$$s_{l+2}\,(\mu_{nl+1/2}) = \sum_{n'} \mu^2_{n'l+5/2} / (\mu^2_{n'l+5/2} - \mu^2_{nl+1/2})^3$$

$$= \frac{2l+7}{16\,(2l+3)^2} - \frac{\mu^2_{nl+1/2}}{8\,(2l+3)^3}. \qquad (3)$$

The wave-functions corresponding to these states are given in zeroth approximation (up to the normalization factor) by

$$(\psi_{n1})_1 = \psi_{n10},\ (\psi_{n1})_2 = \psi_{n11} + \psi_{n1-1},\ (\psi_{n1})_3 = \psi_{n11} - \psi_{n1-1}.$$

From (2) and (3) it may be easily seen that for a filled shell the spherical shape is energetically the most favorable one. As the p shell is gradually filled the equilibrium shape, starting with the third nucleon, will deviate not only from the spherical one but also from the axially-symmetric one. For example, for the $(1s)^2(1p)^4$ configuration, in which the levels E_{10}, $(E_{11})_1$ and $(E_{11})_2$ are filled, the minimum total energy is at $\alpha \approx 0.015$ and $\delta \approx 0.3$.

A detailed analysis of the deviations of the equilibrium shape of actual nuclei from axial symmetry will be published later.

Similar calculations for the oscillator potential have been made by Garskii (cf. Wilets and Jean[3]) and Geilikman[4].

The author expresses his thanks to A. S. Davydov for discussing the results of this work.

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Translated by G. Volkoff
101

SECOND RELAXATION IN A SPIN SYSTEM IN CERTAIN COMPOUNDS OF ELEMENTS OF THE IRON GROUP

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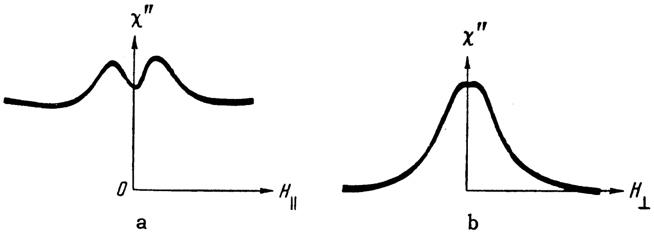
Submitted to JETP editor May 10, 1958

J. Exptl. Theoret. Phys. (U.S.S.R.) **35**, 530-532 (August, 1958)

SPIN-SPIN absorption in parallel fields, $\chi''(H_{\parallel})$, decreases monotonically with increase of the constant magnetic field $H_{\parallel}$.[1-5] The experimental curves of $\chi''(H_{\parallel})$ that have been obtained are described by the theory of Shaposhnikov.[6]

In a number of cases,[7-9] the spin-spin absorption curves of hydrated salts of elements of the iron group have a maximum in $\chi''(H_{\parallel})$, dependent both on the frequency of the alternating field H_ν and on the intensity of $H_{\parallel}$. Gorter and de Vrijer[7] suggested that the maximum in the spin-spin absorption curve in chromium-potassium alums at 20°K is due to relaxation between two spin systems (second relaxation in the spin system).

Conditions for production of second relaxation are created also as a result of nonuniform heating (or ventilation) of certain hydrated salts of Mn^{++} Fe^{+++}, and Cu^{++}. In such slightly hydrous salts, the ions in different elementary cells have different environments, and this leads to production of second relaxation in the spin system. Similar conditions should be present likewise in substances with residual antiferromagnetism.



Double absorption curves χ'' (arbitrary units) in $FeNH_4(SO_4)_2 \cdot H_2O$; ν = 296 Mc/sec, T = 300°K. a – absorption in parallel fields; b – absorption in perpendicular fields.

