Thermal photons. Molecule recoil in photon emission

Professor Vladimir Leonov

This article was published like chapter 8 in the Leonov's book: Quantum Energetics. Volume 1. Theory of Superunification. Cambridge International Science Publishing, 2010, pp. 583-602. This article is the basis of quantum thermodynamics. The fact is that the molecular-kinetic theory of heat is morally outdated and does not reflect modern requirements. We cannot formulate the correct concept of temperature. We only state the fact that with increasing temperature the chaotic vibrations of molecules and atoms increase. But this is a consequence. The cause of the phenomenon is the recoil of the molecule (atom) upon emission of a photon. The recoil force of a molecule (atom) upon emission of a photon was first calculated only in the theory of Superunification. And here we are faced with another paradox of quantum theory. It turns out that the recoil force is inversely proportional to the energy of the photon when it is emitted. The maximum recoil force per molecule (atom) is produced by low-energy thermal (infrared) photons. High-energy photons do not produce thermal effects. The temperature of a substance is determined by the concentration of thermal photons in it.

In the development of quantum thermodynamics in the Superunification theory it was necessary to deal with the paradox contradicting classic approaches. It has been established that atom recoil in photon emission is inversely proportional to photon energy. The strongest recoil is characteristic of thermal low-energy photons. This result is explained by the special feature of the two-rotor structure of the photon – the compound and inseparable part of the quantised space-time. The electrical rotor of the photon induces an electrical field in the quantised space-time which, acting on the charge of the atom nucleus, produces a momentum, ensuring a recoil of the atom (molecule) and their oscillations. The atom (molecule) is repulsed from the electrically polarised quantised space-time and not from the photon. Only in this case can calculations produce the results corresponding to the actual processes and eliminate the existing energy paradox.

8.1. Energy paradox in atom recoil

The results of the previously described investigations of photon emission by the orbital electron [1], including the results obtained previously for the photon structure [2], open new prospects for the development of quantum thermodynamics. Taking into account the restrictions of the current molecular thermodynamics, the development of quantum considerations regarding the nature of heat make it possible to investigate the principle of various concepts such as temperature, heat capacity and heat forming capacity (the heat of combustion of fuel), linking the nature of these

thermodynamic parameters with the nature of thermal photons.

Regardless of the advances in molecular thermodynamics and molecular-kinetic theory of heat, the reasons for the thermal motion of the molecule are ignored and considerations are restricted to concluding that the manifestation of heat is associated with the thermal motion of the molecules. However, what does prevent the atoms and molecules from moving (vibrating) and determines the temperature parameters of matter? The only reason for this motion is the atom recoil (molecule recoil) in emission and re-emission of the photon, or in interaction with the photon without re-emission. It is difficult to propose another concepts. Despite this, the mentioned concept has not been developed any further because of a number of reasons:

1. The two-rotor structure of the photon and the method of calculating the electromagnetic parameters of the rotors were not known. This problem was solved in [3].

2. The nature of emission of the photon as a result of the mass defect of the orbital electron was not known. This problem is solved in this book.

3. There were clear contradictions between molecular thermodynamics and quantum theory. In accordance with (6.1), the photon energy increases with increasing frequency. However, the observed atom (molecule) recoil is characterised by an inverse dependence and increases with decreasing frequency energy in the infrared region disrupting apparently the energy balance. In interaction with the atom (molecule), the photon does not behave in the classic fashion.

In his studies, Planck faced a similar non-classic problem when investigating the radiation of a black body with the radiation intensity proportional to the field frequency (1). This contradicted classic electrodynamics in accordance with which the intensity of electromagnetic radiation is determined by the strength of the field. The authors of [3] describe the reasons for the proportionality of the energy (6.1) to the photon radiation frequency when the unique structure of the photon as a relativistic particle determines the non-classic behaviour of the photon:

$$W = \hbar\nu \tag{8.1}$$

where $\hbar$ is the Planck constant, ν is radiation frequency, Hz.

8.2. Classic approach to calculating the atom recoil

From the classic viewpoint, the momentum **p** of the orbital electron at the moment of photon emission is equivalent to the photon momentum and determined by the mass defect Δm_c of the electron and the speed of the

photon $\mathbf{C}_0$:

$$\mathbf{p} = \Delta m_e \mathbf{C}_0 \tag{8.2}$$

The modulus of the momentum p (8.2) can be connected with the frequency of photon emission (8.1):

$$p = \frac{\Delta m_e C_0^2}{C_0} = \frac{\hbar\nu}{C_0} \tag{8.3}$$

At the moment of photon emission, the momentum p (8.3) should recoil not only to the orbital electron but also to the atom (molecule) as a whole. The recoil speed n, for example, of a hydrogen molecule with mass $2m_p$ (where m_p is the proton mass), can be determined on the basis of the equivalence of the amount of motion $2m_p$ of the molecule and the momentum of the photon p (8.3):

$$2m_p v = \frac{\hbar\nu}{C_0} \tag{8.4}$$

Equation (8.4) is used to determine the speed of recoil n of the hydrogen molecule in emission of a thermal infrared photon, for example, with a frequency of $2.3\cdot10^{14}$ Hz (wavelength $l = 1.3\cdot10^{-6}$ m) from the Paschen series:

$$v = \frac{\hbar\nu}{2m_p C_0} \approx 0.02\,\text{m}/c << 1800\ \text{m/s} \tag{8.5}$$

