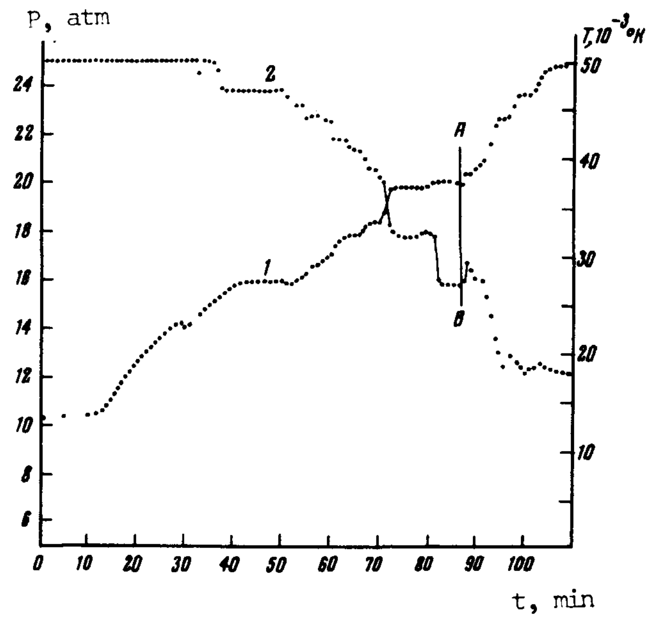


Fig. 3. Time schedule of the experiment with adiabatic recrystallization of $He^3$. 1 - $He^4$ pressure, 2 - $He^3$ temperature.

temperature was determined from the susceptibility of the cerium-magnesium nitrate. The reason why abrupt cooling does not set in immediately, but only after the pressure of the $He^4$ has risen to 15 - 16 atm, is that at large pressure drops, when $P_{He^3} \sim 30$ atm and $P_{He^4} \sim 1$ atm, the membranes 14 and 15 (Fig. 2) become strongly deformed and come in contact with each other. Consequently a noticeable change in the volume of the $He^3$ occurs only when $P_{He^4} > 15$ atm. It is very important to vary the pressure smoothly. A sharp increase in pressure can lead not to cooling but, to the contrary, to an increase in the temperature of the $He^3$. By accident, the pressure rose on curve 1 (Fig. 3), at the point A, by several tenths of an atmosphere within 2 - 3 seconds. (No such pressure jumps are noted on curve 1, since the readings of the instruments were recorded not oftener than once a minute.) This was followed immediately by a rise of approximately 0.005° in the temperature of the $He^3$ (point B on curve 2).

A more detailed study of the Pomeranchuk effect, using nuclear thermometry, is presently under way.

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## TIME PARITY NONCONSERVATION IN STRONG INTERACTIONS

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Henley and Jacobsohn [1] (see also [2]) calculated the correlation of the pulses of two cascade gamma quanta emitted by an excited polarized nucleus. The correlation calculation took account of the nonconservation of time parity in strong interactions for the particular case when the first $\gamma$ transition is mixed and the second pure.

In this paper we calculate the correlation of the pulses of two cascade $\gamma$ quanta for the general case when both $\gamma$ transitions are mixed.

Let the polarized nucleus go over from an excited state with momentum $j_0$ and polarization P to a state with momentum $j_1$ by emitting a mixed $\gamma$ quantum of multipolarity $ML_1 + E(L_1 + 1)$ ($L_1$ - total angular momentum of the quantum), followed by a transition to a state with momentum $j_2$ by emission of a quantum $ML_2 + E(L_2 + 1)$.

The angular correlation of the $\gamma$ quanta will in this case be of the form

$$\begin{aligned} W = \sum_{g=0,2,4\ldots} & P_g(\cos\theta)\Big\{F_g(L_1L_1j_0j_1) + 2|\delta_1|\cos\eta_1 F_g(L_1L_1 + 1j_0j_1) \\ & + |\delta_1|^2 F_g(L_1 + 1L_1 + 1j_0j_1)\Big\}\Big\{F_g(L_2L_2j_2j_1) - 2|\delta_2|\cos\eta_2 F_g(L_2L_2 + 1j_2j_1) \\ & + |\delta_2|^2 F_g(L_2 + 1L_2 + 1j_2j_1)\Big\} - 6P\sin\eta_1\left(\frac{j_0}{j_0+1}\right)^{1/2}|\delta_1|\, \mathbf{s}\cdot[\mathbf{n}_1 \times \mathbf{n}_2] \\ & \times \sum_{g=2,4\ldots} P_g'(\cos\theta)\left\{\frac{2g+1}{g(g+1)}\right\}^{1/2} F_{1g}^{g}(L_1L_1 + 1j_1j_0)\Big\{F_g(L_2L_2j_2j_1) - 2|\delta_2|\cos\eta_2 F_g(L_2L_2 \\ & + 1j_2j_1) + |\delta_2|^2 F_g(L_2 + 1L_2 + 1j_2j_1)\Big\} \end{aligned} \tag{1}$$

