[3] J.E. Christopher, R.V. Coleman, A. Jain, and R.C. Morris, Phys. Rev. 172, 485 (1968).
[4] J. Appelbaum, J.C. Phillips, and C. Tzouras, Phys. Rev. 160, 554 (1967).
[5] J. Solyom and A. Zawadowski, J. Appl. Phys. 39, 705 (1968); Phys. Kondens. Materie 7, 325, 342 (1968).
[6] N. Mott and R. Guerney, Electronic Processes in Ionic Crystals (Russian translation), IIL, 1950, pp. 193 - 199 [Oxford, 1940].
[7] E.I. Adirovich, Fiz. Tverd. Tela 2, 1410 (1960) [Sov. Phys.-Solid State 2, 1282 (1961)].
[8] F. Gutmann and L.F. Lyons, Organic Semiconductors (Russian translation), Mir, 1970, pp. 484 - 501 [Wiley, 1967].
[9] I.O. Kulik and I.K. Yanson, Effekt Dzhozefsona v sverkhprovodyashchikh tunnel'nykh strukturakh (Josephson Effect in Superconducting Tunnel Structures), Nauka, 1970, p. 158.
[10] I.K. Yanson and N.I. Bogatina, Zh. Eksp. Teor. Fiz. 59, 1509 (1970) [Sov. Phys.-JETP 32, No. 5 (1971)].

OPTICAL ORIENTATION OF Kr ATOMS IN THE METASTABLE $^3P_2$ STATE

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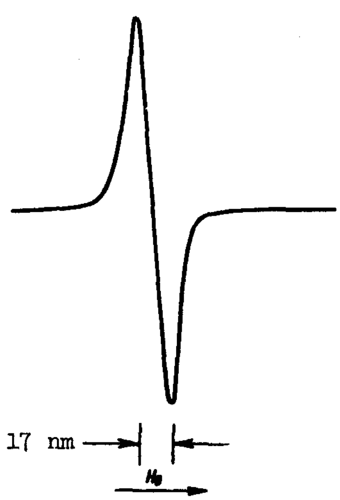
The phenomenon of optical pumping of inert-gas atoms in the metastable $^3P_2$ state has been observed so far only in three gases, Ne, Ar, and Xe [1 - 3]. We report here the first experiments on optical orientation of Kr atoms in the $^3P_2$ states.

We use in the experiments the usual procedure of observing optical-pumping signals as revealed by the change of absorption of light by the atoms at magnetic resonance, using the differential-passage technique (frequency modulation of the resonant RF field was used). To increase the pump-light intensity, we used a disk lamp (3 cm diameter, 0.4 cm thick) similar to that used for optical orientation of helium atoms in [4].



Derivative of absorption signal in optical orientation of Kr atoms in the $^3P_2$ state (registered wavelength λ = 8929 Å, Kr pressure 1.4 mtorr, resonant frequency ν_0 = 3 MHz).

The discharge was excited in the lamp with the aid of a GS-6 oscillator (frequency 450 MHz, power 3 W). The pump lamp and the absorbing call (4 cm diameter, 8 cm length) were connected to a vacuum system that made it possible to vary the Kr pressure in the lamp and in the cell independently.

Metallic cesium was used as a getter to eliminate the influence of the impurities [5].

Signals of optical pumping of the Kr atoms were obtained at 8929 and 8113 Å, corresponding to the transitions $5s\,^3P_2 \rightarrow 5p\,^3S_1$ and $5s\,^3P_2 \rightarrow 5p\,^3D_3$. An interference filter was placed ahead of the photoreceiver to separate each of the indicated wavelengths. The magnetic-resonance signals were observed at a g-factor value close to 1.5. The largest attained signal/noise ratio was 2×10^3 in a band of 0.5 Hz. The figure shows the magnetic-resonance signal of the Kr atoms in the $^3P_2$ state at a pressure 1.4×10^{-3}

Torr. The optical-pumping signals were obtained both with polarization of the Kr atoms (circularly-polarized pumping light) and with alignment of the atoms (unpolarized and linearly-polarized pumping light). The signals had a maximum value when the Kr pressure in the lamp was of the order of 0.5 - 0.7 Torr, and were observed at Kr pressure in the cell from 10^{-4} to 10^{-2} Torr.

At a low amplitude of the radio-frequency field and a low value of the modulating deviation of the resonant frequency, the line width of the observed signals varied with the krypton pressure from 15 to 50 kHz in a pressure range 1 - 25 mtorr. The line width was assumed to be the distance between the extrema of the derivative of the absorption signal. An estimate of the contribution made to the line width by the inhomogeneity of the magnetic field yielded a value of 10 kHz.

The measured dependence of the line width on the Kr pressure has made it possible to calculate the cross section σ for the disorientation of the Kr atoms in the metastable $^3P_2$ states in collisions with Kr atoms in the ground $^1S_0$ state, $\sigma = 78 \pm 23$ Å^2. Worthy of attention is the fact that the obtained cross section for Kr is smaller than the value of σ published in [3] for Ar (100 ± 7 Å^2), in spite of the fact that the polarizability of the Kr atoms is larger than the polarizability of Ar. It is also of interest that the absolute width of the line (15 kHz) for Kr at 10^{-3} Torr is less than half the corresponding value for Ar (46 kHz) [3].

No magnetic-resonance signals of the odd isotope ^{83}Kr were observed in the experiment. Apparently the main obstacles were the small natural concentration of this isotope (11%) and the large spin of the nucleus, I = 9/2.

Further investigations are being continued.

[1] L.D. Schearer, Phys. Rev. Lett. 21, 660 (1968).
[2] L.D. Schearer, Phys. Rev. 180, 83 (1969).
[3] L.D. Schaerer, Phys. Lett. 28A, 660 (1969).
[4] F.D. Colegrove, L.D. Schearer, and G.K. Walters, Phys. Rev. 132, 2561 (1963).
[5] R.A. Zhitnikov and I.A. Kravtsov, Zh. Tekh. Fiz. 40, 2131 (1970) [Sov. Phys.-Tech. Phys. 15, 1662 (1971)].

SPIN RELAXATION OF ELECTRONS ORIENTED BY LIGHT IN A GaAs CRYSTAL

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It was shown in [1] that excitation of electrons in a GaAs crystal by circularly-polarized light produces spin orientation. This orientation was observed in a wide interval of photon energies $E_{h\nu}$, exceeding the energy of the spin-orbit splitting between the valence bands $^4\Gamma_8$ and $^2\Gamma_7$. An increase of $E_{h\nu}$ from the value E_g = 1.52 eV, corresponding to excitation at the point k = 0, is accompanied by a decrease of the degree of orientation P of the electron spins. In experiment this is manifest by a decrease in the observed degree of circular polarization ρ_e. The $\rho_e(E_{h\nu})$ curve given in [1] differs from the theoretical $\rho_T(E_{h\nu})$ plot by a factor T/τ, where τ is the lifetime of the electron and T is the time of "magnetization" of the non-equilibrium electrons ($1/T = 1/\tau + 1/\tau_s$ [2], where τ_s is the spin-relaxation time). From a comparison of