HUBBLE LAW, DOPPLER EFFECT, AND THE MODEL OF "HOT" UNIVERSE: ERRORS IN COSMOLOGY

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Abstract. The critical analysis of the foundations of cosmology is proposed. The unity of formal logic and rational dialectics is the correct methodological basis for the analysis. The main results of the analysis are as follows: (1) the Hubble law represents the formal-logical error because the Hubble formula contradicts to the correct definition of the speed of motion of the material object; (2) the Doppler effect represents the physical error because the speed of motion of the photon does not depend on the speed of motion of the radiating atom. The correct explanation of the red shift is that the frequency shift of the radiation is the result of a shift in the energy spectrum of the radiating atom; (3) the theory of "hot" Universe represents the physical error because the Universe is the "cold" Universe at any point of time. The correct explanation is that the background radiation is described by the Planck function (Planck's formula). The Planck function (Planck's formula) characterizes the equilibrium state of the isolated and closed macroscopic system "photon gas + gas of radiating atoms" (where temperature is the statistical temperature of the radiating atom). Consequently: (a) the Universe represents the isolated and closed system at any point of time; (b) the total energy of the Universe is a conserved quantity at any point of time; (c) the low temperature of substance in the Universe is a conserved quantity at any point of time.
These results signify that the correct physical theory of the Universe cannot be created.

Keywords: origin and formation of the Universe, background radiations, cosmology, observational cosmology, general physics, foundations of theoretical physics, atomic and molecular physics, mathematical physics, education, formal logic, philosophy of science.

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Introduction

Progress in the research of the Universe depends on the interpretation of empirical data. The interpretation is based on physical laws and theories. The interpretation is the starting point of theoretical models of the Universe. Currently, Hubble law, the Doppler effect, the model of "hot" Universe, the "Big Bang" theory, and the general theory of relativity are substantially the starting point and the theoretical basis for research of the Universe.

As is shown in the pioneering works [1-121], the foundations of theoretical physics, mathematics, and philosophy contain formal-logical and dialectical errors. In other words, the foundations of science do not satisfy the correct criterion of truth: the unity of formal logic and rational dialectics. This criterion of truth is also the correct methodological basis of science. Therefore, one must call the Hubble law, the Doppler effect, the model of the "hot" Universe, the "Big Bang" theory, and the general theory of the relativity in question within the framework of the correct methodological basis.

The purpose of this work is to analyze critically the Hubble law, the Doppler effect, and the model of "hot" Universe within the framework of the correct foundations of kinematics of material point, the correct foundations of the theory of quantum particle, and the correct foundations of the theory of photon (quantum) gas.

1. The correct foundations of kinematics of material point

The correct foundations of kinematics of material point represent the following statements [114-118].

1. The motion of the material point can be given (represented) by one of three mutually complementary ways: vector, coordinate, and trajectory (natural) ways. The coordinate way (coordinate representation) is that the position of the point relative to the coordinate system (reference frame) is determined by certain three coordinates x, y, z (i.e., by the Cartesian coordinates x, y, z) and the law of motion is given by three equations (i.e., by $x = x(t)$, $y = y(t)$, $z = z(t)$). If one eliminates variable t from the equations, one can find the trajectory (i.e., line in the coordinate system) of the moving point. The trajectory (natural) way of describing is used if the trajectory of the moving point relative to the coordinate system (reference frame) is known. The position of the given point is determined by the distance between the reference point selected on the trajectory and the given point on the trajectory (the distance is measured along the trajectory). The law of motion is given by the equation expressing dependence of the traveled (traversed) distance on time: $l = l(t)$. The basic kinematic characteristics of a moving point are the speed and acceleration of the point.

2. Clock C (i.e., a material device created by man) determines time t; time t characterizes clock C; time t is a property of clock C. (Если бы один уничтожил все часы в мире, то время не существовало бы в мире). Time t is the universal informational (i.e., non-physical) variable quantity. Therefore, time is not a property of natural material objects. The dimension of time is "second (s)". If t_0 and t_1 are the values of the variable quantity t (i.e., t_0 and t_1 are certain points of time), then the difference $(t_1 - t_0) \equiv \Delta t_{10}$ represents the fixed increment of the value of the variable quantity t from the value t_0 to the value t_1. The difference $(t - t_0) \equiv \Delta t_0$ is the variable increment of the value of the quantity t from the value t_0 to some other value at that $\Delta t_0 \neq 0$.

3. The Cartesian metric coordinate system XOY is the metric material system formed by the identical material scales OX and OY on the plane. Scales OX and OY have the dimension of "meter (m)". The material point M on the plane XOY represents a material object M. The set of possible positions (i.e., the geometrical states) of the object M in the system XOY is called geometric space of the states of the object M. (Description of the positions of the material object M in the system XOY is called geometrical representation (coordinate representation) of the object M). The material object M and the material system XOY are the independent parts of the whole.

