Here

$$z_1 = m_Y(W - E_e) + {}^1/_2 m_p^2, \quad z_2 = 2(z_1 + m_p^2), \quad W = (m_Y^2 - m_p^2 + m_e^2)/2m_Y.$$

The present considerations can be used for μ-meson decay[4] of spin-$^3/_2$ particles according to the scheme $Y \rightarrow p + \mu + \tilde{\nu}$, as well as for the electron decay scheme considered above.

I wish to acknowledge the guidance provided by Professor M. A. Markov and to thank B. N. Valuev and I. V. Polubarinov for discussions.

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ELECTRONIC PARAMAGNETIC RESONANCE IN ALLOYS OF ALKALI METALS

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REFERENCES 1 to 3 report on the influence of impurities on resonance absorption in metals due to conductive electrons.

We have investigated the 290-Mcs resonance absorption in alloys of sodium at T = 90°K and 300°K, as a function of the concentration of components. The following metals served as components: Li, K, Hg, Pb and Woods' alloy.

The measurement procedure was described previously.[4] The original sodium was 99.5% pure and contained approximately 0.4% of potassium. The alloys were produced under a layer of paraffin or in an argon atmosphere. To prevent skin effect from distorting the shape of the absorption lines,[5] the alloy was dispersed in paraffin; the average size of metal particles was approximately 4μ. The width ΔH in the original sodium measured between the half-intensity points of the resonance-absorption curve, has a maximum of 16 Oe at room temperature and equals 9 Oe at 90°K.

Our data on the width coincide with the results of Gutovsky and Frank.[6] The measurements of paramagnetic resonance in alloys indicate that the metals used as alloy components can be divided into two groups. The first group includes

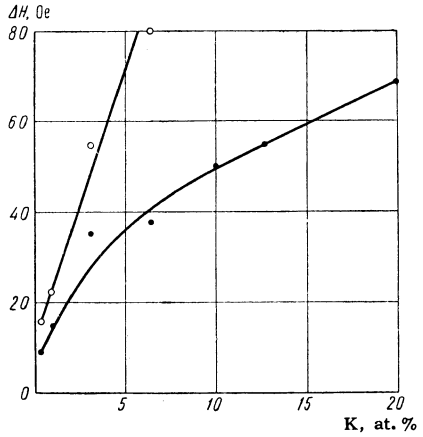

FIG. 1. Alloys Na–K. ● – T = 90°K, ○ – T = 300°K.

Li and K, which have little effect on ΔH, and consequently on T_1 and T_2.

In Na-K alloys ΔH has a greater temperature dependence than in the original sodium (Fig. 1).

The second group contains the heavy metals Hg, Pb and Wood's alloy, which increase ΔH almost 10^4 times more than the metals of the first group. (Fig. 2). In the alloys of these metals ΔH is independent of the temperature.

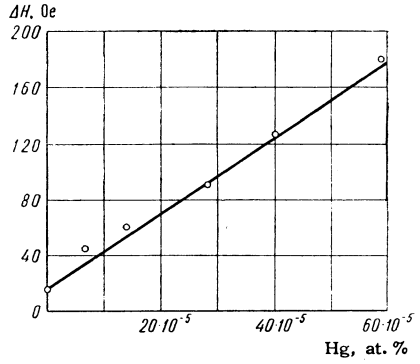

FIG. 2. Alloy Na–Hg. T = 300°K.

We have also investigated paramagnetic resonance in lithium alloys. The alloying components used were Na, K, Hg, Pb and Wood's alloy.

The effect of the alkali metals Na and K on paramagnetic resonance in lithium is just as weak as in the case of sodium. However, even 0.001% of a heavy component such as Hg, Pb, or Wood's alloy broaden the line to such an extent that it becomes impossible to observe absorption in these alloys. We offer no quantitative data on these alloys, because the purity of the original lithium was only 98%. Furthermore, lithium alloys very poorly with sodium or potassium.[7]

Our results agree with Elliot's theory,[8] from which it follows that impurity metals with strong spin-orbit interaction greatly shorten the spin-lattice relaxation time. This results in such a broadening of the lines in the Li and Na alloys with insignificant admixtures of heavy metals. On the other hand, the alkali metals (Li, Na and K) have relatively weak spin-orbit interactions and therefore have a weak influence on the width ΔH.

The shift of the g-factor of the line can be used as a measure of the spin-orbit interaction of the impurity atoms. We propose to conduct measurements of g-factors at 10,000 Mcs in alloys with smaller metal-particle dimensions. We also plan to measure the Knight shift for the resonance lines of Na^{23} and Li^{7}. These experiments will permit a detailed comparison with the theory.

In conclusion, the authors express their gratitude to K. A. Valiev for his review of the results.

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THE FIRST EXCITED STATE OF Tb^{159}

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In a scintillation-spectrometer study of the γ radiation of Dy^{159}, which decays entirely via K capture, a weak line at twice the energy was observed in the pulse distribution in addition to the K radiation of Tb^{159} (44.5 kev). Measurements with varying distances from source to crystal, and using filters showed that this line is the result of full summing of 44.5-kev quanta. For the 1.5-microsec resolving time of our apparatus (a 128-channel analyzer[1]), the chance-coincidence rate would be two orders of magnitude smaller than that actually observed in the sum peak. From this one is naturally led to the assumption that the observed 90-kev line is the result of summing two cascade quanta of half the energy, the first of which is the K radiation of Tb^{159} after K capture, while the second is the result of decay of the first excited state of Tb^{159}.

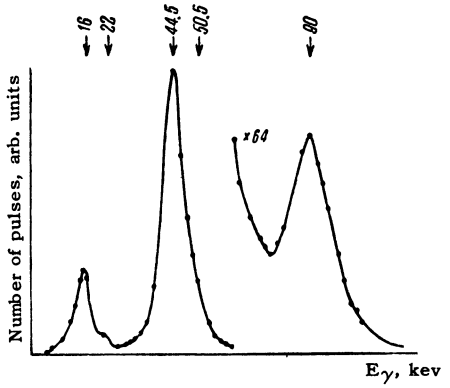

FIG. 1. γ spectrum of Dy^{159}, using NaI (Tl) crystal. The 16-kev peak is due to K_α radiation of iodine, the 22-kev peak to K_β radiation of iodine.

A suggested value of the energy of the first excited state of Tb^{159} (57.5 kev) was given on the basis of Coulomb excitation of Tb.[2] The conversion electrons corresponding to this excited state have been observed.[3] Gamma rays from deexcitation of this state have never been observed. Our experiments show that if such a line does exist, its intensity does not exceed 1% of the 44.5-kev peak.

An additional check was made using a "sum" spectrometer with a CsI (Tl) crystal (diameter