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VERIFICATION OF EXPONENTIAL DECAY LAW

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If the number of decays per unit time is $N(t) = N_0 e^{-\Gamma t}(1 + \alpha\Gamma^2 t^2)$,* then the experiments yield the following limitations on the value of α (Γ = width):

Particle	Time interval Γt	Upper limit of $\lvert\alpha\rvert$ at 70% confidence level		Particle	Time interval Γt	Upper limit of $\lvert\alpha\rvert$ at 70% confidence level	
μ^+	$\leqslant 3$	$\leqslant 5.0\cdot10^{-3}$	1	K_L^0	$1.3 \leqslant \Gamma t \leqslant 2.1$	$\leqslant 1.5\cdot10^{-2}$ ***	11
	$\leqslant 8$	$\leqslant 1.2\cdot10^{-3}$	2		$\Gamma t = 1.0$; 1.4; 1.8;	$\leqslant 5\cdot10^{-2}$	12
π^+	$\leqslant 15$	$\leqslant 5.0\cdot10^{-4}$	3				
	$\leqslant 8$	$\leqslant 1.6\cdot10^{-3}$	4	Λ^0	$\leqslant 4.6$	$\leqslant 2.0\cdot10^{-2}$	13
	$\leqslant 6$	$\leqslant 2.0\cdot10^{-3}$	5		$\leqslant 3.0$	$\leqslant 2.0\cdot10^{-2}$	14
K^+	$\leqslant 7.3$	$\leqslant 7.0\cdot10^{-6}$ *	6	Σ^-	$\leqslant 1.6$	$\leqslant 4.0\cdot10^{-2}$	15
	$\leqslant 4$	$\leqslant 5.0\cdot10^{-4}$ **	7	Ξ^-	$\leqslant 6$	$\leqslant 1.0\cdot10^{-2}$	16
K_S^0	$8 \leqslant \Gamma t \leqslant 13$	$\leqslant 2.0\cdot10^{-3}$	8				
	$\leqslant 5$	$\leqslant 5.0\cdot10^{-3}$	9				
	$\leqslant 4$	$\leqslant 3.0\cdot10^{-2}$	10				

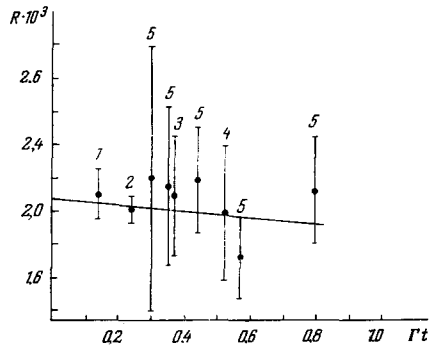
*W. Fitch determined α_F by using the expression

$$N(t) = N_0 e^{-\Gamma t}(1 + \alpha_F t)^2.$$

**This value was obtained on the basis of the statement by the authors that at $\Gamma t = 4$ the deviations from exponential were less than 1%.

***This quantity contains more uncertainties and is based on the 3% accuracy with which the lifetime was measured in that investigation.

All the remaining estimates were obtained on the basis of the decay curves given in the papers.



Time dependence of the probability ratio of the decays $K_L \to \pi^+\pi^-$ and $K_L \to$ all charged modes, $R = \Gamma(K_L \to \pi^+\pi^-)/\Gamma(K_L \to$ all charged modes); the straight line is drawn by the least squares method and is described by the equation $R = a + b\Gamma t$. $a = (2.07 \pm 0.06) \times 10^{-3}$, $b = (0.18 - 0.19) \times 10^{-3}$. The numbers over the experimental points denote the following references: 1. X. de Bouard et al., Phys. Lett. 15, 58 (1965) 2. M. Bott-Bodenhausen et al., Phys Lett. B24, 194 (1967). 3. W. Galbraith et al., Phys. Rev. Lett. 14, 383 (1965). 4. J. Christenson et al., Phys. Rev. Lett. 13, 138 (1964). 5. V. L. Fitch et al., Phys. Rev. Lett. 164, 1711 (1967).

*In the expansion $N(t) = N_0 e^{-\Gamma t}(1 + \alpha_1 t + \alpha_2 t^2 + \ldots)$ the linear term yields only redefined widths at small values of time. Indeed

For Mn^{56}, the decay curve was investigated from 13 to 29 lifetimes[17]. Up to 25 lifetimes, no deviations from an exponential law were observed (the statistics at larger times are poor).

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