Clock C as a material object can be and move in the system XOY. The material object C and the material system XOY are the independent parts of the whole. But time t (as the property of clock C) does not exist in the system XOY: t does not represent a geometrical (material) object. Scale of time does not belong to the system XOY and does not represent an extension of the system XOY because time has no dimension of "meter (m)". The quantity which has no dimension of "meter (m)" cannot be graphically represented in the system XOY [91-94]. In other words, the quantity which has no the dimension of "meter (m)" does not exist in the coordinate system XOY.

4. The positions of the material point (i.e., the material object) M on the plane XOY is determined by the coordinates (i.e., by the material projections, the segments of the scales) x^M and y^M which have the dimension of "meter (m)". (Coordinate is the geometric concept which designates certain segment of the scale. Description of the positions of the material point M in the system XOY is called geometric representation (coordinate representation) of point M). Material point M exists in the system XOY if and only if the coordinates of point M exists in

the system XOY. There are no coordinates in general, but there exist only the coordinates of the material point M. The concepts "positions of material point M on plane XOY" and "coordinates of material point M on plane XOY" are identical ones. If point M move on plane XOY, then the coordinates of point M are functions of time: $x^M = x^M(t),\ y^M = y^M(t)$.

5. If clock C is in system XOY and material object M has no effect on the clock mechanism, then property of clock C (i.e., time t) does not depend on the existence of object M. If property of clock C does not depend on clock positions in system XOY, then time t does not depend on rate of change in positions of the moving clock C in system XOY. Furthermore, time t does not depend on the length of the path traveled by moving clock C in system XOY.

6. If point M is moved on plane XOY, then the positions of the point M characterize the trajectory of the point M: the path (i.e., the material line on plane XOY) is the locus of the positions of point M. The length of the path (i.e., the length of the segment of line) traveled by point M over (for) time t is $l^M(t)$. The concepts of "segment" and "length of line segment" are not identical ones: the segment of the line is a material object, and the length of the segment of the line is a denominate (dimensional) number (i.e., property, the quantitative determinacy of the material object). The line segment exists on plane XOY, but the path length (as length of segment) does not exist on the plane XOY. In other words, there are only geometrical (i.e., material) objects on plane XOY: material points, material lines, and material figures on plane XOY. The path length (i.e., the quantitative determinacy of the line segment) is measured by the use of a device; measurement results are denominate (dimensional) numbers. In other words, the path length exists as a set of denominate (dimensional) numbers. The length l^M of the line segment has the dimension of "meter (m)", but the quantity l^M has no a graphical representation because l^M is not the material segment of the line on plane XOY. Therefore, the concepts "length of path of point M" and "coordinates of point M" are non-identical concepts.

7. The mathematical (i.e., quantitative) quantity l^M has the properties of additivity and multiplicativity, but it is not characterized by the property of directivity on the plane XOY. The property of additivity $l_1^M + l_2^M$ is geometrically (i.e., practically) interpreted as follows: two segments of straight line having lengths l_1^M and l_2^M are coincided with the scale X; origin of the first segment is coincided with the zero point of the scale X; the end of the first segment is connected with the origin of the second segment; the length of the connected segments is $l_1^M + l_2^M$. The property of multiplicativity $l_1^M \times l_2^M$ is practically interpreted as follows: the first segment of straight line having length l_1^M is coincided with the scale X; origin of the first segment is coincided with the zero point of the scale X; the second segment of straight line having length l_2^M is coincided with the scale Y; origin of the second segment is coincided with the zero point of the scale Y; the area of the rectangle constructed on these segments is $l_1^M \times l_2^M$; the quantity of the area does not exist in the system XOY because the quantity of the area has no the dimension of "meter (m)".

8. Measure of material object M represents the unity of qualitative and quantitative determinacy of object M. The measure of the material object M is invariant under transformation of coordinates. The length of path (i.e., property of line segment, measure of line segment) is invariant under transformation of coordinates. In other words, the length of path is independent of choice of coordinate system. The concepts of "direction", "direction of motion", and "vector" in system XOY represent the physical concepts (i.e., qualitative determinacy) and cannot be defined mathematically (i.e., in terms of quantity) in the system XOY. In physical point of view, there exists a direction of motion. But, in geometric and mathematical points of view, there are only line segments and numbers. The length of the line segment (length of trajectory) is not characterized by a direction of motion, and the direction of motion does not

determine the length of path. (Explanation is that the mathematical formalism does not contain motion as change in general. Changes are made by man. Vector is an illustration of direction).

Thus, the path length is independent of the direction of the motion of the material point M.

