The increasing thermal effect due to accumulation of Po^{210} and RaE in the compounds was also accounted for.

Compound	Weight of salt, mg	Weight of Ra, mg	Thermal effect mcal/hr	Thermal effect of 1 g of Ra, mcal-hr
Ra I	274.8	160.7	20.96	129.2
Ra II	305.8	178.8	23.19	129.9
Ra III	256.3	149.9	19.55	129.9
				129.7

On the basis of the latest experimental data on α and β spectra of the elements of the radium series, we calculated ϵ for the equilibrium compound Ra^{226}. It turned out to be 25.335 Mev ($\pm 0.3\%$). Using this value, we obtained for the half-life of Ra^{226} a value $T = 1577 \pm 9$ years. This gave respectively for a value $z = 3.71 \pm 0.02 \times 10^{10}$ decays/sec-g, the specific activity z. The latter is connected with T by the simple relation $z = 1.847 \times 10^{21}/T$.

The values of z and T we determined are close to those adopted by the International Commission[8] ($z = 3.70 \times 10^{10}$, $T = 1580$ years), but differ noticeably from the values recently obtained by Kohman, Ames, and Sedlet[9] and Sebaoun[10] ($z = 3.61 - 3.62 \times 10^{10}$ ($\pm 0.5 - 0.6\%$); $T = 1617 - 1622$ years). In these two investigations the number of particles emitted by the equilibrium[10] or non-equilibrium[9] radium compound was measured directly. To explain the causes of such a discrepancy, it would be desirable to repeat the determination of these important quantities z and T of Ra^{226}, using the above methods as well as other possible methods.

[1] J. Stout and W. Jones, Phys. Rev. **71**, 582 (1947).

[2] N. S. Shimanskaia and E. A. Iashugina, Атомная энергия (Atomic Energy) **1**, 133 (1957).

[3] V. Hess, Wien. Ber. IIa, **121**, 1419 (1912).

[4] S. Watson and M. Henderson, Proc. Roy. Soc. **A118**, 318 (1928).

[5] G. V. Gorshkov and N. S. Shimanskaia, Атомная энергия (Atomic Energy) **1**, 86 (1956).

[6] Z. Gritchenko and T. Il'inskaia, Фонд РИАНа, Отчет 1957 (Fund of Radium Inst. Acad. Sci., Report for 1957).

[7] N. S. Shimanskaia, Тр. Радиевого ин-та (Trans. Radium Inst.) **7**, 198 (1956).

[8] Curie, Debiern et al., Revs. Mod. Phys. **3**, 427 (1931).

[9] Kohman, Ames, and Sedlet, NNES PPR V14B PII, 1657 (1949).

[10] W. Sebaoun, Ann. phys. **1**, 680 (1956).

Translated by J. G. Adashko
146

ROLE OF INTERELECTRON COLLISIONS IN METALS IN THE INFRARED REGION OF THE SPECTRUM

G. P. MOTULEVICH and A. A. SHUBIN

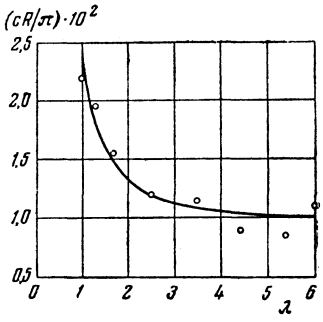
P. N. Lebedev Physics Institute, Academy of Sciences, U.S.S.R.

Submitted to JETP editor December 7, 1957

J. Exptl. Theoret. Phys. (U.S.S.R.) **34**, 757-758 (March, 1958)

As is known, the contribution of interelectron collisions to the value of the surface impedance of the metal is insignificant in the low-frequency region. However, as the frequency increases, this contribution increases, as was already noted, for example, in Ref. 1. Calculations pertaining to the infrared region of the spectrum were made by Pitaevskii[2] and Gurzhi.[3] It follows from these calculations that the interelectron collisions lead to the appearance of an additional term of the form B/λ^2 in the real part of the surface impedance. Here B is a factor that is independent of the wavelength of the light λ. The measurements we performed on the optical constants of silver[4] show that this additional term is substantial in the spectral region we investigated ($1 - 6\mu$). The diagram shows the dependence of the real part of the surface impedance R on λ. The dots indicate the experimental data for cR/π. The solid line represents the curve of $(c/\pi)(R_0 + B/\lambda^2)$ for $(c/\pi)R_0 = 0.96 \times 10^{-2}$ and $(c/\pi)B = 1.40 \times 10^{-2}\mu^2$. Here R_0 and B are independent of λ, and c is the velocity of light. It can be seen that the experimental points fit the solid curve well (diagram). A measurement of the real part of the surface impedance in the infrared region of the spectrum, using the same method, makes it possible to clarify the role of the interelectron collisions.