The mean speed of thermal motion of the hydrogen molecule at temperature $t = 0°C$ is ~1800 m/s. The results of calculations carried out using the classic equation (8.5) give too low a value of the recoil speed (by almost a factor of 10^5). At the same time, as already mentioned, an increase of the photon emission frequency reduces the recoil speed (instead of increasing it), as shown by (8.5). To obtain a speed of 1800 m/s, the molecule should emit approximately 10^5 photons in the direction opposite to the direction of thermal motion. It is not possible to produce charge synchronous radiation in one direction, taking into account the random nature of the radiation process. At the same time, the process of continuous radiation of the molecule is not substantiated from the energy viewpoint because emission is possible only from the state of preliminary excitation. Even if we examine the problem of multiple photon re-emission, and also the effect of both the accelerating and decelerating momentas, it may be seen that again the molecule cannot be accelerated to the required speed of thermal motion. In particular, the random nature of thermal motion should determine the required speed of the molecule as a result of recoil at the moment of

photon emission. However, the calculation results are not in agreement with the observed facts.

Thus, the classic approaches are not suitable for investigating the recoil of atoms (molecules) at the moment of emission (absorption) of the photon. If we use equation (8.5), there should be no recoil. However, this contradicts experimental observations of the Brownian motion of the particles determined by molecule recoil in interaction with thermal photons and has been regarded for a long time as the fluctuation of thermal vibrations of the particles as a result of random bombardment with the molecules because only an increase of the temperature increases the intensity of thermal oscillations of Brownian particles (without interrupting this vibrations). Like perpetual motion, the Brownian motion is never interrupted and its intensity increases with increasing temperature.

8.3. Method of calculating atom (molecule) recoil in photon emission

Since the classic approaches do not work in analysis of molecule recoil in interaction with a thermal photon, the reasons for thermal motion of the molecules must be found in the two-rotor structure of the photon (Fig. 6.10, 8.1).

It was shown in [1, 2] that the non-classic motion of the photon in the optical medium along the wave trajectory is associated with the capture of the atomic centres of the lattice of the optical medium by the photon rotor. The wave trajectory of the photon is longer than the straight path. For this reason, the phase speed C_p in the optical medium is lower than the speed of the photon C_0 in the quantised space-time. In particular, knowledge of the structure of the photon has made it possible to determine the reasons for the reduction of the speed of the photon in the optical medium which were not previously known.

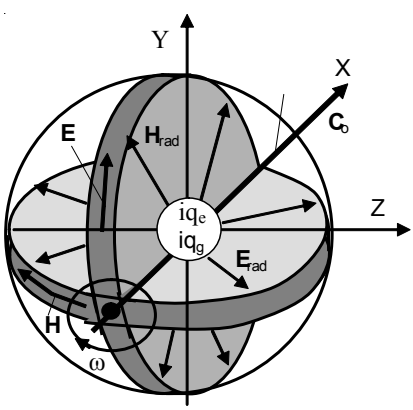

Fig. 8.1. Two-rotor structure of the photon emitted by an orbital electron.

The information on the two-rotor structure of the photon (Fig 8.1) will now be applied for the evaluation of the force momentum under the effect on the atom (molecule). The solution will not be found on the basis of the principle of equivalence of the momentum (8.3) of the photon to the amount of motion of the molecule (8.4), and it will be determined on the basis of the interaction of the electrical field E of the photon rotor with the electrical charge eZ_p of the atomic nucleus during its capture by the rotor (here Z_p is the number of protons in the nucleus).

In fact, the electrical field of the photon rotor polarises the quantised space-time. If the atom nucleus is situated in the electrically polarised field, the atom charge will be subjected to the effect of a force from the side of this field, i.e., from the side of the quantised space-time. The atom (molecule) in photon emission is not repulsed from the photon and instead is repulsed from the electrical field of the quantised space-time induced by the photon. In particular, the quantised space-time electrically polarised by the photon 'ejects' the atom (molecule) ensuring their recoil during photon emission.

Figure 8.2 shows the scheme of the effect of the electrical field **E** of the photon rotor on the charge eZ_p of the atom nucleus with the force **F** when the atom nucleus is captured by the electrical rotor. The vector of the force **F** is directed along the vector **E**. The actual value of the strength **E** of the electrical field in the rotors of the infrared photon with a frequency $2.3\cdot10^{14}$ Hz (wavelength $\lambda = 1.3\cdot10^{-16}$ m) from the Paschen series is determined using equation (6.42) from [2] for $\varphi_e = 0.511\cdot10^6$ V and the mean length ℓ of the line of force of the photon

$$E = \frac{\varphi_e}{\ell} = \frac{2\varphi_e}{\pi\lambda} = 2.5\cdot10^{11}\,\frac{\text{V}}{\text{m}} \tag{8.6}$$

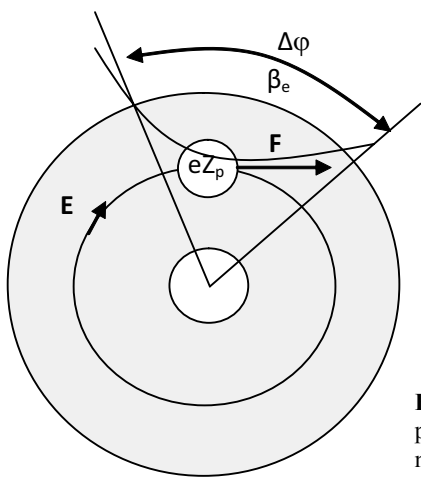

Fig. 8.2. Effect of electrical field **E** of the photon rotor on the charge eZ_p of the atom nucleus with force **F**.