Actually, in $Mn(COCH_3)_2$, $FeNH_4(SO_4)_2 \cdot H_2O$, $Fe_2(SO_4)_3 \cdot 3H_2O$, and $CuCl_2$, in the frequency range 600 to 150 megacycle/sec, by the method described earlier,[10] we have succeeded in obtaining curves of the absorption in parallel fields with a maximum in $\chi''(H_{\parallel})$. In these substances the position of the maximum is independent of temperature* (in the range 300 to 90°K); on decrease of the frequency ν, it moves toward lower magnetic fields $H_{\parallel}$ (cf. table).

In the magnetically concentrated salts listed

Substance	ν = 542	ν = 296	ν = 146
$FeNH_4(SO_4)_2 \cdot H_2O$	450 Oe	220 Oe	Not resolved
$Fe_2(SO_4)_3 \cdot 3H_2O$	300 "	160 "	" "
$Mn(CO_2CH_3)_2$	320 "	200 "	" "
$CuCl_2$	400 "	200 "	" 90 Oe

above, quite narrow resonance curves of $\chi''(H_\perp)$ are observed at 542 Mcs in perpendicular fields. This indicates the presence of incomplete exchange interaction between the ions. In such substances the spin-spin absorption depends very little on the field intensity $H_{||}$; therefore the absorption observed by us, at sufficiently low values of $H_{||}$, is due only to second relaxation in the spin system.

In the frequency range 600 to 150 Mcs in Cr_2O_3, CuO, and Nd_2O_3,[1] we have succeeded in detecting absorption at T = 90°K and 295°K both in perpendicular and in parallel fields. In these oxides, the absorption decreases monotonically with increase of the field $H_{||}$. The half-widths $\Delta H_{||}$ and $\Delta H_\perp$ become narrower with decrease of frequency and with rise of temperature.

Apparently the absorption observed by us in oxides and anhydrous salts is due to relaxation between two antiferromagnetic sublattices, which are partly preserved even above the Curie temperature in these substances. At frequency 10,000 Mcs in Cr_2O_3 and CuO, no paramagnetic resonance absorption below the Curie point has been observed.[11] Furthermore, second relaxation is also observed upon partial dilution of hydrated paramagnetic salts with diamagnetic ones. No second relaxation was detected in the interval 90 to 300°K in substances with strong exchange ($CuCl_2 \cdot 2H_2O$, $Fe_2(SO_4)_3$, $Mn(SO_4)_2$, in free radicals, and in alkaline metals), in liquid solutions of paramagnetics, and in vitreous systems. Apparently, in all these substances there is a single spin system.

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*In $CuCl_2$ at T = 90°K, there is a phase transition; consequently the absorption both in parallel and in perpendicular fields changes.

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Translated by W. F. Brown, Jr.
102

FISSION CROSS SECTION OF Pu^{240} *BY FAST NEUTRONS*

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Submitted to JETP editor May 10, 1958

J. Exptl. Theoret. Phys. (U.S.S.R.) **35**, 532-533 (August, 1958)

ALL that is known from published data on the cross section for the fission of Pu^{240} by fast neutrons is that its plateau amounts to 1.4 to 1.6 barns[1,2] and that the threshold of the (n, f) reaction is in the neutron-energy interval from 250 to 900 kev.[1]

In the present work we measured the fission cross section of Pu^{240} relative to the fission cross section of Pu^{239}, using a double ionization chamber. Layers of Pu^{240} (2.5 mg) and Pu^{239} (4 mg), 5 centimeters in diameter, were deposited on a common high-voltage electrode and were consequently located in an identical neutron flux. The collecting electrodes were hemispheres of 14 cm diameter. Electrodes of this shape, along with the use of a working gas mixture of 90% Ar + 10% CO_2 at a pressure of 35 mm Hg, made it possible to separate reliably the fission fragments from the α particles.

The Pu^{239} layer contained Pu^{240} impurities amounting to 1.80 ± 0.05%, while the concentration of Pu^{239} in the Pu^{240} specimen amounted to 7.7 ± 0.5%. The Pu^{241} content was negligibly small in the first layer and less than 0.2% in the second