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2) The authors are grateful to N. N. Mikhailov and L. N. Vasil'ev for constructing the solenoid and placing it at our disposal.

BEAM LASER FOR THE INFRARED BAND

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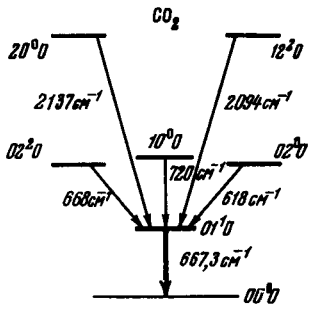
The problem of obtaining a source of electromagnetic oscillations with high frequency stability has always been related in quantum radiophysics to the construction of a quantum generator based on a beam of atoms or molecules, since there is practically no shift of the top of the spectral line as a result of interaction between molecules in a beam quantum generator.

The beam quantum generators realized to date have been confined to the radio band. We consider in this article the possibility of producing a laser for the infrared band, with thermal excitation. Thermal pumping is based on choosing molecular energy levels E_β and E_α such that the time of their radiative decay satisfies the relation $\tau_\beta > \tau_\alpha$ $(E_\beta > E_\alpha)$. The idea of the laser under consideration is simple: a highly heated beam of molecules is allowed to escape to a vacuum in which the equilibrium radiation is much smaller than $(E_\beta - E_\alpha)/k$. Spontaneous emission soon depletes the α level and a state with population inversion can be produced for the $\beta \to \alpha$ transition. The necessary condition for the occurrence of population inversion between the levels β and α is

$$\tau_\beta > \left(1 + \frac{\tau_{\beta\alpha}}{\tau_\beta}\right)\tau_\alpha.$$

The most convenient range of wavelengths, from the point of view of the proposed method, is 3 - 20 μ. For shorter wavelengths, the lifetimes in the excited states are too small. For long-wave transitions, the lifetime in the excited state becomes too large, calling for excessively large apparatus dimensions.

The figure shows the CO_2 molecule vibrational levels suitable for obtaining population inversion in a molecular beam [1]. The thick arrow denotes very intense transitions, and the



thin ones transitions of medium intensity.

From the point of view of the method under consideration, it is convenient to use similar transitions in the molecules N_2O and HCN:

$$02^20 \rightarrow 01^10, \quad 02^00 \rightarrow 01^10.$$

In the HCN molecule the $02^00 \rightarrow 01^10$ transition belongs to strong lines [1], thus facilitating satisfaction of the self-excitation condition.

It is possible to excite molecules in a molecular-beam source not only by heating, but also by electric discharge, as in gas lasers. Contributing to the production of active particles is the addition of molecules possessing metastable levels and in "resonance" with the working levels of the active medium [2]. It turns out that the first excited vibrational state of the D_2 molecule is close to the 20^00 and 12^20 levels of the CO_2 molecule.

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SIGN OF THE MAGNETIC FIELD AT TIN NUCLEI IN A FERRODIELECTRIC MATRIX

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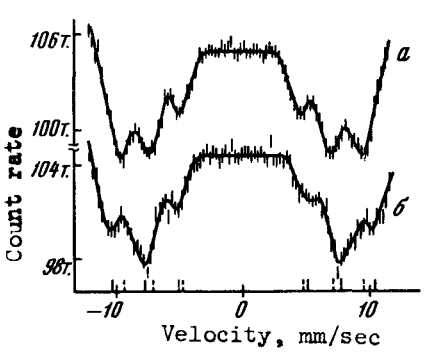
In an earlier paper [1] (see also the paper by Belov and Lyubutin [2]) we reported experimental observation of indirect (super-exchange) induction of a magnetic field of hundreds of kOe at the nuclei of nonmagnetic tin atoms introduced into an yttrium-iron-garnet matrix $\{Y_{3-x}Ca_x\}[Sn_xFe_{2-x}](Fe_e)O_{12}$ with $x = 0.25$.



To determine the sign of this field we investigated the Mossbauer spectra of the same garnet sample placed in an external magnetic field. The obtained spectra (SnO_2 source, room temperature) are shown in the figure. Spectrum a was obtained without an external field, and b in a field of 15 kOe. The positions of the peaks of spectra a and b are marked on the abscissa with dashed and solid lines, respectively.

The change in the intensity ratio of the various components of spectrum b, compared with a, is due to polarization of the sample in the external magnetic field, and accordingly to the change in the char-