller and smaller in this collapsing universe.

Otherwise, we could not explain and understand how and why the entropy of the initial cosmos was very low, even according to the Big-Bang theory and the inevitability of the singularity theorem from the general theory of relativity.

This result is the corrected second law of thermodynamics by CFLE theory. According to $\Delta S \leq 0$, $\Delta S \geq 0$ there are no entropy changes in the initial and final states of the universe. CFLE theory calls this the law of conservations of order of the cosmos. The classical second law of thermodynamics demands that the direction of time be always flowing in one direction only, because when the universe started with the Big-Bang, any phenomenon that occurred with concomitant increase in volume of a particle would be observed to occur and result according to the flow of time. However, with the possibility of CFLE theory of a spontaneous Big-Crunch according to quantization of the universe by inertia of the force lines, it is possible that the flow direction of time is not only in one direction. This means that anti-direction flow of time is possible too. In CFLE theory, time did not exist in the universe after the Big-Bang and Big-Crunch. That is, all of positive time and negative time was

$$T^{+} + T^{-} = 0 \qquad 16\text{-}2\text{-}14$$

This is called the time conservation law in CFLE theory. To establish such time conservation law, we need to connect time with the charge of matter. CFLE theory can make this connection, because the theory asserts that in nature there are always seven kinds of positive charges and negative charges that are continuum with positive time and negative time. Therefore the time–matter relation is very important in CFLE theory for establishing the conservation law. Now, we can really understand meaning of time symmetry of Newton's second law.

$$F = ma = m\frac{d^2x}{dt^2} \quad 16\text{-}2\text{-}15$$

Newton's second law does not change by positive time t and negative time $\bar{t}$. This means that negative time flow, negative entropy and big crunch of universe is mechanically possible.

However, in classical general relativity, time is connected with space, the so-called space–time continuum. But classical general relativity cannot have any conservations law because of this space-time continuum. As discussed in §13, in CFLE theory, time is always connected with matter. Therefore, globally, time in the universe is zero and the seven kinds of charges are

$$T^+ + T^- = 0,\ \ E^+ + E^- = 0,\ \ \mathrm{e}^+ + \mathrm{e}^- = 0,\ \ g^+ + g^- = 0,\ \ m^+ + m^- = 0 \quad 16\text{-}2\text{-}16$$

When physics introduced the bundle of conservations laws, the inclusion of these results was an unavoidable fate. Therefore, it should be concluded that globally the essentiality of the universe is not changed, is not newly occurring, and is not finally being annihilated. When observing any physical object and related phenomena, it should always be concluded in the last step that everything of the universe occurs from nihility, as in theology, because a lot of conservations laws were introduced as required conditions for physics calculations. Therefore, physics and physicists cannot avoid this "dead end" of explanation any more than theology and theologists can. The first serious contradiction between classical relativity and CFLE theory is the inconsistency of the four dimensions, giving rise to the unphysical space–time continuum.

In CFLE theory, time is connected with matter instead, and with matter being symmetrical and material phenomena symmetrical too, time must be also symmetrical and likewise any phenomena connected with time. So, the flow of time should be related to the Big-Bang, entropy, Big-Crunch, and negentropy. Moreover, when the universe finishes its process from the Big–Bang to the Big–Crunch, all time becomes zero.

In essence, time is conserved. Thus, in the universe, globally there is no time, no charge, no matter, and no physical existence by related symmetry breaking. Otherwise, living things as new so-called Life could not appear, because without time and related entropy conservation there should always only exists old dead things, so-called Death. When expansion started, time appeared with matter and consequently so too did charge-related physical existence. Thus, any questions of the future of the universe and the past of the universe become meaningless.

16.3 Philosophical Interpretations about the Neutral Symmetry of the Universe

Because of CFLE theory's conservation laws of physics, time and matter are not newly created and annihilated as is electric charge conservation in classical electrodynamics. Therefore, globally in the universe, there is not really any physical existence. In the essentiality of existence and matter, time is nothingness by the conservations law and symmetry. Therefore, the essentiality of the universe is nihility. But this nihility is not absolute nihility, since absolute nihility is emptiness. On the other hand, the nihility of the universe is neutral nihility, wherein is annihilated the seven kinds of positive charges and negative charges.