Further, we estimate the actual value of force F on the electrical charge eZ_p of the atom in the electrical field of the rotor E:

$$F = EeZ_p \tag{8.7}$$

The duration t of the effect of the force F (8.7) is estimated on the basis of the half-period 0.5 T and the coefficient k_t of simultaneous interaction between the photon and the atomic nucleus which determines more accurately the duration of the effect of t as part of the half period:

$$\tau = k_\tau 0.5T = \frac{k_\tau}{2\nu} \tag{8.8}$$

From (8.7) and (8.8) we determine the momentum $F\tau$ and equate its value to the amount of motion of the hydrogen molecule with mass $2m_p$, taking into account that the force F (129???), acting on a single atom for $Z_p = 1$, also acts on the entire hydrogen molecule

$$Ee\frac{k_t}{2\nu} = 2m_p v \tag{8.9}$$

From (8.9) we determine the thermal speed of the molecule v:

$$v = \frac{k_t}{4}\frac{Ee}{m_p\nu} \tag{8.10}$$

In contrast to (8.5), in the equation (8.8) for the thermal speed of the molecule n, frequency n is included in the denominator. This corresponds to the observations assuming that only the low-energy photons are capable of carrying out the thermal effect on the molecules. As already mentioned, the thermal mean speed of the hydrogen atom at temperature t = 0°C is ~1800 m/s. Consequently, from (8.10) we determine the value of simultaneity coefficient k_τ for the infrared photon with a frequency of $2.3 \cdot 10^{14}$ Hz

$$k_\tau = \frac{4m_p\nu v}{Ee} = 0.07 \tag{8.11}$$

Equation (8.2) shows that a short-term momentum of $0.035T$ (8.8) is sufficient for the electrical field of the rotor of the infrared photon to accelerate the hydrogen atom to the required speed of thermal motion of ~1800 m/s. Consequently, we can estimate the momentum p received by the hydrogen atom in capture of the photon by the rotor

$$p = F\tau = \frac{k_\tau Ee}{2\nu} \tag{8.12}$$

Thus, even very approximate calculation show that the source of thermal motion of the molecules can be only photons or, more accurately, low-energy

thermal photons. As indicated by (8.12), the value of the momentum p is inversely proportional to the frequency of the emitted photon and, correspondingly, inversely proportional to its energy. This is in agreement with the observed facts.

We can calculate more accurately the force F (8.7) and momentum p (8.20), taking into account the distribution of the strength of the electrical field E both inside the photon rotor and with respect to time [2], and also the duration of combined interaction between the photon and the atom nucleus. However, this greatly complicates the mathematical equations and only slightly improves the accuracy of the calculations without changing in principle the nature of the problem. It is more important to show the reasons for which the moments (8.3) and (8.1) differ so greatly from each other, both in respect of the magnitude and nature.

Equation (8.3) was derived under the false condition in which the photon was regarded as an isolated (closed) particle (matter in itself). In fact, as shown in [2], the photon is an open quantum mechanics system, being the compound part of the quantised space-time. The Superunification theory is the quantum theory of open quantum mechanics systems. In this case, the vector of the strength **E** of the electrical field belongs to both the photon rotor and the quantised medium (Fig. 8.2). Therefore, the momentum of atom (molecule) recoil is not connected with the photon as an isolated particles and it is connected with the photon as part of the quantised stationary system. Atom (molecule) recoil in interaction with the photon takes place during repulsion from the quantised medium which is stationary. The result (8.12) corresponds to the true interaction between the photon and the atom as an open quantum mechanics systems, where the result of (8.12) is affected by the interaction with the quantised medium through the superstrong electromagnetic interaction (SEI) which is not taken into account in (8.3). The effect of the magnetic field of the rotor and radial fields of the photon on the recoil can be analysed [2]. However, this is the subject of a separate investigation which should supplement information on the random nature of the given processes and the statistical scatter of the parameters of the recoil momentum, both with respect to magnitude and direction.

8.4. Energy balance of the atom in photon emission

Only slight interest of the investigators in the processes of thermal recoil of atoms (molecules) in interaction with thermal photons is also caused by the fact that, from the classic viewpoint, the energy of the emitted photon is considerably smaller than the kinetic energy of the thermal motion of the molecule as a result of the effect of the recoil momentum. It would appear

that this is the clear violation of the law of conservation when the energy balance is not maintained. The kinetic energy of thermal motion of the molecule $0.5mv^2$ is considerably higher than the energy $\hbar\nu$ of the emitted photon, and as a result of recoil in photon emission, the molecule receives the speed v

$$\frac{1}{2}mv^2 \gg \hbar\nu \tag{8.13}$$

In fact, the laws of energy conservation are not violated, taking into account the fact that the only source of energy in the universe is the quantised space-time, being the carrier of superstrong electromagnetic interaction. The photon is only a 'trigger', activating the mechanism of release of the energy of SEI. This is also found in the electron accelerators where a small amount of energy controls a powerful energy flux. A source of powerful energy is required in this case. The energy of SEI is such a powerful source here.