where $\mathbf{n}_1$ and $\mathbf{n}_2$ are unit vectors in the directions of the momenta of the first and second $\gamma$ quanta of the cascade, $\theta$ the angle between them, $\mathbf{s}$ the nuclear spin vector, $P_g$ the Legendre polynomial, and $P_g'(\cos\theta) = \frac{d}{d\cos\theta} P_g(\cos\theta)$

$$F_g(LL'j_0j_1) = (-1)^g\Big\{(2g + 1)(2j_1 + 1)(2L + 1)\Big\}^{1/2} C^{L'1}_{L1g0} W(L'j_0gj_1; j_1L) \tag{2}$$

$$\begin{aligned} F^{g_2}_{g_1g_3}(LL'j_1j_0) = (-1)^{L-1}&\Big\{(2j_1 + 1)(2j_0 + 1)(2L + 1)(2L' + 1)\Big\}^{1/2} \times \\ & \times C^{g_20}_{L1L'-1} X(j_0j_0g_1;\ LL'_{g_2};\ j_1j_1g_3) \end{aligned} \tag{3}$$

In formulas (2) and (3) C, W, and X are the Clebsch-Gordan, Racah, and Fano coefficients, respectively. The summation in (1) is over all the allowed values of g. The function $F_g(LL'j_0j_1)$ has been tabulated for some particular cases in [3].

The quantities $\delta_i$ in (1) are the ratios of the reduced matrix element $E(L_i + 1)$ and $ML_i$ of the $\gamma$ transitions

$$\frac{A(EL_i + 1)}{A(ML_i)}\sqrt{\frac{L_i + 2}{2L_i + 3}} = |\delta_i|\exp(i\eta_i) \tag{4}$$

where $\eta_i$ is the phase shift between the matrix elements, due to the nonconservation of the time parity in strong interactions ($\eta_i = 0$ or $\pi$, if the strong interaction conserves time parity).

It follows from (1) that the experimental study of the angular correlation of $\mathbf{s}\cdot[\mathbf{n}_1 \times \mathbf{n}_2]$ is best carried out with nuclei in which the first $\gamma$ transition of the cascade is mixed (ML + + E(L + 1) and the second is pure. In this case the coefficient $\mathbf{s}\cdot[\mathbf{n}_1 \times \mathbf{n}_2]$ in the correlation, proportional to $\sin\eta_1$, depends very strongly on the phase $\eta_1$. $\mathbf{s}\cdot[\mathbf{n}_1 \times \mathbf{n}_2]$ vanishes if the first $\gamma$ transition is pure.

A study of effects connected with nonconservation of time parity becomes particularly important now that decay of the $K_2^0$ meson into two pions has been experimentally observed [4]. The existence of this decay can be interpreted as a result of nonconservation of time parity in the weak interactions.

In connection with the observation of the $K_2^0 \to \pi^+\pi^-$ decay, L. B. Okun' [5] advanced a hypothesis whereby time parity may not be conserved in the amplitudes of all the processes in which strongly interacting particles participate. The expected contribution from the nonconservation of the time parity to the amplitudes of the different processes is then of the order of $10^{-3}$. Thus, according to this hypothesis, the phase shifts $\eta_1$ and $\eta_2$ in formula (1), which are due to nonconservation of time parity, should be of the order of $10^{-3}$.

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## NEODYMIUM GLASS LASER WITH SINGLE PULSE DURATION CLOSE TO THE LIMIT

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The role of various factors that determine the power and duration of a single pulse produced in Q-modulated lasers has been discussed in several papers. No account was taken in these papers, however, of the fact that when the duration of the pulse is on the order of several nanoseconds and the cavity is 30 cm or longer, the travel time of the radiation quantum between the cavity mirrors becomes commensurate with the pulse duration. It is obvious that the limiting duration of the single pulse is determined by the time required for the quantum to cover twice the distance between the cavity mirrors, this being necessary to effect feedback, i.e., for lasing to occur. At low values of the negative-absorption coefficient, the limiting duration of the single pulse is determined by more than two passages of the quantum between mirrors, the larger number being necessary to discard the excess particles from the metastable level. The pulse duration in neodymium-glass lasers with phototropic shutters amounts to 25 nsec according to [6] or 35 nsec according to our data [7], i.e., much longer than for ruby lasers, where it amounts to 9 nsec [3, 4] 1).

We have therefore attempted to obtain a phototropic substance which would yield in the case of a neodymium laser a single pulse of near-limiting duration. After many attempts we found that one of the analogs of the pentacarbocyanins [6] makes it possible to obtain a single pulse of sufficiently small duration.

We used in the experiment a laser with neodymium glass of length 120 mm and diameter 12 mm and with an effective cavity length $L_{eff}$ = 55 cm (the cavity is made up of two external mirrors with $R_1$ = 99 and $R_2$ = 40%). The transmission coefficient of the cuvette with the solution,