on g/μ, but there are no experimental data on the decays $V \rightarrow P + P + \gamma$. The ratios presented thus serve as a check on the model and, for the time being, agree well with experiment. It is interesting to note that the predictions of the model contradict the predictions of the naive dipole model of meson photoproduction (see the table and formula (4)).

The author thanks S. B. Gerasimov, A. B. Govorkov, and A. A. Komar for useful discussions.

[1] B. Sakito, Phys. Rev. 136B, 1756 (1964); F. Gursey, A. Pais, and L. A. Radicati, Phys. Rev. Lett. 13, 107 (1964).

[2] M. I. Adamovich, V. G. Larionova, A. I. Lebedev, S. P. Kharlamov, and F. R. Yagudina, Yadernaya fizika 2, 135 (1965), Soviet JNP 2, 95 (1965).

[3] J. V. Allaby, H. L. Lynch, and D. M. Ritson, Stanford University Preprint HEPL-408, 1965.

[4] R. L. Anderson, E. Gabathuler, D. Jones, B. D. McDaniel, and A. J. Sadoff, Phys. Rev. Lett. 9, 131 (1962).

[5] S. B. Gerasimov, JINR Preprint R-2439.

1) Thus, the coupling constant g is sufficiently small to be able to consider this interaction by means of perturbation theory in the quark model.

PARITY NONCONSERVATION IN RADIATIVE TRANSITION OF Lu^{175}

V. M. Lobashov, V. L. Nazarenko, L. F. Saenko, L. M. Smotritskii, and G. I. Kharkevich
A. F. Ioffe Physico-technical Institute, USSR Academy of Sciences
Submitted 29 January 1966
ZhETF Pis'ma 3, No. 7, 268-274, 1 April 1966

We have investigated the circular polarization of the γ quanta of Lu^{175}, resulting from weak nucleon-nucleon interaction. We investigated the 396-keV $9/2^- \rightarrow 7/2^+$ γ transition with multipolarity E1 + M2, going to the ground state of the Lu^{175} nucleus. A favorable circumstance in this case is the fact that the $9/2^+$ state, which should mix in with $9/2^-$ as the result of the weak interaction, is located nearby. This is the 113-keV $9/2^+$ level, from which a γ transition of a multipolarity M1 + E2 goes to the ground state. Thus, the probability of the main (E1) and admixture (M1) transitions is known [1], and from this we can obtain the enhancement factor R = 50.

The possibility of determining the enhancement factor, or at any rate its lower limit, from the experimental data was the stimulus for the investigation of Lu^{175}.

The circular polarization was measured by the procedure of forward Compton scattering from magnetized iron with a resonance method of separating and storing the periodic signal. The apparatus used was the same as in [2].

In order to exclude more reliably the interfering factors, such as the magnetostriction changes of the polarimeter dimensions and the inductive pick-up during the instant of reversal of polarimeter magnetization, we turned off the signal during the magnetization reversal time. The period of signal storage in a pendulum filter was reduced to 3 hours. The measurement procedure was the same as in the earlier work. The results of the measurements are represented in the form $\delta = \Delta U/U_0$, $\Delta U = U_1 - U_2$, $U_0 = (U_1 + U_2)/2$. Here U_1 and U_2 are the voltages at the input of the amplifier circuit, proportional to the intensity of the scattered γ quanta at the different magnetization directions of the polarimeter. For 400 keV γ-quantum energy the circular polarization is equal to

$$P_\gamma = \delta/4 \times 10^{-2}.$$

Table 1 gives the results of control experiments. The absence of the effect is demonstrated for unpolarized γ quanta, the source of which was Sc^{46} (type E2 γ transition); an effect close to that expected was obtained for γ quanta with definite circular polarization. The latter, as in [2], were γ quanta scattered from magnetized iron (the "double scattering" row in Table 1) and bremsstrahlung quanta from β electrons of Au^{198}, obtained as an admixture to the main 411-keV E2 γ transition.

Table 1

Type of experiment	No. of periods	δ		ΔU, V	
Sc^{46}	8	$+(0.0 \pm 0.3) \times 10^{-6}$			
	6	$+(0.15 \pm 0.3) \times 10^{-6}$			
	8	$+(0.3 \pm 0.3) \times 10^{-6}$			
	10	$-(0.1 \pm 0.2) \times 10^{-6}$			
Double scattering		Theor. value	1.7×10^{-3}	3×10^{-5}	
	2	Experim.	1.4×10^{-3}	2.4×10^{-5}	
Au^{198}	3	Dilution 1 : 6	2.1×10^{-5}		Theor. value of intern. bremsstrahlung 1.4×10^{-5}
	3	Undiluted	4.9×10^{-5}		
Lu^{177}	5			1.1×10^{-5}	
$Lu^{177} + Sc^{46}$	11	$(1.0 \pm 0.16) \times 10^{-6}$		$(1.2 \pm 0.2) \times 10^{-5}$	

An unfavorable factor in investigations of the circular polarization of the γ quanta of Lu^{175} obtained by β decay of Yb^{175} is that only 10% of the β decays go to the investigated $9/2^-$ level, and the greater part (87%) goes to the ground state (end-point energy 467 keV). This gives rise to the presence of negatively-polarized γ quanta of internal and external bremsstrahlung of the β electrons. Since the end-point energy is higher here than the energy of the investigated γ transition, elimination of the bremsstrahlung spectrum via energy discrimination is impossible. Therefore, in order to take into account the contribution of the bremsstrahlung spectrum to the γ-quantum polarization, we used an Lu^{177} source having a β spectrum with end-point energy 497 keV and 208-keV γ quanta. The use of energy discrimination with the aid of lead filters made it possible to suppress almost all of the 208-keV γ quanta, so that the relative fraction of the bremsstrahlung in the Lu^{177} was greatly increased.

