NEW ISOMER Sn^{113m}

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ACCORDING to the systematics of the half-lives of the isomers, one would expect the long-lived (T = 119 days) tin isotope Sn^{113} to have an isomer with a half-life somewhat shorter than that of Cd^{111m} (T = 48.7 min). Actually, an investigation of the isotope Sb^{113} (T = 7 min) with a double-lens β spectrometer has disclosed that, as a result of positron decay, this isotope is partially transmuted into a new isomer, Sn^{113m}, with a half-life of 27 ± 3 min.

There have been observed in the conversion spectrum of Sb^{113} electrons with energies 49.6, 75.3, and 77.4 kev, corresponding to conversion of γ radiation of energy 79.3 ± 0.5 kev on the K, L, and M shells. The ratio of the conversion on the K shell to that on the L shell is 1.75.

Theoretical values of this ratio, for transitions of various multipolarities, are: E1 — 9.45, E2 — 3.8, E3 — 0.95, M1 — 7.55, M2 — 3.8, and M3 — 3.56. The extrapolated value for M4 is about 1.7. Consequently, the isomer transition from the metastable state of Sn^{113m} has a multipolarity M4.

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201

REMARK ON THE DECAY OF THE CASCADE HYPERON

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IF the spin of the cascade hyperon is $\frac{1}{2}$, the amplitude of its decay

$$\Xi^0 \to \Lambda^0 + \pi^0, \quad \Xi^- \to \Lambda^0 + \pi^- \tag{1}$$

can be written in the form

$$A = 2\bar{u}_\Lambda (a + be^{i\varphi}\sigma\mathbf{n})\, u_\Xi. \tag{2}$$

Here a and b denote the amplitude for the formation of Λ^0 and π in the S and P states, respectively, and φ is the difference of the phase shifts for the scattering of the π meson by the Λ hyperon in these states. The unit vector **n** is directed along the momentum of the Λ^0 hyperon in the rest system of the Ξ hyperon, the σ's are the Pauli matrices, and u_Λ and u_Ξ are two-component spinors.

If the polarization vector of the Ξ hyperon (in the rest system of Ξ) is denoted by $\boldsymbol{\eta}$ and the polarization vector of the Λ hyperon (in the rest system of Λ) by $\boldsymbol{\zeta}$, the probability of the decay of a polarized Ξ hyperon with formation of a polarized Λ hyperon, as calculated with the help of the amplitude (2), has the form

$$W(\mathbf{n}, \boldsymbol{\eta}, \boldsymbol{\zeta}) = a^2 + b^2 + 2ab\cos\varphi(\boldsymbol{\zeta}\mathbf{n} + \boldsymbol{\eta}\mathbf{n}) + (a^2 - b^2)\boldsymbol{\zeta}\boldsymbol{\eta} + 2b^2(\boldsymbol{\zeta}\mathbf{n})(\boldsymbol{\eta}\mathbf{n}) + 2ab\sin\varphi[\boldsymbol{\eta}\boldsymbol{\zeta}]\mathbf{n}. \tag{3}$$

Formula (3) contains, of course, all possible correlations which were recently considered by Teutsch, Okubo, and Sudarshan.[1] With regard to this formula we should like to make the following observation. As is seen from formula (3), the polarization of the Λ hyperons in the direction perpendicular to the plane defined by the vectors $\boldsymbol{\eta}$ and **n** will be zero unless $\varphi \neq 0$. The study of the polarization of the Λ hyperons in this direction (together with the measurement of the longitudinal polarization of the Λ hyperons, for example) permits, therefore, the determination of the difference of the S and P phase shifts in the scattering of π mesons by Λ hyperons.

We note that, by isotopic invariance, the value of φ_-, obtained from the decay of the Ξ^- hyperon, and of φ_0, obtained from the decay of the Ξ^0 hyperon, should be identical.

For comparison we mention that the S phase shifts for the scattering of a π meson by a nucleon at corresponding energies (the momentum in the center-of-mass system is equal to $m_\pi c$) are approximately equal to $\alpha_1 \approx -7°$ for the channel $T = 1/2$ and to $\alpha_3 \approx +10°$ for $T = 3/2$ (reference 2). The resonance P phase is equal to $\alpha_{33} \approx 12°$, while the other P phases are close to zero.

[1] Teutsch, Okubo, and Sudarshan, Phys. Rev. **114**, 1148 (1959).

[2] J. Orear, Phys. Rev. **100**, 288 (1955).

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202