Here $\xi = E\sqrt{g}$, and the limit as $m \to 0$ is considered. A similar investigation of this problem, with an estimate of the contribution of many-particle intermediate states, is now under way.

5. It follows from the results that, at least within the framework of the models considered, the NRI problem has a singular solution free of the difficulties inherent in these interactions and non-analytic in the charge. This solution cannot be obtained from the dynamic equations and arises only when the problem is axiomatically formulated. The results confirm the likelihood of this point of view on the difficulties of the NRI theory, which starts from the assumption that the dynamic theory is not suitable for a description of such interactions.

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LIFETIMES OF THE EXCITED LEVELS OF Pm^{151}

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The Pm^{151} nucleus has not been thoroughly studied. All that are known at present are the quadrupole moment (Q = 1.9 b [1]) and the spin and parity ($5/2^+$ [2]) of the ground state. Only one paper [4] is devoted to the measurement of the lifetimes of its excited levels on the basis of the decay scheme of [3]. We present here a more thorough experimental investigation of the lifetimes of the excited levels of Pm^{151} using a delayed coincidence method that yielded many new data.

The time resolution of the apparatus was $2\tau_0 = 5 \times 10^{-10}$ sec. The source was obtained by irradiating a natural mixture of neodymium isotopes in a beam of thermal neutrons from the VVR-S reactor of the Uzbek Institute of Nuclear Physics. The integral activity of the interfering components did not exceed 1/10 of the fundamental activity during the time of the measurements. By additional energy tuning, their influence on the measured time spectrum was reduced to 1% or less.

The lifetime of the 118-keV level was determined from the time coincidence spectrum of the 1180- and 118-keV γ rays. Analysis of the pulse-height spectrum of coincidences with 1180-keV γ rays when tuned to the upper limit of its Compton spectrum disclosed the presence of additional γ radiation which did not agree with the decay scheme. This radiation contributed little to the measured time spectrum. Reduction of the data by the method of moments yielded for the lifetime of the 118-keV level

$$\tau_{\gamma} = 8 \times 10^{-11} \text{ sec},$$

which did not contradict the known estimate $T_{\frac{1}{2}} \leq 0.3$ nsec [4].

The lifetime of the 256-keV transition was determined from the β (2.06 MeV) - γ (256 keV) coincidences with selection of the upper limits of their energy splitting. In this and subsequent cases the reduction of the obtained time spectrum (Fig. a) was by least squares. The half-life for the 256-keV transition was

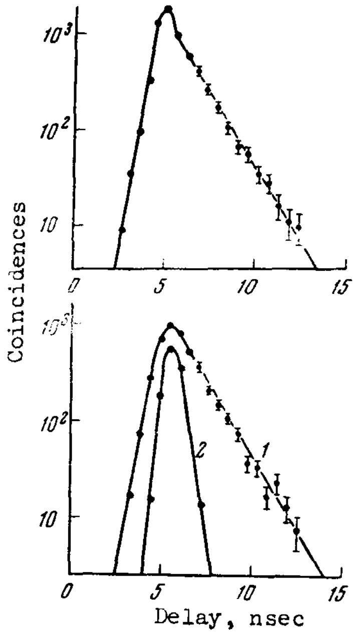
$$T_{\frac{1}{2}} = (0.93 \pm 0.03) \times 10^{-9} \text{ sec}.$$

This agreed with the earlier measurement [4].

From the analysis of the $\beta\gamma$ coincidence we obtained also tentative values for the half-lives of the 1298, 1122, 855, and 425 keV levels

$$T_{\frac{1}{2}} \leq 10^{-10} \text{ sec}.$$

The character of the γ spectrum of Pm^{151} does not make it possible to determine the partial lifetime of the 138-keV transition from the 256-keV level when working with two detectors. We therefore carried out in the measurements additional selection with a third detector. The time spectrum was obtained from β (206 MeV) - γ (138 keV) - γ (118 keV) coincidences (Fig. b, curve 1). The result for the 138-keV transition corresponds to $T_{\frac{1}{2}} = (0.95 \pm 0.04) \times 10^{-9}$ sec.



a - Spectrum of delayed coincidences for the 256-keV transition; b - (1) delayed-coincidence spectrum for the 138-keV transition from the 256-keV level, (2) prompt coincidences.

We measured in similar fashion the lifetimes of the 176- and 170-keV transitions from the 1298- and 425-keV levels, respectively:

$$T_{\frac{1}{2}} \leq 2 \times 10^{-10} \text{ sec}.$$

Taking into account the shortcomings of the previously presented decay scheme [3], we have plotted, using the new three-detector procedure, the pulse-height spectrum of the γ rays participating in three cascade transitions. The multichannel analyzer registered in this case only those γ rays from the scintillation spectrometer, which corresponded in time to coincidences in the two fast γ detectors. The obtained spectrum shows an intense anomalous maximum near 90 keV, which apparently belongs to the low-energy levels.

The delay factors of the 118- and 256-keV levels relative to the single-particle estimates after Moszkowski, are equal to 9 and 670 respectively.

The latter suggests that the 256-keV level is ℓ-forbidden with multipolarity M1 and level spin $7/2^+$. The lack of additional information on the experimental quantum characteristics of Pm^{151} does not permit an unambiguous discussion of the results.

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SOME CONSEQUENCES OF THE ALGEBRA OF WEAK AND ELECTROMAGNETIC CURRENTS

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A few years ago Nambu [1] proposed that the axial current of β decay is rigorously conserved in the limit when the pion mass vanishes, $m_\pi \to 0$.

It was shown in [1] that the Goldberger-Treiman condition is satisfied exactly in this limit. If we take into account the smallness of the pion mass compared with other hadrons, then it becomes clear why the Goldberger-Treiman condition is apparently satisfied in the real world. In this note, on the basis of Nambu's hypothesis and under the assumption that weak and electromagnetic currents from an SU(3) x SU(3) algebra, we obtain several relations that are valid in the limit as $m_\pi \to 0$. We proceed to derive these relations. Let $j^i_{\alpha 5}(x)$ be the axial current of the i-th isospin component, and $j^i_\alpha(x)$ the vector current of this component. We start from the formula:

$$\partial_\alpha \partial'_\beta \langle B | T\, j^i_{\alpha 5}(x)\, j^k_{\beta 5}(x') | A \rangle = i\epsilon^{ik\ell} \langle B | j^\ell_\gamma(x) | A \rangle\, \partial'_\gamma\, \delta(x - x') \qquad (1)$$

$$(\partial_\alpha = \partial/\partial x_\alpha, \quad \partial'_\beta = \partial/\partial x'_\beta).$$

In the derivation (1) we took into account the equalities

$$\partial_\alpha\, j^i_{\alpha 5}(x) = 0; \; [j^i_{05}(x),\, j^k_{\alpha 5}(x')]_{x_0 = x'_0} = i\epsilon^{ik\ell}\, j^\ell_\alpha(x)\, \delta(\vec{x} - \vec{x}'). \qquad (2)$$

If we take the Fourier transforms of (1) with respect to x and x' (corresponding to the momenta q and q') then this equation can be expressed graphically as shown in Fig. 1, where the short dashed lines correspond to the current operators. We now let q and q' approach 0 1). In this limit, the main contribution to the left side of (1) are made by diagrams which have pion poles both in q and in q'. If we denote the amplitude of the transition of an axial