The exchange interaction in monocompounds of uranium with elements of groups V and VI is indirect, via the conduction electrons [12]. Within the framework of this model, as shown in [12], the difference between the types of magnetic ordering in monocompounds of uranium with group-V or VI elements is due to the difference in the number of their conduction electrons: the concentration of the conduction electrons is one electron per uranium atoms in compounds with group-V elements and two electrons per uranium atoms in group-VI compounds. Palewski [13] calculated in the same approximation the energies of different ferromagnetic and antiferromagnetic structures in mixed UX_ZY_{1-Z} compounds and has shown that the energies of the ferro- and antiferromagnetic phases of compounds with $Z \approx 0.75$ are close to each other. This gives rise to metamagnetic transitions in $UX_{0.75}Y_{0.25}$ compounds in relatively weak fields.

A comparison of the data obtained by us with results by others [8, 9] (cf. also above) shows that the metamagnetic transition occurs in a mixed compound of uranium with selenium in stronger fields than in analogous compounds with sulfur and phosphorus, i.e., the antiferromagnetic structure is more stable in compounds with selenium than in compounds with sulfur or phosphorus. The reason may be that $UAs_{0.75}S_{0.25}$ and $UP_{0.75}S_{0.25}$ have in the absence of a field a noncollinear magnetic structure [1, 2, 4, 5], while $UAs_{0.75}Se_{0.25}$ is a collinear antiferromagnet [3]. In addition, the metamagnetic-transition field is apparently affected by the magnetic anisotropy, for it is shown in [8, 9, 14] that the anisotropy of uranium monoselenide s larger than that of the monosulfide.

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FEATURES OF THE BEHAVIOR OF $\rho_f(H)$ NEAR $H_{c2}(T)$ OF EXTREMAL TYPE-II SUPERCONDUCTORS

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According to the theory [1, 2], the behavior of the differential resistance $\rho_f(H, T)$ near $H_{c2}(T)$ in type-II superconductors with electron mean free path

$\ell \ll \xi_0$ is determined fully by the temperature dependence of the parameter

$$\kappa_2(T) \sim [d(M_s - M_n)/dH]^{-1/2}_{H_{c2}(T)} .$$

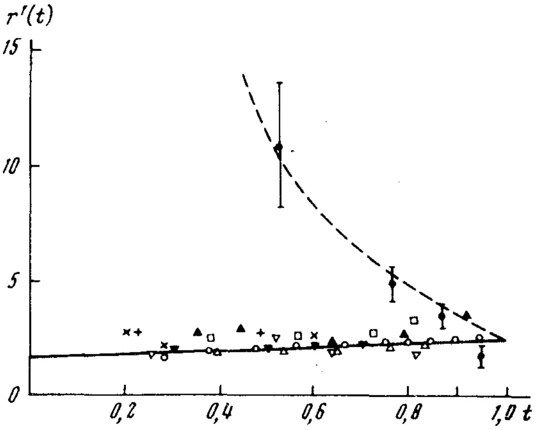
In the case of extremely high $H_{c2}(0)$, when the spin paramagnetism comes strongly into play, the theory [2] yields

$$\frac{\rho_f}{\rho_n} = \left\{1 - \frac{4.95\,\kappa_2^2(1)}{[2\kappa_2^2(t) - 1]} \left[1 - \frac{H}{H_{c2}(t)}\right] A(t)\right\} \qquad (1)$$

from which we get for the derivative

$$r'(t) \equiv \left[\frac{H}{\rho_n}\,\frac{\partial\rho_f}{\partial H}\right]_{H_{c2}(t)} = \frac{4.95\,\kappa_2^2(1)}{2\kappa_2^2(t) - 1}\,A(t) . \qquad (2)$$

Here $A(t) = M_d/(M_s - M_n) \leq 1$; M_d is the diamagnetic contribution to the mixed-state magnetization.



Temperature dependence of $r' \equiv [(H/\rho_n)(\partial\rho_f/\partial H)]_{H_{c2}(t)}$: ●) Nb - 80%Zr, o) $Nb_{80}Mo_{20}$[7]; Δ) V - B, ∇) V - A [8]; □) Pb-24%In [10]; +) $Nb_{90}Ta_{10}$, ×) $Pb_{90}In_{10}$ [11]; ▲) $Nb_{0.1}Ta_{0.9}$; ▼) $Nb_{0.5}Ta_{0.5}$ [9]. The solid and dashed curves are theoretical ones calculated for ordinary type-II superconductors [1] and "extremal" superconductors [2].