9. The quantity $l^M(t) - l^M(t_0)$ is called increment of the length of the path of the material point M over (for) time $\Delta t_0 \equiv t - t_0$ where $\Delta t_0 \neq 0$, t_0 is the initial point of time. The quantity

$$\frac{l^M(t) - l^M(t_0)}{\Delta t_0} \equiv v^M(\Delta t_0)$$

is rate of change in the quantity l^M. In other words, speed of motion of point M is rate of change in quantity $l^M(t)$. (Movement is change in general). Here is the correct definition of speed: the speed of the motion of point M is the average speed over time Δt_0. There is no "instantaneous speed" (i.e., speed at point of time t) [60]. The speed of the motion is the essential feature (property, characteristic) of motion: speed is the rate of the change in number. The rate of the change in the quantity $l^M(t)$ has no a graphical representation in system XOY because the quantity of the rate has no the dimension of "meter (m)". The rate of the change in the quantity $l^M(t)$ is not defined and is not characterized by any direction because the quantity $l^M(t)$ is not defined and is not characterized by a direction of the motion of the point M in the system XOY. Thus, the rate of the change in the path length is independent of a direction of the motion of the point M.

10. The variable quantity $v^M(\Delta t_0)$ takes on the values $v_1^M(\Delta t_{10})$, $v_2^M(\Delta t_{20})$, $v_3^M(\Delta t_{30})$ under Δt_{10}, Δt_{20}, Δt_{30}, respectively. If the interval (duration) of time is the variable quantity $\Delta t_0 \equiv t - t_0$, then the quantity $v^M(\Delta t_0)$ of the speed is a function of the argument $\Delta t_0 \equiv t - t_0$. The conventional concept of speed at point of time (at instant of time) t (or at point of plane XOY) has no scientific and practical sense because the speed of the motion is determined by two (different) positions of the moving point M on plane XOY and by two (different) points of time: movement is change in general; but there is no change in position at point of time t (or at point of plane XOY).

11. If the speed of the motion of point M depends on time, then the quantity

$$\frac{v^M(\Delta t_0) - v_1^M(\Delta t_0)}{\Delta t_0} \equiv a^M$$

is called acceleration of the point M on the path length $l^M(t) - l^M(t_0)$ where $v_1^M(\Delta t_0)$ is certain value of speed, which is experimentally determined. Acceleration characterizes the motion of the point M: acceleration is the essential feature (property, characteristic) of the motion of point M. The quantity of the acceleration of the point M has no graphical representation in the system XOY because the quantity of the acceleration has no dimension of "meter (m)". The quantities $l^M(t)$ and a^M are connected by the following relationship:

$$l^M(t) - l^M(t_0) = a^M \times (\Delta t_0)^2.$$

12. The correct definition of speed of motion results in the following correct statements: if $l^M(t_1) - l^M(t_0) = const$, then $t_1 - t_0 = const$; if $t_1 - t_0 = const$, then

$l^M(t_1) - l^M(t_0) = const$. A logical contradiction in the definition of speed of motion arises if $l^M(t) - l^M(t_0) \neq const$ and $t_1 - t_0 \equiv T = const$. The logical contradiction is that the relationship $l^M(t) - l^M(t_0) \neq const$ signifies that time is a variable quantity; and the relationship $t_1 - t_0 \equiv T = const$ signifies that time is not a variable quantity. Consequently, the relationship

$$\frac{l^M(t) - l^M(t_0)}{T} = v^M(\Delta t_0), \quad 0 < T < \infty$$

is incorrect definition of the speed of motion of the material point M because this relationship contradicts to formal logic.

13. The incorrect relationship

$$\frac{l^M(t) - l^M(t_0)}{T} = v^M(\Delta t_0), \quad 0 < T < \infty$$

signifies that: (a) $l^M(t) - l^M(t_0)$ is an oscillating quantity; the quantity $1/T$ is the frequency of oscillations; and the quantity T is the period of the oscillations; (b) the speed $v^M(\Delta t_0)$ depends on time t (i.e., the speed is a variable quantity, and, consequently, the material point moves with acceleration).

2. Critical analysis of the Hubble law

The correct foundations of kinematics of material point are the basis for analysis of the Hubble law.

1) As is known [122, 123], the mathematical formulation of the Hubble law represents the following velocity-distance relationship:

$$v = Hr$$

where v is the velocity of the galaxy's motion away from the observer, r is the moving galaxy distance, H is the Hubble constant. The dimension of the Hubble constant is the frequency: $[H] = 1/s$.

2) Как показано выше, соотношение

$$\frac{l^M(t) - l^M(t_0)}{T} = v^M(\Delta t_0), \quad 0 < T < \infty$$

является некорректным определением скорости движения материальной точки M, потому что это соотношение противоречит формальной логике.

2) As is shown above, the relationship

$$\frac{l^M(t) - l^M(t_0)}{T} = v^M(\Delta t_0), \quad 0 < T < \infty$$

is incorrect definition of the speed of motion of the material point M because this relationship contradicts to formal logic.

3) The formulas

$$v = Hr, \quad \text{i.e.,} \quad v(t) = Hr(t),$$
$$\frac{l^M(t) - l^M(t_0)}{T} = v^M(\Delta t_0), \quad T = const, \; 0 < T < \infty$$

are identical under $t_0 = 0$, $l^M \equiv r$, and $1/T \equiv H$.

Remark.

(a) If the galaxy were a fixed object, it would be $r = const$.