To determine the actual amount of the energy transferred by the quantised medium to the atom (molecule) as a result of photon emission, it is necessary to look for the kinetic energy of recoil in the interaction with the quantised medium and not link it with the photon emission energy. The photon is a relativistic particle – wave as a result of electromagnetic polarisation of the quantised medium. Therefore, the recoil momentum takes place from the polarised quantised medium and not from the photon. Consequently, the molecule is accelerated to the speed v (8.10) which also determines the kinetic energy W_k of the hydrogen molecule:

$$W_k = \frac{1}{2}(2m_p)v^2 = m_p\left(\frac{k_t}{4}\frac{Ee}{m_p\nu}\right)^2 = \frac{1}{16m_p}\left(\frac{k_tEe}{\nu}\right)^2 \tag{8.14}$$

The total energy of interaction of the atoms (molecules) with the quantised medium, taking SEI into account, is determined by the work carried out in the transfer of the atomic nucleus in the electrical field of the photon rotor which should be equivalent to the kinetic energy of thermal motion but not to the photon emission energy. These are different energy parameters of the open quantum mechanics system. The work W in the transfer of the atomic nucleus in the electrical field E of the rotor along the path $\Delta\ell$, can be described taking into account force **F** (8.7) and angle α between the direction of the force **F** (vector of the strength of the field **E**) and the direction of the trajectory along the path $\Delta\ell$, in the photon rotor (Fig. 8.3)

$$W = \int F\cos\alpha d\ell = \int EeZ_p\cos\alpha d\ell \tag{8.15}$$

In order to solve (8.15), it is necessary to know the function of distribution of at least strength **E** of the field along the path $\Delta\ell$. The function of the strength **E** was determined in [2] but the trajectory of the path $\Delta\ell$, which is random, was not determined. The problem is greatly simplified if the work is estimated on the basis of the maximum difference of the electrical potentials $\Delta\varphi_{max}$ travelled by the atom nucleus in the electrical field of the photon rotor, irrespective of the form of the trajectory.

Taking into account that the rotor electrical potential φ_e of the photon is known and equals $\varphi_e = 0.511 \cdot 10^6$ V [2], the difference of the electrical potentials $\Delta\varphi$ is determined by the angle β_e (in radians)

$$\Delta\varphi = \frac{\beta_e}{2\pi}\varphi_e \tag{8.16}$$

To determine the work for the transfer of the atomic nucleus in the electrical field with a difference of the electrical potentials of the rotors $\Delta\varphi$, it is sufficient to know the coordinates of entry and exit of the nucleus in the rotor which defined the angle β_e

$$W = \Delta\varphi e Z_p = \frac{\beta_e}{2\pi}\varphi_e e Z_p \tag{8.17}$$

The work W (8.17) determines the kinetic energy $W_k = 0.5\, m_m v^2$ of the thermal motion of the molecule with the mass m_m as a result of interaction with the photon through one of the atoms

$$\frac{\beta_e}{2\pi}\varphi_e e Z_p = \frac{1}{2} m_m v^2 \tag{8.18}$$

From (8.18), we determine the speed of thermal motion of the molecule:

$$v = \sqrt{\frac{\beta_e \varphi_e e Z_p}{\pi m_m}} \tag{8.19}$$

Attention should be given to the fact that the speeds of thermal motion

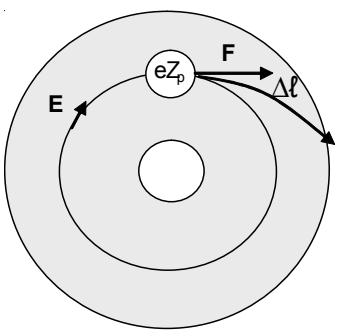

Fig. 8.3. Calculation of the work of transfer of the nucleus in the electrical field **E** of the photon rotor with the effect of the atom nucleus with the force **F** on the charge eZ_p.

of the molecules determined from the equations (8.8) and (8.19) are equivalent because they take into account the effect of superstrong electromagnetic interaction with the photon recoil of the molecules. Kinetic energy W_k (8.14) ensures the energy balance in atom (molecule) recoil at the moment of photon emission.

8.5. Nature of thermal oscillations

The parameters of pressure p and volume V, linked together and with temperature T, show that an increase of the temperature increases the speed of random oscillations of the molecules and atoms in the gas medium (including plasma) or in solids [3]. However, the random movements of the molecules and atoms with increasing temperature are determined by their recoil as a result of photon emission by the orbital electron. This means that the thermal oscillations of the molecules and the atoms are only a consequence caused by the concentration of the photons which can be characterised as thermal photons.

In fact, heating of a solid is associated with an increase of the concentration of thermal photons in the solid which have been many times re-emitted on the atoms and molecules, generating recoil momenta leading to temperature oscillations. Part of the thermal photons leave the heated solid and a thermodynamic equilibrium is established under specific conditions in which the concentration of the thermal photons is stabilised, stabilising the temperature of the solid.

Therefore, it is more logical to link the temperature of the solid (gas) with the concentration of the thermal photons in the solid (gas). It is necessary to determine the radiation spectrum and the spectrum of absorption of thermal photons, linking the concentration of thermal photons with the spectrum on the basis of the integral features. In the final analysis, this integral approach makes it possible to characterise the temperature as a spectral concentration (taking into account the energy with the thermal photon) of the thermal photons in the unit volume or mass of the matter, taking into account the non-linear form of these dependences. Actually, in rapid compression of the gas (by a factor of two), the concentration of thermal photons in the volume is doubled whereas temperature is not doubled and in calculations is linked with the absolute temperature.