Until recently, the experimental values of r'(t) were compared quantitatively with the theory only for type-II superconductors with a relatively low upper critical field [6 - 8], which is characterized by a negligible monotonic increase of $\kappa_2(t)$ with decreasing temperature, and accordingly by a weak decrease of r'(t) from 2.5 at $T \sim T_c$ to 1.7 as $T \to 0$ (see the figure).

In the case of extremal type-II superconductors, measurements of the magnetization have revealed [3, 4] a strong decrease of $\kappa_2(t)$ with decreasing temperature, in agreement with theoretical predictions [5, 14] that take the spin paramagnetism and the spin-orbit scattering of electrons into account. Such a behavior of $\kappa_2(t)$ should lead to a corresponding growth of r'(t). An experimental verification of this fact is the subject of the present communication, which is devoted to the dependence of the differential resistance ρ_f on the magnetic field at different temperatures in the Nb - 80%Zr ribbon samples described in detail in [12]. The technique for measuring ρ_f is described in [13]. For these samples, $\kappa_2(1) \sim 60$, $H^e_{c2}(0) \sim 100$ kOe, and the parameter that determines the influence of the spin paramagnetism is $\alpha \simeq 1.9$. The figure shows the measured values of r'(t) and also the limiting theoretical curve obtained from formula (2) on the basis of the theoretical $\kappa_2(t)/\kappa_2(1)$ ratio at $\alpha^2 = 3.3$ [3, 14] and $\lambda_{so} = 0$ (λ_{so} is a parameter characterizing the spin-orbit scattering) under the assumption that A(t) = 1. We see that the experimental points do not contradict qualitatively the predicted growth of r'(t) with decreasing temperature. A similar tendency in the behavior of r'(t) can be seen also in the case of the alloys $Ti_{0.5}V_{0.5}$ and $Ti_{0.75}V_{0.25}$, although the published incomplete $\rho_f(H)$ curves [9] yield only an estimate of the lower bound of this quantity. It should be noted that the limiting theoretical curve is overestimated for two reasons. First, A(t) does actually decrease with decreasing temperature, albeit weakly in comparison with $\kappa_2(t)$ [2]. Second, in the case of our samples we cannot neglect the influence of the spin-orbit scattering, allowance for which leads to a less considerable decrease of $\kappa_2(t)$ [3, 5]. An estimate of the minimal value of the parameter λ_{so} yielded a value on the order of 0.3 1) whereas according to the theory [5] a strong spin-orbit interaction is characterized by the condition $\lambda_{so} >> 0.2$ 2). Obviously, for exact quantitative comparison with the theory it is necessary to measure in the experiment not only $\rho_f(H)$ but also $(dM/dH)_{H_{c2}(t)}$ in order to determine $\kappa_2(t)$, as well as the quantities γ and $\partial H^e_{c2}(t)/\partial t$ which enter in the definition of the parameters of the theory.

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DISPERSION OF RESONANT OPTICO-ACOUSTICAL EFFECT

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1. The resonant optico-acoustical effect (ROAE) in polyatomic gases, wherein a standing sound wave is produced in a closed volume and draws energy from the internal degrees of freedom of the molecules of the same gas, which are excited by pulsed laser radiation, was observed in [1, 2].

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1) This estimate was obtained from a comparison of the experimental value $h^*_{min}(\alpha, \lambda_{so})_{t=0} = 0.693[(H^7_{c2}(0)/H^{GLAG}_{c2}(0) = 0.425$ with the theoretical $h^*(\alpha, \lambda_{so})_{t=0}$ dependence [15, 3]. The value $\lambda_{so} = 8.45$ given in [12] should be regarded as the maximum possible, since it has been calculated for $\lambda_{so} = 2\ell$.

2) We note incidentally that formula (57) of [5] for $\kappa_2(\alpha, \lambda_{so}, t)$ obviously contains an error, for when the corresponding parameters are substituted it it the result is absurd and does not lead to the plot given in the same reference.