(b) The quantity r does not determine the speed of motion of a material object if r is not the length of the traveled path.

Consequently, the Hubble law represents the gross formal-logical and physical errors: the Hubble formula contradicts to the correct definition of the speed of motion of the material point. This signifies that the statement about the recession of galaxies is not correct. In addition, the Hubble formula contradicts to the principle of homogeneity of the Universe because the speed v in the Hubble formula depends on time t.

3. Correct foundations of the theory of quantum particle

A new foundation of quantum theory is proposed for the first time in works [24, 31, 32, 52, 53, 58, 59, 69, 119]. It represents a new viewpoint that has arisen from the critical analysis of statistical physics, the special theory of relativity, and standard quantum mechanics. The basis is formed by the following heuristic principles:

1) The principle of motion of quantum particle is as follows: the motion of quantum particle is the form of existence of quantum particle; the motion represents unity of internal and external (i.e. translational) motions.

2) The principle of stability of a quantum particle is as follows: a free quantum particle is identical with itself and has an invariable quantitative determinacy for unlimited time (in the course of unrestrictedly long time). In other words, the quantitative and qualitative determinacy of a free (stable) quantum particle is conserved in the course of unrestrictedly long time.

3) The principle of energy of quantum particle is as follows: the energy

$$E_n \neq 0, \; n = 0, 1, 2, \ldots$$

(where n is the energetic quantum number which characterizes the quantitative determinacy of the particle) is inalienable property of a quantum particle. The energy levels $n = 1, 2, \ldots$ of the quantum particle arise and disappear only as a result of absorption and of emission of other quantum particles (photons, элементарных частиц), respectively. (Consequently, the problem of quantization of energy is not the Schrödinger problem of eigenvalues The dimension of the energy of a quantum particle is $[E_n] = kg\, m^2\, s^{-2}$. From the point of view of formal logic, this is the correct dimension of the kinetic (external) energy of a particle.

4) De Broglie's empirical formula for photon (according to which relation between corpuscular and wave aspects of motion of a quantum particle is defined by the mathematical equation $E = h\nu$ where E is the energy of the particle, ν is the frequency of the wave, h is the Planck constant) can be corrected and generalized in the following way. The principle of

equivalence of energy E_n and frequency ν_n of quantum particle is as follows: energy E_n is connected with frequency ν_n by the following relationship:

$$E_n \equiv h\nu_n,\ \nu_n \neq 0$$

where h and ν_n are the Planck 'constant' (i.e. universal quantum of action) and the frequency of the periodic process of mutual transformation of the internal and external motions of particle, respectively. From the point of view of formal logic, this relationship is correct. The concepts of energy E_n and of frequency ν_n are identical ones. Multiplication of the quantities h and ν_n is permitted by formal-logic law of identity if h is an oscillating quantity.

5) The principle of speed of the translational motion of quantum particle is as follows: the speed v_n is defined by the formula

$$v_n \equiv \lambda_n \nu_n$$

where $\lambda_n \neq 0$ is the size (the diameter) of the particle. The λ_n equals the distance traveled by the particle for the oscillation period

$$\tau_n \equiv 1/\nu_n .$$

This translational motion represents the oscillation contraction (decrease) and extension (increase) of the size (diameter) of the particle. Therefore, the translational motion of the quantum particle relative to a reference system is an absolute one. The absolute motion is invariant under choice of a reference system. This statement means that the velocity addition theorem for quantum particle is not valid. The physical quantities represent the quantities bounded below and above.

6) The principle of rectilinearity of the external motion of a quantum particle is as follows: a free (stable) quantum particle moves along a straight line.

7) The principle of mass and momentum of quantum particle is as follows: the motion mass m_n and the momentum p_n are defined by the formula

$$E_n \equiv (E_n/v_n^2)v_n^2 \equiv m_n v_n^2 \equiv p_n v_n .$$

This formula is a consequence of the dimension $[E_n] = kg\,m^2\,s^{-2}$. (Note: A quantum particle has no rest mass because a quantum particle cannot rest). The concept of mass m_n and the concept of energy E_n are not identical ones. Therefore, the formula

$$E_n \equiv m_n v_n^2$$

does not express the principle of equivalency of mass and energy. The formula is a consequence of the dimension $[E_n] = kg\,m^2\,s^{-2}$.

8) In the case of a photon, $n = 0$, $v_0 \equiv \lambda_0 \nu_0$, $E_0 \equiv m_0 v_0^2$, $v_0 = const$. Therefore,

$$\lambda_0 \propto 1/\nu_0,\ v_0 = const,\ E_0 \propto m_0 .$$

The speed of motion of the photon is constant because the photon has no energy spectrum and cannot absorb or emit another photon.

9) Formulation of the principle of equivalency of mass and energy of quantum particle would be feasible one if the energy E_n was connected with the mass M_n by the formula

$$E_n \equiv kM_n$$

where the concepts of the energy E_n and the mass M_n were identical ones, k was a universal constant, $[k] = energy/mass$. But this formula is incorrect one because the coefficient k does not depend on n (i.e., k does not represent a universal constant).