16.4. Difference Between the Quantum Mechanical Cosmos and the Atom

In the principal of CFLE theory, the atomic model of quantum theory can be applied as the model of the cosmos. In the atomic model of quantum theory, electrons stay in their orbital for a long time without any radiation. Therefore, the movement of electrons can be said to be oscillatory.

However, an observer cannot say that the universe is oscillatory, because in the state just before the Big–Bang's broken symmetry, a perfect state of global symmetry was reached in which no matter and time could exist. Namely, there was only a state of "perfect neutral nothingness." Therefore, questions about whether there was a single Big–Bang or several times repeated Big–Bang become meaningless, because at that moment there was no matter and no physical existence and any characteristic of physical existence without time cannot be asserted. When the Big–Bang started and time and related matter and charge occurred by related local neutral symmetry breaking, only then could any observation about the cosmos and physical existence be described. This is a fundamental difference between the quantum theoretical atomic model and quantum theoretical cosmos model.

16.5 Initial Condition of the Universe and Simple Early History of the Universe by CFLE Theory

The energy quantum of a cosmotom (cf. Table in §18.5) is

$$\hbar_{\blacksquare} = 3.709763 \times 10^{-77} \text{ Js} \qquad 16\text{-}5\text{-}1$$

The mass of the cosmotomic seed is

$$M_{\blacksquare} = 2.006741 \times 10^{28} \text{ kg} \qquad 16\text{-}5\text{-}2$$

Therefore, the size of the comotomic seed is

$$X_{\blacksquare} \leq \frac{\hbar_{\blacksquare}}{M_{\blacksquare\ \text{seed}}c} \qquad 16\text{-}5\text{-}3$$

$$X_{\blacksquare\ \text{seed}} = \frac{3.709763 \times 10^{-77} \text{Js}}{(2.006741 \times 10^{28} \text{kg})\ (2.99792458 \times 10^{8}\ \text{m/s})} /$$

$$= 6.166435 \times 10^{-114} \text{ m}$$

Hence, the bar mass of the universe is

$$M_{\blacksquare} = (2.743589 \times 10^{62} \text{ kg})\ (1.686044 \times 10^{21})\ (\frac{3}{1.078983})$$

$$= 1.286158 \times 10^{84} \text{ kg} \qquad 16\text{-}5\text{-}4$$

where 3 is the product of $c_c = 1.5$ and $g = 2$, and $\frac{3}{1.078983} = 2.780395$ is from Eq. 13-15-15.

Hence, the number of cosmotomic seeds is

$$N = \frac{\text{bar mass of universe}}{\text{cosmotomic seed mass}}$$

$$= \frac{1.286158 \times 10^{84} \text{ kg}}{2.006741 \times 10^{28} \text{ kg}}$$

$$= 6.409188 \times 10^{55} \text{ seed} \qquad 16\text{-}5\text{-}5$$

The possible size of the initial nucleus of the cosmotomic seeds is

$R_{\blacksquare} = (6.166435 \times 10^{-114}\text{ m})\,(2.482982 \times 10^{18})$

$= 1.531115 \times 10^{-95}\text{ m}$ 16-5-6

Because the energy quantum of the bar mass state according to §18.5 is

$\hbar_{\blacksquare} = 1.286158 \times 10^{84}\text{ Js}$ 16-5-7

and the bar mass of the universe is

$M_{\blacksquare} = 1.286158 \times 10^{84}\text{ kg}$ 16-5-8

hence

$\frac{\hbar_{\blacksquare}}{M_{\blacksquare}} = V_{\blacksquare}X_{\blacksquare}$ 16-5-9

$\frac{1.286158\ \times 10^{84}\text{ Js}}{1.286158 \times 10^{84}\text{ kg}} = V_{\blacksquare}X_{\blacksquare}$ 16-5-10

