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I. Introduction

It is customary to assume lasers as the quantum generators [1]. But this name does not correspond to the principle of their action. It is known that the laser emission possesses high coherence and directivity. The principle of the construction of radiating systems with such characteristics is well known in radio engineering, in them a large quantity of elementary phased emitters, located in the determined order, is used. Such systems are called the phased lattices (FL) [2,3]. Moreover, the greater the quantity of elementary sources it is used and the greater the dimensions of space, on which they are located, the greater the directivity and the radiated power can be obtained. For obtaining the high directivity the linear dimensions of system must be considerably more than the length of radiated wave.

In the work substance of laser also always is contained a huge quantity of elementary sources, which the atoms or the molecules of work substance are. If the discussion deals with the solid-state lasers, for example on the basis of ruby, then the radiating atoms, which are the atoms of chromium, it is also located in the crystal of work substance in the strictly defined order. If such atoms are synchronously excited by any means then so that their fluctuations would be phased as in FL, then from a radio-technical point of view this system can give the very narrowly-directed emission, since. A quantity of emitters is very great, and the length of radiated wave is much less than the linear dimensions of the field of emission. But as to excite atoms? One of such methods – the collision excitation, when the work substance of laser they irradiate by short pulse from the flashbulb, as is done in ruby laser. But with the aid of the flashbulb it is not possible to excite atoms so that the phase of their fluctuations would correspond to the conditions of FL. For this selection external macroscopic resonator serves. Selection indicated condition – agreement of one of the resonance modes of external resonator with the natural vibration frequency of the atoms of chromium. But this it is insufficient. The lattice of FL will compose only the atoms of chromium, located in the places, where their phase of fluctuations coincides with the phase of the fluctuations of macroscopic resonator. But in a total quantity of excited atoms of such it is not much, a total of several percentages of a total quantity. Therefore the efficiency of ruby laser is not high [4].

Consequently, this generator works according to all laws of electrodynamics and radio engineering, and there is nothing in it quantum, although the name in it very beautiful - two-level quantum generator.

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II. Physics of Work are Multilevel Quantum Generators and the Relationships of Manley -Rou

The multilevel quantum generators, in which allegedly it occurs by lowering quanta downward through several levels from the higher levels, work also according to the laws of nonlinear parametric systems. Occurs either parametric strengthening or parametric generation according to relationships to Manley–Rou– to the energy relationships, which characterize interaction of fluctuations or waves in the connected nonlinear systems with the concentrated or distributed parameters. Relationships to Mendi-Rou [5] take the form

$$\sum_{m=1}^{\infty}\sum_{n=-\infty}^{\infty}\frac{mP_{mn}}{m\omega_1+n\omega_2}=0;\quad \sum_{m=-\infty}^{\infty}\sum_{n=1}^{\infty}\frac{nP_{mn}}{m\omega_1+n\omega_2}=0.$$

In this relation P_{mn} – a change in the power at the combination frequency $m\omega_1+n\omega_2$, and ω_1 also ω_2 – the frequency of initial vibrations. Relation $\frac{\omega_2}{\omega_1}$ must be irrational, since otherwise, it is possible to express all frequencies as the harmonics of one fundamental frequency.

The relationships of Manley -Rou are valid for the system with the arbitrary reactive nonlinear coupling. In conjunction with the laws of conservation of energy and momentum, they determine the nature of nonlinear interaction of waves (fluctuations) and make it possible to calculate the maximum effectiveness of frequency converter on the reactive nonlinearity.

In the terms of quanta this diagram appears as follows. Let per unit time it appear or disappear A_{mn} the quanta of combination frequency. Then power at this frequency is equal.

$$P_{mn}=A_{mn}\hbar(m\omega_1+n\omega_2) \qquad (1.2)$$

In view of conservation of energy in the system total power is equal to zero:

$$\sum_{m,n} P_{mn}=\sum_{m,n}\hbar A_{mn}(m\omega_1+n\omega_2)=0.$$

Since $\frac{\omega_2}{\omega_1}$ it is irrational; m, n, A_{mn} – integers, this equality is carried out, only if both terms are equal to zero:

$$\sum_{m,n} mA_{mn}=\sum_{m,n} nA_{mn}=0.$$

After expressing A_{mn} from (1.2) and after substituting into the last expression, we will obtain:

$$\sum_{m,n}\frac{mP_{mn}}{m\omega_1+n\omega_2}=\sum_{m,n}\frac{nP_{mn}}{m\omega_1+n\omega_2}.$$

Let us examine the relationships of Manley-Rou in the particular case interaction. Let, for example, combination the difference frequency is $\omega_0=\omega_1-\omega_2$. Then system has three frequencies:

$$\omega_0=(m=1,n=-1);\ \omega_1=(m=1,n=0);\ \omega_2=(m=0,n=1).$$

In this case the relationships of Manley -Rou take the form:

$$\frac{P_{0,1}}{\omega_2}=\frac{P_{1,-1}}{\omega_0}=\frac{P_{1,0}}{\omega_1}.$$

These relationships describe nonlinear medium with three interconnected resonances. Moreover if we excite one of the resonances, then I will be excited and rest. The energy, stored up in each of the resonances, is proportional to resonance frequency what quantum mechanics interprets as the presence on environment of the energy levels, proportional to frequency. But the processes of energy transfer of one resonance in another, which ensures the nonlinearity of medium, quantum mechanics interprets as skate from one energy level to another. This scholastic diagram hides the true physical sense of process.