Therefore, the absolute temperature zero can be represented by the state of matter in complete absence of the thermal photons in it when the atoms and molecules do not emit and do not re-emit photons.

Consequently, it may be concluded that the heat and temperature are determined by the concentration of thermal photons in the unit volume or

mass of the matter, of course, with the frequency distribution taken into account.

Naturally, the development of quantum thermodynamics requires a considerable effort by theoreticians and is time consuming. It is therefore important to mention the main directions of development of quantum thermodynamics and determine the concept of temperature in the initial stage. Regardless of the fact that temperature as a physical parameter is one of the main parameters in molecular ceramics, current ceramics does not have an exact definition of the concept of temperature [3]. The definition of temperature T as a derivative of internal energy U with respect to entropy S does not reflect the physical nature of temperature

$$T = \frac{\partial U}{\partial S} \tag{8.20}$$

The molecular–kinetic interpretation of temperature is linked with the mean kinetic energy of gas molecules or the energy of thermal oscillations of the centres of the solid lattice. However, this is the external side of the thermal phenomena. It is necessary to determine the reasons for thermal oscillations of the molecules. Investigations of photon emission in the present book and also of the two-rotor structure of the photons and their interaction with atoms in [2] indicate that the reason for thermal oscillations of the atoms and molecules are in particular photons, but not all the photons, only thermal ones.

As shown, the complicated nature of the theoretical investigations in this direction encounters contradictions associated with the photon energy. It would appear that as the photon energy increases, the strength of the effect of the photon on the molecule also increases and the photon emits an atom in the composition of the molecule and is many times re-admitted. In this case, the recoil momentum should be determined by the photon energy. However, it appears that the photon energy is not linked with the intensity of thermal oscillations of the molecules and the high-energy photons do not have any significant thermal effect on the molecules. Only a specific group of the low-energy photons is capable of ensuring thermal oscillations of the molecules. This group must be placed in the group of thermal photons. Consequently, the parameters such as: temperature, heat capacity, heat conductivity, energy recoil of fuel, are determined more accurately.

If the temperature is regarded as the spectral concentration of thermal photons in the unit volume of matter, then the heat capacity must be linked with the capacity of matter to retain thermal photons and its conductivity with the speed of movement of the flux of thermal photons in matter. These are quantum approaches to the thermodynamics in which the continuous

thermal fields are determined by the effect of discrete and random fields of thermal photons.

The aim of development of quantum energetics is also to increase the efficiency of the conventional types of fuel. The energy output of chemical fuel is determined by its capacity to produce thermal photons as a result of the mass defect of valence electrons in chemical reactions during changes in the molecular bonds. If conditions are created in which there is a directional (not random) emission of thermal photons, the recoil of the molecules o the blades of a turbine increases many times, increasing the efficiency of utilisation of fuel and of its conversion into mechanical and electrical energy.

8.6. High temperature superconductivity

The current theories of heat conductivity are based on a phenomenological description of a certain hypothesis because the superconductivity problems cannot be solved without knowing the reasons for emission of a conductivity electron in a conductor, knowing the structure of the electron (Fig. 7.1) in the space-time and the effect of the gravitational potential well (Fig. 7.6) of the atomic nucleus on the movement of a conduction electron in a strong electrical field of the nucleus.

Moving inside any conductor, the conduction electron emits energy into the surrounding space and its energy losses determine the electrical resistance of the conductor. In fact, any conductor in movement of electricity carriers in it is a generator of radiation, a peculiar converter of direct alternating current into thermal and optical radiation. If the radiation of the conductor or, more accurately, of conduction electrons in the conductor is interrupted, the conductor transfers to the superconducting state because there are no losses through irradiation into the surrounding medium.

The theory of Superunification supplements the theory of emission of the conduction electron by its structure in the space-time and by the strong effect of the gravitational well of the atomic nucleus on electron emission. In fact, in movement in a conductor the conduction electron is forced to interact with the atoms of the matter crammed with nuclei with gravitational wells and strong electrical fields, and it is very difficult for the electron to bypass them. An effect is also exerted by induced magnetic fields. In movement in such a complicated structure, the electron is subjected to the effect of strong alternating accelerations resulting in the exchange of orbital electrons with conduction electrons.

The conduction electrons, subjected to strong acceleration, and the orbital electrons, whose excitation takes place as a result of exchange with the

conduction electron, represent sources of radiation in the conductor. In particular, the structure of the material of the conductor determines its electrical resistance with the conductor playing the role of a peculiar generator of electromagnetic radiation whose source are primary conduction electrons. As shown by the theory of Superunification, electron emission is possible only as a result of its mass defect which is manifested in jumps (very strong acceleration) inside the gravitational the well of the atomic nucleus in the region of relativistic speeds. The mass defect of the electron results in the production of thermal photons whose spectral concentration determines the temperature of the conductor. This process is cyclic because the mass defect of the electron is replaced by the restoration of the mass defect at exit of the electron from the gravitational well of the atomic nucleus. This cyclic nature of the energy processes in the conductor results in the loss of energy through radiation (production of thermal photons) and, in the final analysis, in heating of the conductor and determines its electrical resistance. The compensation of energy through the losses in the conductor takes place by means of the energy of the electrical field of the power source.