$V_{\blacksquare}X_{\blacksquare} = 1\text{ m}^2/\text{s}$

But, the size of the initial nucleus is

$X_{\blacksquare} = 1.531115 \times 10^{-95}\text{ m}$ 16-5-11

The possible permitted speed is

$1 = V_{\blacksquare}\,(1.531115 \times 10^{-95}\text{ m})$ 16-5-12

$V_{\blacksquare} = 6.531188 \times 10^{94}\text{ m/s}$ 16-5-13

The possible start time of the Big-Bang is

$T_{i\blacksquare} = \frac{1.531188 \times 10^{-95}\text{m}}{6.531188 \times 10^{94}\text{ m/s}}$

$= 2.344313 \times 10^{-190}\text{ s}$ 16-5-14

When $\frac{\hbar_{\blacksquare}}{M_{\blacksquare}} = 1\text{ m}^2/\text{s}$, this state of the universe is called the absolute period. Because there are no force lines and their elements at this period, in order to establish the minimum requirement for the uncertainty principle and relativity principle, the lowest speed possible of the absolute period is the speed of light. Therefore, the end size of the absolute period is

$\frac{\hbar_\blacksquare}{M_\blacksquare} = V_\blacksquare X_\blacksquare$

$1\ \text{m}^2/\text{s} = (2.99792458 \times 10^8\ \text{m/s})\ X_\blacksquare$ 16-5-15

$X_\blacksquare = 3.335640 \times 10^{-9}\ \text{m}$ 16-5-16

The period after this is called the charge screening period or relativity period or uncertainty period. The time required before the charge screening period is

$T_{\text{p}\blacksquare} = \frac{3.335640 \times 10^{-9}\ \text{m}}{2.99792458 \times 10^8\ \text{m/s}}$

$= 1.11265006 \times 10^{-17}\ \text{s}$ 16-5-17

At the end of the charge screening period, any component object of the universe can maintain the speed of light. Therefore, the nucleus of the universe is

$\hbar_\blacksquare = \Delta M\ (2.997925 \times 10^8\ \text{m/s})\ \Delta X$ 16-5-18

$1.286158 \times 10^{84}\ \text{Js} = (9.079222 \times 10^{69}\ \text{kg})\ (2.997925 \times 10^8\ \text{m/s})\ \Delta X$

$\Delta X_0 = 4.725252 \times 10^5\ \text{m}$ 16-5-19

This size is the original boundary size of the cosmotomic nucleus and galactomic nucleus in §13.17; that is,

$\Delta X = 2.094 \times 10^5\ \text{m}$

The difference is

$d = \frac{\Delta X_0}{\Delta X}$

$= \frac{4.725252 \times 10^5\ \text{m}}{2.904 \times 10^5\ \text{m}}$

≈ 2.256

where 1.627 is the correspondence number $c_\text{c} = 1.5$ and the electrical permittivity of air at $g = 1.5$ is

$d = (1.5)^2 = 2.25$

$Q_1 = (0.000589)\ (1.5) = 0.000884$

$x_1 = 1.000884, \quad x_1^2 = 1.001768$

$Q_2 = 0.000589$

$x_2 = 1.000589, \quad x_2^2 = 1.001783$

$Q_3 = \frac{0.000589}{1.5} = 0.000393$

$x_3 = 1.000393, \quad x_3^2 = 1.000786$

Hence, the total difference is

$$d = \frac{(2.25)\,(1.001768)\,(1.001783)}{1.000786}$$

$$= 2.256223$$

$$\approx 2.256 \qquad 16\text{-}5\text{-}20$$

Therefore, the effective boundary size of the cosmotomic and galactomic nuclei is

$$\Delta X = \frac{4.725252 \times 10^5 \text{ m}}{2.256223}$$

$$= 2.094 \times 10^5 \text{ m} \qquad 16\text{-}5\text{-}21$$

This is the size of a galactomic quasar. Essentially, the charge screening period can also be called the relativity period. In other words, it is during this period that we can establish the principle of relativity and principle of uncertainty. The period after this is called the hierarchical structure forming period.

In this period is changed

$\hbar_{\blacksquare} \rightarrow \hbar_{\mathbb{U}}$

That is,

$\hbar_{\blacksquare} = 1.286158 \times 10^{84}$ Js $\Longrightarrow$ $\hbar_{\mathbb{U}} = 1.080616 \times 10^{77}$ Js