For silver, as follows from the experimental data,[4] the spectral region $1 - 6\mu$ is subject to the inequalities $\omega_0^2 \gg \omega^2 \gg \nu_0^2$, where ω_0 is the limit



Dependence of real part of surface impedance of silver on the wavelength. Abscissa – $cR/\pi = 4n/(n^2 + \kappa^2)$, where $n - i\kappa$ is the complex index of refraction of the metal.

of the internal photoeffect, ω the frequency of the light, and ν_0 the frequency of the collisions between the electrons and the lattice. Therefore, making the important assumption that the Fermi surface is isotropic, we can determine the concentration of the conduction electrons M and the electron velocity v on the Fermi surface by using the expressions obtained for a clearly pronounced anamolous skin effect.[1] Here the reflection of the electrons from the surface of the metal is assumed to be diffuse. We have already determined N earlier, using our measurement data, (for silver $N = 5.2 \times 10^{22}\,cm^{-3}$); allowance for the term due to the interelectron collisions makes it possible to employ the quantity R_0 for the determination of v. We obtained $v = 2.4 \times 10^8$ cm/sec for silver.

Measurements of the optical constants of tin and lead in the spectral region $1 - 6\,\mu$ has shown that the contribution of the interelectron collisions to the real part of the surface impedance is substantial for these metals, too. However, the processing of the results obtained for these metals is made complicated by the circumstance that the inequality $\omega^2 \gg \nu_0^2$ is not satisfied in the above spectral region, by virtue of which it is impossible to employ the expressions obtained for the sharply-pronounced anomalous skin effect. Considerably less reliable are the calculations of the surface impedance or optical constants of the metal in the region where $\omega \sim \nu_0$. We used the expressions for the real and imaginary parts of the surface impedance, obtained for this region by Dingle.[5] Assuming that in this region the interelectron collisions lead to the appearance of a term B/λ^2 in the expression for R, we can determine for these metals not only N, but also v. Such a treatment yielded the following microscopic parameters: for tin, $N = 4.2 \times 10^{22}\,cm^{-3}$ and $v = 2.6 \times 10^8$ cm/sec (this value was obtained for $cR_0/\pi = 2.9 \times 10^{-2}$ and $cB/\pi = 24 \times 10^{-2}\mu^2$); for lead, $N = 3.8 \times 10^{22}\,cm^{-3}$ and $v = 4.0 \times 10^8$ cm/sec (this value was obtained for $cR_0/\pi = 5.1 \times 10^{-2}$ and $cB/\pi = 11.2 \times 10^{-2}\mu^2$).

In Ref. 4 we determined the upper limit of N for these metals, using a limiting formula which, as is clear from what has been said above, is not valid. Therefore, the estimate obtained there for the upper limit is too rough and is improved here. However, even these data should be considered as approximate, for we used in the calculation theoretical formulas which cannot be considered very reliable. To obtain more reliable values of these microscopic parameters it is necessary to measure the optical constants of Sn and Pb at low temperatures, at which ν_0 become substantially smaller.

In conclusion I express my gratitude to V. L. Ginzburg for discussing the results of this work.

[1] V. L. Ginzburg and G. P. Motulevich, Usp. fiz. nauk **55**, 469 (1955).

[2] L. P. Pitaevskii, J. Exptl. Theoret. Phys. (U.S.S.R.) **34**, 942 (1958), Soviet Phys. JETP **7** (in press).

[3] R. N. Gurzhi, J. Exptl. Theoret. Phys. (U.S.S.R.) **33**, 451, 660 (1957), Soviet Phys. JETP **6**, 352, 506 (1957).

[4] G. P. Motulevich and A. A. Shubin Оптика и спектроскопия (Optics and Spectroscopy) **2**, 633 (1957).

[5] R. B. Dingle, Physica, **19**, 311 (1953).

Translated by J. G. Adashko
147

ABSORPTION OF POLARIZED MU⁻ MESONS BY NUCLEI

E. I. DOLINSKII and L. D. BLOKHINTSEV

Moscow State University

Submitted to JETP editor December 9, 1957

J. Exptl. Theoret. Phys. (U.S.S.R.) **34**, 759-761 (March, 1958)

As was shown in Ref. 1, the angular distribution of neutrons produced upon capture of polarized μ^- mesons by free protons is of the form $1 + \alpha \cos\theta$. In this work we have calculated the coefficient α for the case of absorption of μ^- mesons by protons bound in the nuclei, for the scalar (s), vector (v), tensor (t) and pseudo-vector (a) versions of the four-fermion interaction of μ mesons with nucleons. The shell model is used and the recoil of the nucleus is neglected. Since the nucleons in the nucleus acquire energies on the