If the emission the direction electron inside the conductor is interrupted, we obtain ideal superconductivity. An ideal superconductor is the quantised space-time free from matter, i.e., the physical vacuum. Once accelerated, the electron moves in it without radiation and with no resistance to movement, i.e., electrical resistance. It would appear that it is sufficient to take a hollow isolated tube in a vacuum and we obtain a very cheap superconductor, working in the widest temperature range.

However, the problem of vacuum superconductors is not reduced to the problem of formation of superconductivity; instead, it is reduced to the problem of introducing electricity carriers in vacuum and withdrawing them from it. This is the problem of the work function of the electrons from the cathode material, and the problem of reception of carriers by the anode which is in fact a target. Bombardment of a target with the electrons results in bremsstrahlung with a wide spectrum which is used partially for heating the anode and in the final analysis is completely scattered in space. In particular, the losses through the work function of the electrons and acceleration of the electrons in vacuum, and also the energy losses by the electrons in interaction with the anode, determine the electrical resistance of the system, although the main vacuum section is in fact an ideal superconductor.

Discussing the solid state high-temperature superconductors, the problems associated with the search for structures characterised by the formation of conduction bands similar to vacuum bands become evident. It

is necessary to produce conduction bands with the minimum depth of the gravitational wells and the maximum distance between the atomic centres, having a lesser effect on conduction electrons. On the other hand, a superconducting material should have a rigid structure (of the ceramic type) with a smaller external thermal effect which interfere with the movement of electricity carriers. At the moment, I do not know how to develop such structures. Evidently, we are concerned with laminated structures, possibly with the longitudinal orientation of the layers between which a vacuum-like condition is produced.

To eliminate the resistance of the conductor it is necessary to stop jump-like movement of the conduction electrons in the conductor. In a smooth (without jumps) movement of the electron in the gravitation well of the atomic nucleus, it's energy remains constant because the increase of the electrical component is completely compensated by the gravitational component. When the temperature of the conductor drops to very low values the thermal oscillations of the crystal lattice of the conductor and of the conduction electrons are terminated. This prevents the jump-like movement of the conduction electron which is the source of electron emission.

In any case, the theory of Superunification provides a powerful tool for analysis of the superconducting state of matter and a new direction for theoretical and experimental investigations in the area of development of superconducting materials.

8.7. Leonov's task

In April 2000 I posted on the Internet a study in which it was proposed to the physicists to test their forces in solving the problem of atom recoil including photon emission. Nobody replied for more than one year. Here, I present the full text of the Leonov task.

In the 17th century, the French mathematician Piette de Fermat threw a challenge to all mathematicians for many centuries ahead by formulating his outstanding theory which he solved and subsequently destroyed. For me, this precedent is a clear example of the proof of the superiority of the scientific mind over dogmas which always existed and in large numbers. However, history shows that the numerical majority has no meaning in fundamental science and the fundamental discoveries are made by lone persons subjected to several pressure from dogma tests.

There are many examples. Newton was brought to the stress state and temporary loss of reasoning, Boltzmann committed suicide, Einstein became an outcast in his native country Germany, Vavilov was murdered, and there are many similar examples. The dogmatists can be flawed by many means

that do not take any convincing reasoning because they regard themselves as true scientists and everything which does not fit in the narrow framework of the limited thinking is regarded as force science. In Russia, this phenomenon has acquired the hypertrophied form, expressed in the development of the anti-constitutional commission 'Fight with pseudoscience and falsification of the scientific investigations by the Presidium of the Russian Academy of Sciences (RAS) under the leadership of the atomic physicist Academician E. Kruglyakov who is the main inquisitor of the country. It is strange that this medieval formation inside the Russian Academy of Sciences includes Nobel Prize Laureate for Physics V.L. Ginzburg (now deceased) and the well-know populiser of science Prof. S.P. Kapitsa.

In science it is accepted that any new scientific concept, without being disproved, has the right to live together with the established views. If you cannot refute the new scientific concept, then you do not have the moral right to attempt to destroy, regardless of whether you agree with the new concept or not. This is the normal form of existence and development of science when at the point of change old concepts are replaced by new ones. But this conventional standard of the development of science is rejected by Kruglyakov's commission, reflecting the reactionary position of the RAS as a whole. I am not a specialist in the area of torsional fields, but as theoretical physicist, who created the theory of the Superunification of fundamental interactions - main physical theory, I cannot accept when Kruglyakov's commission brings into question the existence of torsional oscillations and also rejects antigravity and much more.

I entered physics in 1996, when after many years of meditation I discovered almost immediately the quantum of space-time (quanton) and superstrong electromagnetic interaction (SEI) whose existence was predicted by the genius Einstein in the form of the unified field. He spent more than 30 years of life searching for this without success. SEI unites the known interactions (electromagnetism, gravity, nuclear and electroweak forces) in the theory of Superunification.

Within several years I solved the very difficult tasks of theoretical physics, whose solution was put aside for at least a century. The structure of the quantised space-time, nature of gravity, antigravity and nuclear forces were determined. The quanton is the physical carrier of time, assigning the rate to electromagnetic processes and uniting space and time into the united substance. The limiting parameters of elementary particles were determioned, preventing infinite solutions. A two-component solution of the Poisson gravitational equation was obtained – fundamental equation of gravity, which determines mass as the result of the deformation (distortion

according to Einstein) of the quantised space-time. The wave equation of elementary particles was analytically derived and the structure of the electron, positron, proton, neutron, neutrino, photon described. It has been proven that the law of relativity is the fundamental property of the quantised space-time. The joint principle of relativity and quantum theory, which embarked on the path of deterministic development, were united.

