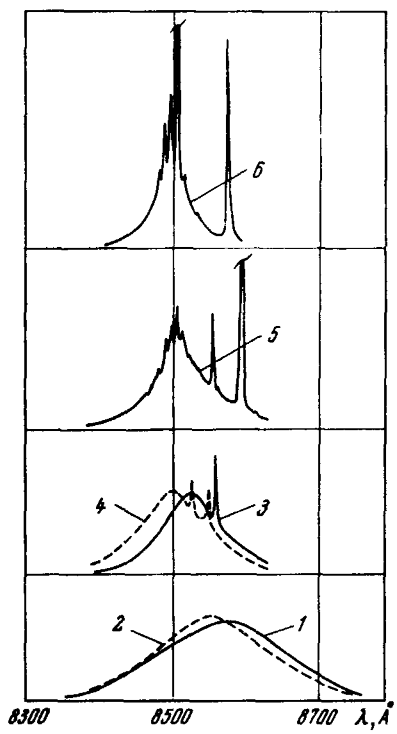
creasing current; this shift is due to the "dispersal" of the Fermi quasilevels with increasing pump energy, and also to the shift to the long-wave section of the spectrum in the continuous mode, relative to the spectrum in the pulsed mode, connected with the constant heating of the active region in the continuous case. This difference between the spectra in the two modes is larger for small currents and decreases on approaching the threshold current. The latter effect is connected with the presence of deep electronic levels with very low state density [2].



Coherent radiation in the continuous mode occurs at a current of 250 mA (612 A/cm^2). The narrow spectral line appearing in this case corresponds most probably to the nonaxial "annular" type of resonator oscillations. At 410 mA (1020 A/cm^2), a new system of coherent lines appears, which can be interpreted as corresponding to axial modes of the cavity.

The total emission power of the diode for which the spectra are presented is 5 mW at the appearance of the first coherent line and 70 mW at a current 1.5 A.

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NEW GENERATION LINES OF A PULSED IODINE-VAPOR LASER

V. M. Koval'chuk and G. G. Petrash
P. N. Lebedev Physics Institute, USSR Academy of Sciences

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We report in this note the observation of four new generation lines in a pulsed discharge in iodine vapor. An ordinary laser was used in the experiments, with quartz windows mounted at the Brewster angle and with external mirrors. Glass tubes with internal cold aluminum electrodes were used. The inside diameters of the tubes were 10 - 12 mm, and the discharge lengths 80 - 100 cm. The tube was excited by current pulses from the discharge of a 0.01 μF capacitor through a controlled three-electrode discharge gap. The capacitor voltage was adjustable from 10 to 50 kV, the discharge current reached approximately 1 kiloampere. The iodine crystals were placed in a lateral stub separated from the discharge tube by a valve. During the operation, the iodine vapor was first admitted into the discharge tube and then pumped out to the required pressure. In addition to the vapor of pure iodine, mixtures of iodine with inert gases and with nitrogen were investigated.

Under the conditions described, we observed generation only in the discharge of pure iodine at iodine-vapor pressure of the order of 10^{-3} Torr. Addition of the buffer gases interrupted the generation. Three generation lines were observed in the visible part of the spectrum and one in the infrared. The visible generation occurred at a capacitor voltage near 30 kV and its power increased with increasing voltage to 50 kV. The infrared generation was observed only at voltages near 50 kV and was unstable. No other iodine generation lines were observed under our conditions in either pure iodine or in mixtures of iodine with inert gases and nitrogen.

The wavelengths of the generation lines were measured with a DFS-13 instrument having a dispersion 2 and 4 Å/mm in the visible and infrared, respectively. The estimated measurement errors were $\Delta\lambda \approx +0.03$ Å for the visible lines and approximately ±0.06 Å for the infrared. The measured wavelengths were 4533.79 Å, 4674.40 Å, 4934.67 Å, and 10,417.2 Å.

