PHYSICAL MEANING of RYDBERG's CONSTANT

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The spectra of radiation of hydrogen atom and of hydrogen-like ions can be precisely enough calculated under the serial formula by Balmer-Rydberg

$$\nu_B(n_i, n_j) = c \cdot R \cdot Z^2 \cdot \left[\frac{1}{n_i^2} - \frac{1}{n_j^2}\right] \qquad |\text{Hz}| \qquad (1)$$

where c = 299792458 |m/s| – speed of light in vacuum;
Z – atomic number of element;
n_i и n_j – the main quantum numbers for top and bottom energy levels of energy of electron in atom;
R = 10973731.568549 $|\text{m}^{-1}|$ – the Rydberg's constant.

For calculation of the Rydberg's constant there are some formulas, though its initial value has been determined experimentally. One of these formulas (most exact) has the following kind

$$R = \frac{\alpha^2 \cdot M_e \cdot c}{2 \cdot h} \qquad |\text{m}^{-1}| \qquad (2)$$

where $\alpha = 7.297352533\times10^{-3}$ – the fine structure constant;
$M_e = 9.10938188\times10^{-31}$ |kg| – the electron rest mass;
$h = 6.62606876\times10^{-34}$ |J×s| – the Planck's constant.

In polytronic model of a structure of substance we use more exact formula for spectra of radiation of completely ionized atoms.

$$\nu(m_i, m_j, n_r) = \frac{4 \cdot \pi \cdot M_e \cdot c^2}{\alpha \cdot h} \cdot \left[\frac{\left(\frac{n_r}{K}\right)^4}{\left(\frac{m_i}{Z}\right)^2 + \left(\frac{n_r}{K}\right)^2} - \frac{\left(\frac{n_r}{K}\right)^4}{\left(\frac{m_j}{Z}\right)^2 + \left(\frac{n_r}{K}\right)^2}\right] \qquad |\text{Hz}| \qquad (3)$$

where K=3.3515 – parameter of the geometrical shape of radiator (radial polytron) of electromagnetic energy in atom;
m_i и m_j – the frequency orders of the top and bottom levels of radiator in atom;
n_r – the amplitude order of radial polytron.

As a result of the mathematical and logic analysis of formulas (1) and (3) we have drawn the conclusion, that inverse value of the Rydberg's constant is equaled to the length of wave of gamma-quantum, which is necessary for ionization of free atom of hydrogen, which is taking place at temperature of absolute zero.

$$\lambda_R = \frac{1}{R} = 91.126705\times10^{-9} \qquad |\text{m}| \qquad (4)$$

The energy of Rydberg's gamma-quantum is equal 13.606 eV.
The experimental value of energy of ionization of hydrogen atom is equal 13.598 eV.
The amplitude order of radial polytron in hydrogen atom is equal $n_r = n_e = 0.0528466$.
At frequency orders $m_i = 2$ and $m_j = \infty$, the hydrogen radial polytron possesses the same tangential radiating energy $W_t(2, n_e) = 13.598$ eV.
As a result of the given quantum transition, the atom of hydrogen radiates gamma-quantum with length of wave 91.180886×10^{-9} |m|.

The difference between energy of Rydberg's gamma-quantum and energy of ionization of atom of hydrogen is equal 0.008eV. This energy turns into kinetic energy of movement of electron and proton. At that, the electron gets speed 37511m/s; the proton gets speed 875m/s.
The more clear understanding of the processes of ionization gives for us hope for more clear understanding of processes of annihilation of the charged particles and processes of transformation of kinetic energy of these particles into electromagnetic radiation.
First let's get acquainted to theoretical postulates and the experimental data concerning to the one-photon annihilation.
1) The one-photon annihilation is forbidden by the law of conservation of energy-momentum.
2) The one-photon annihilation of electron and positron is possible only near to the third particle, for example, near nucleus.
3) The spectrum of one-photon annihilation radiation in a strong magnetic field (for example, in a magnetic field of a cyclotron) looks like an asymmetric line with sharp breakage aside smaller energy from maximum.
As you can see, the theory and experiment cannot find common language in this question.
Now let's look at the proof of new idea, which has appeared as a result of application of the formula for kinetic energy of the charged particle (the formula 5 in our previous work "THE ELECTRICAL WIND") to the Josephson effect. This formula is:

$$W_k(U) = \frac{M_e \cdot [v(U)]^2}{2} = q_e \cdot U \cdot \sqrt{1 + \frac{q_e^2 \cdot U^2}{M_e^2 \cdot c^4} - \frac{q_e^2 \cdot U^2}{M_e \cdot c^2}} \qquad |J| \qquad (5)$$

where $q_e = 1.602176462 \times 10^{-19}$ |C| – the elementary charge.