I could mention many other solved tasks in the theory of Superunification, but I destroyed the solution of one fundamental problem of quantum theory and I propose to repeat its solution to all physicists. I am confident that now no one will be able to do this. I address this call to those physicists who fan cheeks from their importance and occupy leading posts in the RAS. Only in this manner is it possible to show their scientific insolvency and to simultaneously draw to the problem young people who are the future of Russian science. Before formulating the essence of task, it is necessary to make some explanations.

I was forced to make this step by the years irreconcilable and long-standing fight with the grayness, corruption and the scientific incompetence of the management of the RAS. This leads to the degradation of the academic system. You will never defend your thesis if your scientific work exceeds the level of members of the Russian Academy of Science. You can become a member of the Academy if you stand in a long que without allowing scientific dissent in order not to be excluded from the que. It is necessary to wait for death of a member of the RAS in order to occupy his/her place, or more precisely place on the elite cemetery. This is amoral in its basis. You will not be able to publish an article in an academic periodical, without being toady, without having acquaintances and support of members of the RAS, even if you are 'on the Einstein level'. Today no unknown patent inventor Einstein could publish his first and fundamental articles in a Russian academic periodical.

Such examples can be found quire easily. In the three editorial boards of the leading physical academic periodicals: Journal of Experimental and Theoretical Physics (chied editor Academician of RAS A.F. Andreev), Uspekhi Fizicheskikh Nauk (chief editor was Academician of RAS V.L. Ginsburg (now deceased)), periodical Theoretical and Mathematical Physics (chief editor Academician of RAS A.A. Logunov) there are 13 fundamental theoretical articles concerning Superunification with the total volume of more than 500 pages. In spite of all my urgent requests, specialists of the RAS cannot prepare the articles for review. The matter is down to the complete marasmus - they do not publish articles without a review, but there is no one write a since the RAS has no experts on superunification. There is a criminal suppression of new fundamental discoveries in addition

to the violation of the current legislation and constitution of the Russian Federation.

Gentlemen, the chief theorists of the RAS! In order to determine "Who is Who" in contemporary physics, I am sending you this challenge to solve Leonov's task which obviously is not to your liking. It has been solved by me. This is one of the primary task of quantum theory. I would like to mention that the formation of quantum theory at the beginning of 20th century was the result of the contradictions detected by Planck in the study of black body radiation, when the intensity of emission proved to be proportional to the frequency of the electromagnetic field. This contradicted the classical electrodynamics, in accordance with which the intensity of electromagnetic radiation is determined by the field strength and not by its frequency. The presence of such serious contradictions led in physics ton the discovery of the quantum of radiation (photon) – the particle transferring the energy of electromagnetic radiation in specific portions (discretely) in proportion to the field frequency.

Leonov's task

Today contradictions in quantum theory lie between temperature and atom recoil with the emission (absorption) of photon. It would seem that as the energy of the emitted photon increases, the recoil of the photon on the atoms becomes greater and the intensity of the temperature variations of atoms (molecules) also increases. In practice everything appears reversed, the largest recoil is produced by the low-energy infrared photon (thermal photon). The physical task of Leonov is thus formulated. It is necessary to mathematically prove that the thermal recoil of the atom (molecule) is inversely proportional to energy of the radiated photon.

Thus, gentlemen down to work! You became accustomed that the recoil of a gun is proportional to the pulse of the ejected bullet. It is now necessary to prove the reverse. These are the paradoxes of quantum theory. I will continue the criticism of the activity of the atomic physicits E. Kruglyakov who, after being absorbed in fighting pseudoscience, dedicated his entire life to the creation of anti-science such as the false concept of controlled thermonuclear fusion (CTF). One agrees that the temperature concept of CTF was not formulated by Kruglyakov but by founders of thermonuclear physics A.D. Sakharov, etc. But they also were not insured against errors.

More than four decades with the participation E. Kruglyakov we were told that the future of power engineering is controlled thermonuclear fusion (CTF), clowing down other directions of studies. With the aid of CTF they promised us to solve all energy problems of humanity by the year 2000,

after spending enormous sums of money. Time has gone past, energy problems not only have not been solved but the situation is now in a critical state. A new international project ITER costing 10 billion US$ (with Russia contributing $1 billion) has been proposed instead of inoperative CTF systems of the Tokamak type.

I openly declare that the ITER project is a grandious scientific adventure and will taxpayers money on antiscientific and futile studies as was the case with Tokamaks. CTF is based on the false temperature concept of synthesis. It was originally considered that it would be sufficient to heat the hydrogen-forming plasma in a magnetic trap to a temperature of 15 million degrees to start CTF of helium with the release of energy as a result of the mass defect of nuclei. The temperature in the plasma has already reached 70 million degrees, but CTF does not take place. The temperature concept of nuclear fusion does not work. Kruglyakov and his associates lead the government of the country and scientific community into a dead end.