In order to reduce the bremsstrahlung, the Yb^{175} and Lu^{177} sources were diluted with magnesium oxide so as to decrease the effective Z of the source material. Measurements were made at different dilutions and with lead filters of different thickness (1 and 2 mm) surrounding the detector.

The results of the measurements and the values of $\delta \cdot 10^{+6}$ are listed in Table 2. For Lu^{177} we present the value of $\delta = \Delta U/U_0$, where U_0 is the voltage produced by a Yb^{175} source of equal intensity of β decay to the ground state. The results obtained with Lu^{177} and Yb^{175} can therefore be compared directly. The comparison of the Lu^{177} and Yb^{175} activities was with the 396-keV γ line for Yb^{175} and the 208-keV line for Lu^{177}. The relative intensities of these lines, referred to the number of β decays, were taken from [3,4]. The comparison error was ~10%.

Table 2

	Filter thickness	Lu^{177}, dilution		Yb^{175}, dilution			Yb^{175} aver.	Yb^{175} recal.	$Yb_{recal} - Yb_{aver}$		P_γ
		1:2.5	1:6	1:2.5	1:3.5	1:6					
Experim. results	1 mm lead	-5.7±0.5	-4.9±0.5	-1.6±0.2	-1.7±0.3	-1.4±0.2	-1.4 ±0.15	-3.1 ±0.3	+1.7 ±0.4	+1.6 ±0.3	+(4±1) x 10^{-5}
	No. of periods	5	6	12	6	11					
	2 mm lead	-3.3±0.3	-2.8±0.3	-0.2±0.15	-0.3±0.3	-0.2±0.3	-0.2 ±0.15	-1.7 ±0.3	+1.5 ±0.3		
	No. of periods	4	8	22	16	18					
Theor. values	1 mm lead	4.6		3.15							
	2 mm lead	2.9		1.85							

We see from Table 2 that dilution of the Lu^{177} source with magnesium oxide in ratios 1:2.5 and 1:6 by weight changes the circular polarization little. This means that even at these dilutions the main contribution is made by the internal bremsstrahlung. The magnitude of the effect due to the internal bremsstrahlung was calculated with the formulas of [5].

The calculated value of the effect agrees well with experiment; in addition, it is seen that the ratio of the effect for different filter thicknesses and for different sources (Lu^{177} and Yb^{175}) depends very little on the approximation used in the calculations. This makes it possible, using the theoretical relations between Lu^{177} and Yb^{175}, to determine from the experimental results on Lu^{177} the value of the effect that would be obtained if the effect were due only to the internal and in part to the external bremsstrahlung of the β electrons. Comparison of such recalculated results, designated Yb^{175}_{recal} in Table 2, with the experimental data on Yb^{175} shows that a difference does exist, and is apparently due to the positive circular polarization of the γ quanta of Yb^{175} (396 keV).

The value obtained for the circular polarization from all the data is

$$P_\gamma = +(4 \pm 1) \times 10^{-5}.$$

An additional control experiment was carried out to denomstrate that the addition of unpolarized γ quanta to the source of the bremsstrahlung quanta (Lu^{177}) does not change the result. Table 1 shows the results of measurement of Lu^{177} and of Lu^{177} together with Sc^{46}. It is seen that the result has not changed.

Since we used a natural mixture of Yb isotopes for the preparation of the source, we obtained in addition to Yb^{175} ($T_{1/2}$ = 4.2 days) also Yb^{169} ($T_{1/2}$ = 30 days). This isotope decays via K capture, whose internal bremsstrahlung has positive circular polarization. A measurement of the circular polarization with an Yb^{169} source has shown that the internal bremsstrahlung is suppressed by the lead filter and makes no noticeable contribution to the measured effect.

Our experiments show therefore that the γ quanta of Lu^{175} (396 keV) have positive circular polarization, apparently due to weak nucleon-nucleon interaction.

Using R = 50, we find from the value $P_\gamma = 4 \times 10^{-5}$ that the ratio of states with different parity F is equal to $\sim 0.8 \times 10^{-6}$. This agrees in order of magnitude with the value obtained by Yu. G. Abov et al. [6]

It should be noted in conclusion that, in view of the fundamental significance of the investigated effect, further investigations with other isotopes, in which the bremsstrahlung accompanying β decay or K capture can be fully suppressed, are desirable.

In conclusion, the authors are deeply grateful to Professor D. M. Kaminker for constant support and a discussion of the results, and to V. A. Knyaz'kov, N. V. Porozov, G. D. Chuklin, V. P. Lapin, and V. B. Belyakov for participating in the preparation of the apparatus and in the measurements. The authors are also deeply grateful to L. N. Kondurova for calculations of the internal bremsstrahlung and to A. I. Egorov for help in preparing the sources.

[1] Nuclear Data Sheets 6, 52 (1965).

[2] V. M. Lobashov, V. A. Nazarenko, L. F. Saenko, and L. M. Smotritskii, JETP Letters 3, 76 (1966), transl. p. 47.

[3] E. Bashandy and M. S. El-Nesr, Arkiv Phys. 21, 65 (1961).

[4] E. Bashandy and M. S. El-Nesr, Nucl. Phys. 31, 128 (1962).

[5] R. R. Lewis and G. W. Ford, Phys. Rev. 107, 756 (1957).

[6] Yu. G. Abov, P. A. Krupchitskii, and Yu. A. Oratovskii, Yadernaya fizika 1, 479 (1965), Soviet JNP 1, 341 (1965).