ENERGY LEVELS OF A DYE LASER

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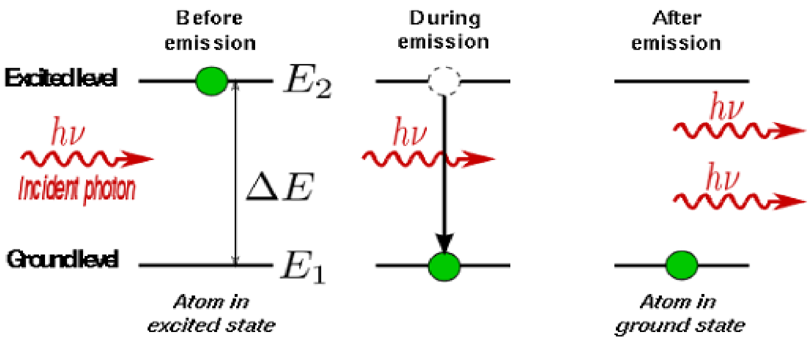
Abstract. *In this work, the possibility of creating and using a stable conducting channel in a dielectric liquid under the influence of laser radiation is considered. The pattern of breakdown was established. The dependence of the type of breakdown on the radiation power density and frequency is considered. The calculation of the main parameters of the breakdown, such as the breakdown temperature, the calculation of the values of F (intensity) and E (strength) of radiation, the dimensions of the focusing region of laser radiation to achieve the goal of the work, was carried out.*

Keywords: *laser, spectrum, IR radiation, conduction, molecule.*

The equilibrium energy level and the excited state energy levels of the dye form a band of a certain width. Energy levels with inverse occupancy are also located in a certain energy range, and the energy of the laser radiation when passing from top to bottom of them is proportional to these ranges. This radiation consists of quasi-monochromatic rays lying in a certain spectral range.

In helium-neon and ruby lasers, this width is equal to and, and in dye lasers, too. Since the active medium consists of solutions of dyes, the active medium of the liquid optical generator consists of complex organic molecules, the width of their photoluminescence spectrum is $0.03\,va\,20\,sm^{-1}$.

Since the molecules have a large number of degrees of freedom for vibrational motion, the structure of both levels is complex. In the figure, the transition from the upper level to the ground level is a luminescent transition, which has a certain band. Here, the vertical sections correspond to the Bohr frequencies of transitions between individual levels, the dotted curve shows the contours of individual spectral lines, and the solid curve shows the total contour of the luminescence band [1]. Let us consider the general picture of the processes that occur during the optical excitation of dye molecules. After the molecule absorbs an excitation photon, it moves from one of the energy levels of the ground (lower) equilibrium state group to one or more (depending on the spectral width of the excitation light) vibrational levels of the excited electron state group.



$$E_2 - E_1 = \Delta E = h\nu$$

This process is depicted as an arrow pointing from level group to level group. The molecule, which is excited by the interaction of the molecules with the atoms of the solvent, spontaneously passes to the lowest energy level of the level group without radiation. This spontaneous transition begins to occur within a second after the transition due to optical relaxation.

The transition from the lower energy levels of the level group to all energy levels of the main energy level group occurs spontaneously or involuntarily with the emission of light. This transition is depicted as an arrow pointing from top to bottom [2]. This set of lines associated with these electronic vibrational transitions forms a broad absorption spectrum of luminescence and enhancement. Thus, particles in the lower energy levels of a group of energy levels are considered to be particles occupying an inverse occupation state. After transitions from the lower level of the group to the upper level of the group, after a second of vibrational motion, they are transferred to the group levels and the energy is absorbed by the level atoms (wavelike arrows in the level group).

In the described scheme, there are factors that interfere with the development of generation.

The high irradiance during the quenching causes photochemical decomposition of the dye molecules, which is a factor that interferes with the development of non-radiative quenching generation of the excited electron state as a result of heating the solution. These interference factors are eliminated using special methods, and there are currently more than 100 of them. For example, in one of these methods, the solution is pumped through a cuvette at a speed of several tens of times under high pressure. Dye lasers can produce laser radiation in a wide range of spectra in pulsed and continuous modes. It is possible to perform forced radiation generation using xenon gas-discharge lamps and lasers as excitation radiation [3].

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