10) The principle of acceleration and of deceleration of quantum particle is as follows: acceleration and deceleration of particle are results of absorption and emission of other quantum particles (elementary particle), respectively. The acceleration $w_{n+1,n}$ of the quantum particle under the transition $n \to (n+1)$ which is effect of absorption of other quantum particle (photon) is defined by the formula

$$w_{n+1,n} \equiv (\nu_{n+1} - \nu_n)(\nu_{n+1} - \nu_n) \equiv \nu_{n+1,n}\, \nu_{n+1,n}\,.$$

11) The excitation of the energy state of the atom (quantum particle) leads to a change in the energy of bond between the electron and the nucleus. This means a change in the structure of the atom. The atom makes transition from the excited state to the unexcited state by a structural (energy) transition with the emission of photon. The elementary act of structural radiation of the photon by the atom is described by the following relationship:

$$(E_{n+1}^{(atom)} - E_n^{(atom)}) = h\nu_{n+1,n}^{(photon)}$$

where $(E_{n+1}^{(atom)} - E_n^{(atom)})$ is an indecomposable expression. This correct relationship defines the qualitative and quantitative determinacy of the emitted photon. This quantitative relationship satisfies the formal-logical law of identity:

(qualitative determinacy of photon) =
(qualitative determinacy of photon).

The proof of this assertion is as follows. The correct relationship

$$(E_{n+1}^{(atom)} - E_n^{(atom)}) \neq E^{(atom)}$$

signifies that the quantity $(E_{n+1}^{(atom)} - E_n^{(atom)}) \neq 0$ does not belong to atom. (In other words, the qualitative determinacy of the quantity $(E_{n+1}^{(atom)} - E_n^{(atom)}) \neq 0$ does not represent atom). This relationship is a negative formal-logical definition of the concept $(E_{n+1}^{(atom)} - E_n^{(atom)})$. A positive (formal-logical, physical, practical) definition of the concept $(E_{n+1}^{(atom)} - E_n^{(atom)})$ is the following definition:

$$(E_{n+1}^{(atom)} - E_n^{(atom)}) \equiv h\nu_{n+1,n}^{(photon)}\,.$$

This definition is correct because it satisfies the formal-logical law of identity.

Remark:
But the expression

$$E_{n+1}^{(atom)} = E_n^{(atom)} + h\nu_{n+1,\,n}^{(photon)}$$

is incorrect because it does not satisfy the formal-logical law of identity.

4. Explanation of the effect of shift of radiation frequency

As is known [122, 123], "spectral analysis of light from stars, distant galaxies and quasars shows that the frequencies of certain reference spectral lines are very noticeably shifted to the red edge, i.e. to the low-frequency edge of the visible spectrum. This red shift of the radiation of moving away stars and galaxies is interpreted on the basis of the normal Doppler effect: the change in the oscillation frequency, measured by the observer, under motion of the oscillation source and observer relative to each other. The relative quantity $\Delta\nu/\nu$ of the frequency shift is directly proportional to the distance from the source to the observer. The red shift caused (stipulated) by the Doppler effect arises if the motion of a radiation source relative to the observer leads to an increase in the distance between them. The Doppler effect is used to determine the speed of motion of radiation sources. The simplest non-relativistic explanation of the dependence between the radiation sources distance and the speed of their relative motion is given by the so-called "Big Bang" theory. Measurements of the Doppler shift of lines in the emission spectra of distant galaxies lead to the conclusion of an expanding Universe (the effect of "recession" of galaxies). But all known explanations for the red shift of radiation frequencies cannot be considered as proven statements" (Russian Wikipedia).

In my opinion, the correct foundations of the theory of quantum particle are the basis for the analysis of the red shift of the radiation frequencies.

In accordance with the correct foundations of the theory of quantum particle, the frequency of photon (i.e., the "color" of photon) is determined by the radiating particle. Therefore, the shift of the radiation frequency is a consequence of the shift of the energy levels of the radiating atom:

$$(E'^{(atom)}_{n+1} - E'^{(atom)}_{n}) \equiv h\nu'^{(photon)}_{n+1,\,n}.$$

where $E'^{(atom)}_{n+1}$, $E'^{(atom)}_{n}$ are shifted levels (i.e., shifted spectrum) of the energy of the atom, $h\nu'^{(photon)}_{n+1,\,n}$ is a shifted frequency of the photon. The shift of the energy spectrum of the atom arises because the ground level of the energy of the atom is shifted: $E_0^{(atom)} < E_0'^{(atom)}$. The shift of the ground level of energy $E_0^{(atom)}$ does not depend on the speed of motion of the quantum particle. This shift is determined by influence of environment. Consequently, the Doppler effect for a photon does not exist because the frequency ("color") of the photon does not depend on the speed of motion of the emitting atom.

