which do not collide with the surface. In a magnetic field parallel to the surface, the formula for the magnetic moment, for any kind of reflection from the surface, coincides with formula (14) of the work by Kosevich and Lifshitz.[4]

Consequently, if one investigates $\chi_q(H)$ in a film with $D < \ell$, then, by determining the successive values of the magnetic field H for which there are sharp increases in the quantum oscillations with a given period, for all possible directions of H, we determine d and S_{ext} for each of the surfaces individually (we mean here the closed surfaces into which $\epsilon(p) = \epsilon_0$ is resolved), without resorting to harmonic analysis. (The applicability of the above arguments to this case is obvious.)

The values of $d = D$ in a parallel field make it possible to determine

$$p_x^{\max} = |eHD|/2c$$

for the central cross-section of the above surfaces, at all directions x in the plane of the film, i.e., to construct directly all the cross-sections $\epsilon(p) = \epsilon_0$ and $p_y = 0$. A set of monocrystallographic films with a varying orientations of the crystallographic axes relative to the surface would make it possible to plot $\epsilon(p) = \epsilon_0$.

The values of S_{ext}, as already indicated, also make it possible to synthesize the Fermi surface by the Lifshitz-Pogorelov method.

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[1] I. M. Lifshitz and A. V. Pogorelov, Dokl. Akad. Nauk SSSR **96**, 1143 (1954).

[2] I. M. Lifshitz and A. M. Kosevich, Izv. Akad. Nauk SSSR, ser. fiz. **19**, 395 (1955).

[3] I. M. Lifshitz and A. M. Kosevich, Dokl. Akad. Nauk. SSSR **96**, 963 (1954); J. Exptl. Theoret. Phys. (U.S.S.R.) **29**, 730 (1955), Soviet Phys. JETP **2**, 636 (1956).

[4] A. M. Kosevich and I. M. Lifshitz, I. M. Lifshitz, J. Exptl. Theoret. Phys. (U.S.S.R.) **29**, 743 (1955), Soviet Phys. JETP **2**, 646 (1956).

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CALORIMETRIC DETERMINATION OF THE HALF-LIFE OF Ra^{226}

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IN the determination of the half-lives of long-lived isotopes by the calorimetric method, one measures the thermal effect Q of the radioactivity of a known weight p of a given isotope. The half-life T is determined from the relation $T = (\ln 2) \cdot pN_0\epsilon/AQ$, where N_0 is Avogadro's number, A the atomic weight of the isotope, and ϵ the energy liberated by the isotope in the calorimeter in a single decay event. The decay constants of Pu^{239} (Ref. 1) and Ac^{227} (Ref. 2) were measured relatively recently by such a calorimetric method.

Many investigators have used this method to determine T for Ra^{226}. They measured the thermal effect of radium, either free of its short-lived derivatives[3] or in equilibrium with these derivatives.[4,5] Unfortunately, the Ra contents in the measured compounds was determined in these investigations indirectly, usually on the basis of γ measurements. In addition, for the most part, the accuracy of the calorimetric measurements themselves was insufficient (1 — 4%), as was the accuracy with which ϵ was calculated for the elements of the Ra^{226} series.

We made precise calorimetric measurements of three equilibrium compounds of radium, subjected to 10 (Ra I, Ra II) and 15 (Ra III) additional crystallizations to eliminate possible contaminations. The purity of these compounds was controlled by means of a spectral method, which detected the presence of only insignificant impurities of certain elements of the second group of the periodic table.[6] The total contamination α did not exceed, in all three cases, 0.2% (by weight).

The results of direct weighing of radium bromide before sealing the compounds, and the Ra^{226} content in these compounds, are given in the table. The table lists also the results of the calorimetric measurements performed with the aid of a double static calorimeter.[9] The last column of the table gives the determined values of $Q_{\alpha+\beta}/p$ — the thermal effect of α- and β-radiation per gram of radium. In the calculation of these quantities, account is taken of the absorption of γ-rays in the compound itself (self absorption), in the protective container, in the glass of the ampoules, and in the walls of the calorimetric cylinder itself.

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 (±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] ($z = 3.61 - 3.62 \times 10^{10}$ (±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.

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[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).

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

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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