The essence of the idea consists, that radiation in the Josephson's contact arise from one-photon annihilation. But in this case, electrons and holes (or positrons) are annihilated not completely. In this case is "annihilated", i.e. is turned into quantums of electromagnetic radiation, only kinetic energy, which these particles got at passage of the accelerating potential *U* by them.
Frequency of radiation in the Josephson's contact is determined under the formula

$$\nu_D = \frac{2 \cdot q_e \cdot U}{h} \qquad (6)$$

We have made calculation for well-known Josephson's contact Sn-SnO-Sn, which has the voltage of a non-stationary mode 1.2mV, and have received the following results.
Kinetic energy of electron under the formula (5), after passage by it of the accelerating potential 1.2mV, is equal 192.261×10^{-24} |J|. Accordingly, kinetic energy of two particles is equal 384.522×10^{-24} |J|.
Energy of radiation $h \times \nu_D$ from Josephson's contact at $U = 1.2 \times 10^{-3}$ |V| is equal

$$W_D(U) = h \cdot \nu_D = 2 \cdot q_e \cdot U = 384.522 \times 10^{-24} \qquad |J|$$

Thus, we have received experimental confirmation of the hypothesis about one-photon annihilation in Josephson's contact

$$W_D(U) = 2 \cdot W_k(U) \qquad (7)$$

Substituting in the formula (7) the detailed expressions for $W_D(U)$ and $W_k(U)$ we shall receive, apparently, very strange result

$$\frac{2 \cdot q_e \cdot U}{M_e \cdot c^2} = 0 \qquad (8)$$

Actually, it is mathematical misunderstanding, which has arisen as a result of absence of correct mathematics for processes of annihilation and electromagnetic radiation.

The formula (8) could be written down so

$$\frac{(e^{+})\cdot U}{M_e \cdot c^2}+\frac{(e^{-})\cdot U}{M_e \cdot c^2}=0 \qquad (9)$$

But this way also does not solve the arisen mathematical incident.

Solving the equations (5) and (6) concerning frequency of radiation of Josephson's contact, we shall receive the following formula

$$\nu_D=\frac{2\cdot q_e \cdot U}{h}\cdot\left(\sqrt{1+\frac{q_e^2\cdot U^2}{M_e^2\cdot c^4}}-\frac{q_e\cdot U}{M_e\cdot c^2}\right) \qquad |\text{Hz}| \qquad (10)$$

The length of wave of radiation of Josephson's contact Sn-SnO-Sn, calculated under the formula (6) is equal 516600.774×10^{-9} |m|; the length of wave under the formula (10) is equal 516600.775×10^{-9} |m|, i.e. distinction between them does not exceed 10^{-6} %.
At a stationary operating mode of contact Sn-SnO-Sn, the direct current of superconductivity cannot exceed 13.3mA. At that, the enclosed voltage to contacts should be no more 1.2mV. At the absence of thermal fluctuations of crystal lattice, the slow negative and positive charges freely transfer resonant energy of atoms through the insulating layer, which thickness is approximately equal 10^{-9} |m|.
At the voltage of the power supply more, than 1.2mV, the superconductivity collapses, and Josephson's contact is switched in a non-stationary mode. Intensity of an electric field in dielectric grows up by jump to $E \sim 10^6$ |V/m|. Speed of charges achieves 20000 |m/s | and more. Hence, the reason of destruction of superconductivity is the big kinetic energy of the carriers of electric charges.
As you can see, despite of the veto of the law of conservation of energy-momentum and the absence of strong magnetic field, photons easy fly out one by one the Josephson's contact.
And, as you see, we did not use in our conclusions no the theory of superconducting pairs by Cooper, nor the model of superfluid electrons.
In our opinion, in this case there is the following process.
At the certain kinetic energy of opposite charges and at the certain intensity of the electric field, the colliding particles get rid of excessive kinetic energy, transforming it into energy of electromagnetic radiation.
Something similar occurs at formation of negative ions. Energy of affinity to electron (or proton affinity) represents kinetic energy of the electron, which it should extinguish at collision with atom. During collision with atom, this energy turns into electromagnetic energy.
We suppose also, the formula (10) can be used in area of higher accelerating potentials, for example, at research of spectra of bremsstrahlung of the charged particles.

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