5. The correct foundations of the theory of photon (quantum) gas being born by radiating atom

The quantum-statistical theory of photon (quantum) gas in isolated and closed macroscopic system "atom + atomic gas + photon gas" (where the subsystem "photon gas" being born by the subsystem "atom" in the process of quantum transitions not stipulated by acts of the atom-atom collisions) includes the theory of non-equilibrium ideal (normal) gas of nonradiating atoms and represents the following assertions [1-9, 12, 19, 21, 22, 40, 42, 50, 52, 58, 59, 66, 69, 105, 106, 112, 119]:

1) The theory of non-equilibrium ideal (normal) gas of nonradiating atoms is valid one.

2) Process of change in number of photons in the system is stipulated by acts of emission and of absorption of photons by atoms of ideal (normal) gas. This is stochastic process because the process of change in energy quantum state of the colliding atom is stochastic process.
3) The statistical ensemble of identical macroscopic systems "atom in nth quantum state + atomic gas + photon gas" defines probability $f_n(t)$ that atom is in nth quantum state:

$$f_n(t) \equiv \lim_{\mathrm{N}\to\infty} \frac{\mathrm{N}_n(t)}{\mathrm{N}}, \qquad \mathrm{N} = \sum_{n=0}^{\infty} \mathrm{N}_n(t), \qquad 0 \le t < \infty,$$

where $\mathrm{N}_n(t)$ is number of systems "atom in nth quantum state + atomic gas + photon gas" at point of time t; N is full number of systems "atom + atomic gas + photon gas" in the ensemble (this number does not depend on time).
4) Stochastic process of change in quantum state of atom in the system "atom + atomic gas + photon gas" represents Markovian process with numerable states and is described by the master equation

$$\frac{d f_n}{d t} = P(f_n), \; P(f_n) \equiv \sum_{\substack{m=0 \\ m\neq n}}^{\infty} \left[P_{n\,m}(t)\; f_m(t) - P_{m\,n}(t)\; f_n(t)\right], \;\; n = 0, 1, 2, \ldots \;\; .$$

5) The set k of identical (i.e. monochromatic) photons being emitted (born) with the energy

$$h\nu_{nm} \equiv \left(E_m - E_n\right)$$

by atom in the process $m \to n$ $(m > n)$ represents ν_{nm} -monochromatic photon gas. The number k of identical photons takes on values from 0 to ∞ because there is no physical prohibition on number of photons being emitted by atom. (In other words, there exists "secondary quantization" of energy of photon gas).
6) The energy of the monochromatic photon (quantum)) gas is a discrete random quantity. Every value of energy $h\nu_{nm}\,k$ – element of numerable set $\{h\nu_{nm}\,k\}$, $k = 0, 1, 2, \ldots$ – is in unambiguous (one-to-one) correspondence with the probability of energy state of the monochromatic photon gas of system "atom + atomic gas + ν_{nm} -monochromatic photon gas".
7) The statistical ensemble of identical macroscopic systems "atom + atomic gas + ν_{nm} -monochromatic photon gas" defines the probability $q_k(\nu_{nm}; t)$ that ν_{nm} -monochromatic photon gas is in kth quantum state at point of time t:

$$q_k(\nu_{nm}; t) \equiv \lim_{\mathrm{M}(\nu_{nm})\to\infty} \frac{\mathrm{M}_k(\nu_{nm}; t)}{\mathrm{M}(\nu_{nm})}, \qquad \sum_{k=0}^{\infty} q_k(\nu_{nm}; t) = 1, \qquad \mathrm{M}(\nu_{nm}) = \sum_{k=0}^{\infty} \mathrm{M}_k(\nu_{nm}; t)$$

where $\mathrm{M}_k(\nu_{nm}; t)$ is number of the systems "atom + atomic gas + ν_{nm} -monochromatic photon gas in kth quantum state" at point of time t; $\mathrm{M}(\nu_{nm})$ is full number of the systems "atom + atomic gas + ν_{nm} -monochromatic photon gas" in the ensemble.

In view of these assertions, stochastic process of change in states of ν_{nm} -monochromatic photon gas represents Markovian process with numerable states. It is described by the master equation $(m > n)$

$$\frac{d\,q_k}{d\,t} = W_{mn}^{k,\,k+1}\, f_n\, q_{k+1} - \left(W_{nm}^{k+1,\,k}\, f_m + W_{mn}^{k-1,\,k}\, f_n\right) q_k + W_{nm}^{k,\,k-1}\, f_m\, q_{k-1}$$

where $W_{mn}^{k,\,k+1}$ is probability of transition $(n, k+1) \to (m, k)$ per unit of time. In accordance with the principle microscopic reversibility of transition processes, the relationship

$$W_{mn}^{k,\,k+1} = W_{nm}^{k+1,\,k}$$

is valid. The coefficients $W_{mn}^{k,\,k+1}$ and $W_{nm}^{k+1,\,k}$ characterize the transition processes $(n, k+1) \leftrightarrow (m, k)$ resulting from a great number of separate (elementary) acts. This master equation at $t \to \infty$ represents the equation of detailed balance