It is now necessary to scientifically explain the reasons for the aforesaid. But I before advise Kruglyakov as an atomic scientist in the region of CTF, instead of becoming a flimsy inquisitor, he should study my work in the physics of the atomic nucleus and elementary particles, for example 'Electrical nature of nuclear forces' and others. Ignorance of the structure of nucleons and of the nature of nuclear forces resulted in the antiscientific concept CTF based erroneously on high temperature. I shall also show to Mr E. Kruglyakov that in interaction of nucleons inside the nucleus the zones of antigravity repulsion are opened and they stabilise nucleons and atomic nuclei. Antigravity is also widespread in nature, like gravity. It turns out that the physicist-atomic scientist, E. Kruglyakov, Academician of the RAS does not understand the nature of nuclear physics, but he attempts to stick the labels of antiscience to others.

Now, when the nature of nuclear forces in theory of Superunification is known, it is difficult to find a way of including the temperature factor in the CTF concept as a factor of overcoming the electrostatic repulsion of protons (hydrogen nuclei). The temperature concept of CTF was based on the positive experience with the explosion of the H-bomb, where the detonator was a preliminary nuclear explosion accompanied by the release of colossal energy. But in this case the temperature is one the factors of energy release. The high pressures and the accelerations, which 'press' proton nuclei onto each other to the distances of the action of nuclear forces (the electric forces of the alternating shells of nucleons), overcoming the electrostatic repulsion of nuclei, are other factors.

Purely because of technical reasons it is not possible to produce colossal pressures and particle accelerations under the action of nuclear explosion inside the thermonuclear reactors under laboratory conditions. Heating of plasma in the magnetic trap of Tokamaks is irrelevant. Knowing the values of nuclear forces and cross sections of their action, it is not difficult to calculate pressures and forces which must be overcome for the nucleons to come closer together in spite of their electrostatic repulsion. For this purpose the proton nuclei of light elements must be squeezed by the accelerated fragments of the atomic nuclei of heavy elements (uranium, plutonium and others) transferring a force momentum to splinters, as is done in the thermonuclear bomb. The acceleration of the splinters of heavy nuclei occurs as a result of their strongest electrostatic repulsion with splitting at the moment of nuclear explosion. The conditions for the natural acceleration of the splinters of nuclei are thus created.

As a result we obtain a nuclear press, when light nuclei are squeezed between the accelerated fragments of heavy nuclei and the quantized space-time, which presents the elastic quantized medium (EQM) which acts as a wall (anvil). The strength of this anvil increases with an increase in the strength of the effect of acceleration and the momenta of splinters on the anvil. This factor of the quantised medium, which possesses the properties of superhardness under the influence of colossal accelerations and forces from the side of the second required factor – accelerated fragments of heavy nuclei, was never examined in the nuclear fusion theory. Without the two factors indicated, which play the basic role in the explosion of a thermonuclear bomb it will not be possible to start CTF.

On the other hand, I wanted to verify by calculations how the temperature concept of thermonuclear fusion is related to nuclear fusion. I could not find in the literature any sources describing the calculations linking nuclear forces with temperature. Of course, they could not be there. In order to calculate these forces it is necessary to have a clear idea about the temperature not as a parameter on the scale of a thermometer or photon energy, but as a thermal power engineering factror. But also here, as already mentioned, present quantum theory gives failures. It occurs, the higher the photon energy, the less the return down the atom it produces. The greatest return produces the low-energy infrared photon (thermal photon), which is not capable to ensure the recoil momentum of atomic nucleus for overcoming the electrostatic barrier between the nuclei of light elements.

I specially focused attention on this energy paradox, since temperature we connect for the sake of the temperature variations of atoms and molecules as a result of return with the emission (re-emission) of photon. Before its time the development of quantum theory also began based on

the energy paradox, when was revealed discrete nature of the emission of atom and dependence of photon energy beyond its frequency, but not from the intensity of emission. This contradicted classical electrodynamics. Today such contradictions to quantum theory lie between temperature and atom recoil during the emission (absorption) of the photon when it is not possible to overcome the force of the electrostatic repulsion of atomic nuclei when attempting their synthesis. The temperature concept of CTF is antiscientific in its basis and it does not have any prospects for further development in power engineering.

Thus, the solution of the Leonov's problem is not only of purely theoretical interest but it also represents the colossal applied value for the processes generating thermal energy in the new power cycles of quantum power engineering. This refers to a number of new experimental effects with the liberation of excess heat, including the Usherenko effect (effect of the ultradeep penetration of microparticles into solid targets). If in CTF they still search for the effect of positive heat liberation, then in the Usherenko effect this release of energy exceeds $10^2 \ldots 10^4$ times the kinetic energy of the accelerated particles–strikers. However, this only one of many facts which experimentally confirm the prospects for the development of quantum power engineering as the basis of power engineering in the 21st century. By the way, quantum power engineering is a more general concept which also includes nuclear reactions which, in the final analysis, are only one of the methods of the extraction of energy of superstrong electromagnetic interaction (SEI). This completely corresponds to the theory of Superunification and the Einstein's concept of the unified field.

More details on new fundamental discoveries and the project 'Quantum Energetics' can be found at www.kvanton.land.ru.

References

1. Leonov V.S., Nature of non-radiation and radiation of the orbital electron, Chapter 7 of this book.
2. Leonov V.S., The two-rotor structure of the photon. The photon hygroscopic effect, Chapter 6 of this book.
3. Myakishev G.Ya., Temperature, Physical Encyclopedia, Vol. 5, Bol'shaya Rossiiskaya Entsiklopediya, Moscow, 1998, 61–62.