Generation in the visible lines occurred at the start of the current pulse, which had the form of a damped sinusoid of approximately 1.5 μsec effective duration. The generation pulse in the visible lines was approximately triangular in shape with a duration of ~150 nsec at half-altitude. The average generation power was measured with a calibrated thermopile at a capacitor voltage 45 kV and pulse repetition frequency 3 cps. The transmission of one of the mirrors in the visible region was approximately 1%, and the transmission of the exit mirror was 80%. The total generation-pulse energy of the three visible lines was 0.33 mJ, corresponding to a peak power of 2.2 kW. There was no infrared generation. A noticeable superradiance effect was observed in the visible lines.

Attempts were made to attribute the lines observed by us to definite transitions. The availability of sufficiently complete data on the spectra of I I and I II [4,5] have allowed us to establish that the observed lines do not pertain to these spectra. Attempts to ascribe these lines to some possible impurities were likewise unsuccessful. Nor were there any coincidences with the known generation lines of other elements [6,7].

We investigated the spontaneous discharge spectrum under conditions at which the generation was observed (this could be readily monitored with the aid of the superradiance). Measurement of 160 lines in the visible and ultraviolet regions of the spectrum has shown that under our excitation conditions there are no I I lines, and the spectrum of I II is represented only by strong lines. Most lines can be attributed, according to the data of [8], to the spectra of I III and I IV. Approximately 70 lines could not be assigned to any definite transition. It most be noted, however, that data on the spectra of I III and I IV [8] are far from complete and are very unreliable. On the other hand, we know of no data on the spectra of higher ions.

On the basis of the results we can propose that the generation lines observed in the present investigation belong to transitions in the spectrum of highly-ionized iodine.

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ELECTRON TEMPERATURE IN THE ELECTRIC DISCHARGE USED FOR THE ARGON ION LASER

V. F. Kitaeva, Yu. I. Osipov, and N. N. Sobolev
P. N. Lebedev Physics Institute, USSR Academy of Sciences
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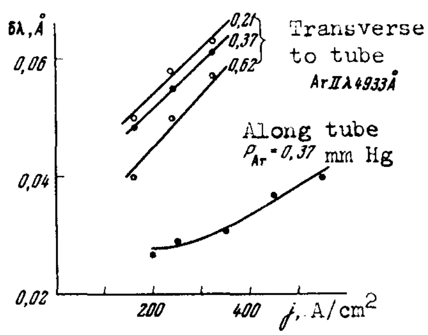
In an earlier investigation [1] we obtained information on the charged-particles concentration and the gas temperature in argon under conditions typical of the operation of a continuously operating ionic argon laser ($p_{Ar} \simeq 0.4$ Torr, $j = 200 - 550$ A/cm^2, capillary radius $r = 0.8$ mm).

The gas temperature turned out to be 1600 - 3600°K, and the electron concentration $\sim(3 - 4) \times 10^{13}$ cm^{-3}.

It follows from these results that the degree of ionization of the gas in such a discharge is ~1% and the ion mean free path λ_i is larger than the capillary radius r, if a value 5×10^{-15} cm^2 is assumed for the charge-exchange cross section [2] and account is taken of the crowding out of the argon from the capillary by the high temperature of the gas. Thus, we can assume that under the indicated conditions the decisive influence on the ion motion in the discharge column is exerted by the drift of the ions to the wall and their recombination.

The present investigation was devoted to a determination of the electron temperature in a discharge of this type.

To this end, measurements were made of the half-width of the Ar II lines radiated transverse to the discharge. The investigations were made in a tube of 2.8 mm diameter and ~40 cm length, with a bypass channel. The gas pressure ranged from 0.21 to 0.62 Torr and the current density from 150 to 350 A/cm^2.



The figure shows the measured half-width of the λ 4933-Å line of Ar II, transverse to and along the discharge, as a function of the current density. The thickness of the Fabry-Perot etalon was 1 cm.

As seen from the figure, the width of the Ar II line increases with increasing current density. The width $\delta\lambda_{i\perp}$ of the line radiated transverse to the channel exceeds the width $\delta\lambda_{i\parallel}$ of the line radiated along the discharge by a factor ~1.5-2.