$$f_n^{\circ}\, q_{k+1}^{\circ} = f_m^{\circ}\, q_k^{\circ}, \quad \text{i.e.} \quad q_{k+1}^{\circ} = q_k^{\circ} \exp\left(-h\nu_{nm}/T\right),$$

where T is the statistical temperature of atom. Obviously, unique solution q_k° of this functional equation is Gibbs quantum canonical distribution:

$$q_k^{\circ} = q_0^{\circ} \exp\left(-h\nu_{nm}\, k/T\right), \qquad q_0^{\circ} = 1 \Big/ \sum_{k=0}^{\infty} \exp\left(-h\nu_{nm}\, k/T\right) = 1 - \exp\left(-h\nu_{nm}/T\right).$$

Substituting well-known quantum-mechanical relationship

$$W_{mn}^{k,\,k+1} = (k+1) W_{mn}^{01}$$

into the master equation and taking into consideration the definition of statistical-average energy

$$h\nu_{nm}\, \rho(\nu_{nm}; t) \equiv h\nu_{nm} \sum_{k=0}^{\infty} k\, q_k\, (\nu_{nm}; t)$$

of ν_{nm} -monochromatic photon gas, one can reduce the master equation to form

$$\frac{d\,\rho}{d\,t} = W_{nm}^{10} \left[(\rho + 1)\, f_m - \rho\, f_n \right]$$

where ρ is statistical-average number of monochromatic photons being born by atom. In the stationary (equilibrium) case (i.e., at $t \to \infty$), this equation takes on the form

$$\left(\rho^{\circ} + 1\right) f_m^{\circ} = \rho^{\circ}\, f_n^{\circ}.$$

The solution of this equation is Planck function (i.e. Bose distribution):

$$\rho^{\circ} = \left[\exp\left(h\nu_{nm}/T\right) - 1\right]^{-1}.$$

This correct result permits to compare the obtained master equation in the ρ with Einstein's equation. The comparison leads to the unique correct relation for Einstein coefficients:

$$A_{nm} \equiv B_{nm} \equiv B_{mn} \equiv W^{10}_{nm}.$$

Thus, the formulated theory of photon gas is based on statistics of radiating atom of the normal gas. The equilibrium photon (quantum) gas obeys "Gibbs statistics": photon gas in the isolated equilibrium system "atom + atomic gas + photon gas" is described by Gibbs quantum canonical distribution. Planck function (i.e., Bose distribution) is consequence of Gibbs distribution. The temperature T in Planck function represents the statistical temperature of radiating atom of the normal gas. Einstein coefficients A_{nm}, B_{nm}, B_{mn} are equal to each other and, consequently, loss the generally accepted physical meaning.

6. Analysis of the theory of "hot" Universe

The correct foundations of the theory of photon (quantum) gas being born by radiating atom are basis for the correct analysis of the theory of "hot" Universe.

As the theory of photon (quantum) gas being born by the radiating atom shows, the statistical-average number of monochromatic photons in the stationary (equilibrium) case (i.e., at $t \to \infty$), is described by the Planck function where the statistical temperature T is the statistical temperature of the radiating atom. The Planck function and the Planck law characterize an isolated and closed system. In this point of view, the following statements are true:

(a) If the Planck function and the Planck law characterize the state of the background photon gas in the Universe, then the Universe represents an isolated and closed system that is in the state of statistical equilibrium. The statistical temperature T is the statistical temperature of the radiating substance (atoms, molecules). The statistical temperature T is not the statistical temperature of the photon gas.

(b) If the isolated and closed Universe was the "hot" Universe at the point of time $t = 0$, then the isolated and closed Universe is the "hot" Universe at any point of time $0 < t < \infty$ because the energy of the isolated and closed system (i.e., the Universe) is the conserved quantity: $E^{(isolated\ and\ closed\ system)} = const$. If the isolated and closed Universe is the "cold" Universe at the points of time $0 < t < \infty$, then the isolated and closed Universe was the "cold" Universe at the point of time $t = 0$ because the energy of the isolated and closed system (i.e., the Universe) is the conserved quantity: $E^{(isolated\ and\ closed\ system)} = const$.

(c) Background radiation does not represent relict radiation because the isolated and closed Universe is a "cold" Universe at arbitrary point of time $0 \le t < \infty$.

Consequently, the "hot" Universe theory and the "Big Bang" theory [122, 123] are erroneous theories.