The first, so-called, quantum generator, in which the electromagnetic vibrations OF SHF were generated with the aid of the molecules NH_3, was created in 1954 H.G. Basov, A. M. Prokhorov and independent of them Ch. Townes, J. Gordon and H. Zeiger [5]. Both versions of generators worked on the molecular beam of ammonia. Its work thus was explained from the point of view of quantum mechanics: molecules NH_3, possessing electrical dipole moment, flying through the heterogeneous electric field, are differently slanted by this field depending on their internal energy. In the first molecular generator the sorting system was the quadrupole capacitor, which consists of the parallel 4 rods, connected in pairs through one with the high-voltage rectifier. The electric field of this of capacitor is not homogeneous, it causes the bend of the trajectories of molecules, which fly along its longitudinal axis. Molecules, which are found in the upper energy state, are slanted to the condenser spindle and fall inside the cavity resonator, that are located in the lower – are rejected to the sides.

Falling inside the resonator, the excited moleculesemit photons under the action of the field of resonator. Photon energy strengthens field in the resonator, increasing the probability of the stimulated emission for the molecules, which fly later (the feedback). If the probability of the stimulated emission of photon is more than the probability of absorption in the walls of resonator and emission in its limits, then the intensity of the field of resonator at the transition frequency rapidly grows due to the internal energy of molecules. Growth ceases, when field in the resonator reaches the value, with which the probability of the stimulated emission becomes so large, that in the transit time of resonator manages to emit photon exactly half of the molecules of beam. In this case for the beam as a whole the probability of absorption the equal probability of the stimulated emission becomes (saturation). The power of molecular generator with molecular beam NH_3 is small and is equal strand 10^{-11} W.

But how in reality does work molecular generator with the molecular beam of ammonia? The molecule of ammonia actually has a dipole moment, and in the space this molecule can have two positions: one steady, but another – no. If with the thermal molecular excitation falls into the unsteady state, i.e. the electric dipole overturns and it begins to hesitate with the resonance frequency. Since the size of dipole, determined by molecular dimension, is considerably lower than the wavelength of emission, this resonance has very high quality. If we with the aid of the quadrupole capacitor filter out molecules in the unsteady state, to and then throw in them into the macroscopic resonator, whose resonance frequency coincides with the frequency of the vibrations of molecular dipole, then such molecules will excite in the resonator of fluctuation, and macroscopic resonator will independently select molecules with the phase of fluctuations, which coincides with the phase of fluctuations in the Ger. Only difference from the ruby laser – in the latter the vibration frequency lies at the

region of light frequencies, and in ammonium – in HF range. Therefore the principle of work of molecular generator as ruby laser, is plotted in the radio-technical concepts without the attraction of quantum-mechanical concepts.

One should separately emphasize that in the existing constructions of lasers the selection of the atoms, which form the phased lattice, which forms the directed laser beam, achieves the macroscopic resonator, in which is located the active material. Macroscopic resonator is the separator, which selects only corresponding to the specified conditions oscillations of the atoms located in it. The excited by impact method atom, which presents dipole source, can be located in the resonator in any place, and its emission can have any polarization and direction. But only atoms with the frequency, which coincides with frequency of one of the modes of macroscopic resonator, have chances to give the contribution to the laser beam. For this it is necessary that the direction of the emission of these atoms would coincide with the axis of resonator, and so that the distance from the atoms to both lenses would be multiple to half of the wavelength of the emission of atom. Then the emissions of atom after multiple reflections from the mirrors of external resonator form exponentially the diminishing standing wave. If such atoms much, and they are excited in the different time, they all together form the not damped standing wave between the mirrors, which, after traversing the semi-transparent mirror, gives laser beam of light. This beam, in view of Huygens's principle, weakly disperses if the size of semi-transparent mirror much more than wavelength that also is observed in practice.

Atoms with the oscillations of those atoms, which do not satisfy these conditions, will consume their vibrational energy for the creation of the scattered incoherent radiation. Because we see the bright glow of the transparent tube of gas laser, through which this emission leaves.

With respect to the excitation of laser emission frequently is used the term stimulated radiation. This term indicate the additional synchronization of the being varied dipoles because they are connected with the electric field of external resonator. Actually, if we in the field of this resonator place the system of the being varied dipoles phases of which are not phased, then after a certain time the phases of such emitters will be phased by the field of external resonator that we have in the continuous laser.

The principle of the quantization of action, which lies at the basis of quantum generators, leads to the fundamental, actually, to insoluble problems in contemporary theoretical physics [6,7]. From this principle it turns out that the energy can change only spasmodically (by portions). Idea about the quanta of energy, which the physical systems are exchanged between themselves hence arose. The fault of this approach lies in the fact that the discontinuity of a change in the energy unavoidably leads to the local (at the level of microcosm) disturbance of the law of conservation of energy even for the conservative systems. Namely, is allowed this disturbance of the law of the conservation of energy of conservative system, with which the value of action does not exceed Planck's constant. Thus, is allowed even an infinitely large increase in the energy, but only during the infinitely small time interval (the greater the increase in the energy, the less the corresponding time interval).

III. Conclusion

It is customary to assume lasers as quantum generators. But this name does not correspond to the principle of their action. Such generators present the antenna phased arrays and are subordinated to the known laws of radio engineering. Physics of the work of such generators describes the relationships of Manley - Rou. The principle of the quantization of action, which lies at the basis of quantum generators, leads to the fundamental, actually, to insoluble problems in contemporary theoretical physics. From this principle it turns out that the energy can change only spasmodically (by portions). Idea about the quanta of energy, which the physical systems are exchanged between themselves hence arose. The fault of this approach lies in the fact that the discontinuity of a change in the energy unavoidably leads to the local (at the level of microcosm) disturbance of the law of conservation of energy even for the conservative systems. Namely, is allowed this disturbance of the law of the conservation of energy of conservative system, with which the value of action does not exceed Planck's constant. Thus, is allowed even an infinitely large increase in the energy, but only during the infinitely small time interval (the greater the increase in the energy, the less the corresponding time interval).

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