7. Discussion

1. As is known, "the formation of modern cosmology is related to the creation of the relativistic theory of gravity (A. Einstein, 1916) and the birth (origination) of extragalactic astronomy (20s of the 20th century). At the first stage of the development of relativistic cosmology, the main attention is paid to the geometry of the Universe (to the curvature of four-dimensional space-time and the possible closure of the Universe). The beginning of the second stage is characterized by the works of the mathematician A.A. Friedman (1922-1924) in which it is shown that the Universe filled with gravitating substance cannot be in stationary state (i.e., the Universe must be expanded or contracted). A.A. Friedman's works win the recognition after the discovery of the red shift of radiation (i.e., effect of the "recession" of galaxies) by E. Hubble (1929). These results stimulated the study of the problems of mechanics and the age of the Universe. The third stage is characterized by the creation of models of the "hot" Universe (G. Gamow, second half of the 40s of the 20th century) which focuses on the physics of the Universe

(i.e., states of substance and physical processes of the expansion of the Universe in various periods of time). G. Gamow's "hot" Universe model is based on A.A. Friedman's theory of an expanding Universe. According to A.A. Friedman, at first there was an explosion. It occurred at the same time and everywhere in the Universe, filling the space with very dense substance. After billions of years, the observable objects in the Universe (the Sun, stars, galaxies and planets, including the Earth) were formed from very dense substance. According to G. Gamov, the primary substance in the world was not only very dense, but also very hot. G. Gamow's idea represents the "Big Bang" model which is the most used scientific model for the evolution of the Universe. The "Big Bang" model asserts that the earliest state of the Universe was an extremely "hot" and dense one (this state is called a cosmological singularity), and that the Universe subsequently expanded and cooled. The model is based on general relativity and on simplifying assumptions such as homogeneity and isotropy of the Universe" (Russian Wikipedia).

2. A characteristic feature of our time is high pace of life. Scientists do not have the time and desire to question old theories. Scientists do not receive fees for criticizing the old theories. Therefore, scientists use the old theories to move forward faster. But they cannot think independently, reasonably, rationally. They have lost the important property of scientist: to think independently, reasonably, rationally. The independence, reasonableness, rationality of thinking in science signifies thinking (reasoning) within the framework of the correct methodological basis: the unity of formal logic (as the science of correct thinking) and rational dialectics. Scientists have lost the desire to search, to understand, and to comprehend the truth. Therefore, cosmological models that are based on the Hubble law, the Doppler effect, the model of "hot" Universe, the "Big Bang" model, and the general theory of relativity do not satisfy the criterion of truth and represents scientific lie.

2. If one destroyed and disassembled a house into its constituent elements, then one could not restore this house without plan, engineering drawings and diagrams (i.e., without the program to build the house). Similarly, the Universe could not go out of the singular state without a program of development and existence. This is the dialectical objection to the "Big Bang" theory. In addition, in the point of view of formal logic, scientists make the following gross logical error: they are trying to determine (define) the unknown past state or the future state of the Universe on the basis of unknown present state of the Universe.

3. Recently, scientists create fantastic (farfetched, cockamamie, absurd, loony) models of the Universe based on "Big Bang" theory and theory of relativity. But, as my 30-year-old experience of critical analysis of A. Einstein's works shows, the special theory of relativity (and, consequently, the general theory of relativity) contains the following formal-logical errors: the standard interpretation of the conditions and results of the Michelson-Morley experiments; definitions of the concepts of space and time; Lorentz transformations. Moreover, all the works of A. Einstein (including the work on the photoelectric effect theory) contain formal-logical errors.

4. The fallaciousness of the Universe models based on the Hubble law, the Doppler effect, the model of "hot" Universe, the "Big Bang" model, and the general theory of relativity is proof of the fact that the correct physical theory of the Universe cannot be created. In my opinion, the Universe at once did not arise in parts or in stages. The Universe manifested itself materially at once as the whole, as complete and finished system. (Similarly, a child is born at once as an indivisible whole). The Universe represents the isolated, closed, stationary, single and unique system. In the philosophical point of view, the Universe is the unity of the essence (information) and the material manifestation of the essence. Therefore, systems approach, information theory, control theory and control-system theory (as the concretization of the basic principles of rational dialectics) can be one of the starting points of the correct theory of the Universe as a system.

Conclusion

Thus, the analysis of the Hubble law, the Doppler effect, and the theory of "hot" Universe within the framework of the correct methodological basis (i.e., the unity of formal logic and rational dialectics) leads to the following conclusion:

1) the Hubble law represents the formal-logical error because the Hubble formula contradicts to the correct definition of the speed of motion of the material object;

2) the Doppler effect represents the physical error because the speed of motion of the photon does not depend on the speed of motion of the radiating atom. The correct explanation of the red shift is that the frequency shift of the radiation is the result of a shift in the energy spectrum of the radiating atom;

3) the theory of "hot" Universe represents the physical error because the Universe is the "cold" Universe at any point of time. The correct explanation is that the background radiation is described by the Planck function (the Planck formula). The Planck function (Planck formula) characterizes the equilibrium state of the isolated and closed macroscopic system "photon gas + gas of radiating atoms" (where temperature is the statistical temperature of the radiating atom). Consequently: (a) the Universe represents the isolated and closed system at any point of time; (b) the total energy of the Universe is a conserved quantity at any point of time; (c) the low temperature of substance in the Universe is a conserved quantity at any point of time.

These results signify that the correct physical theory of the Universe cannot be created.

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