[3] A.A. Galeev and R.Z. Sagdeev, Zh. Eksp. Teor. Fiz. 53, 348 (1967) [Sov. Phys.-JETP 26, 233 (1968)].
[4] B.B. Kadomtsev and O.P. Pogutse, in: Voprosy teorii plazmy (Problems in Plasma Theory), No. 5, p. 326, Atomizdat, 1967.

CONCERNING ONE POSSIBILITY OF MEASURING THE REGENERATION PHASE

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Submitted 16 March 1970
ZhETF Pis. Red. 11, No. 9, 452 - 454 (5 May 1970)

In connection with the new experiments performed with the accelerator of the High-energy Physics Institute [1] and the possible violation of the Pomeranchuk theorem, measurement of the phase of regeneration of K^0 mesons at high energies [2] has become very important. This quantity plays an important role also in the measurement of the parameters that characterize violation of CP-invariance.

We propose to use, for a direct observation of the regeneration phase, the interference between beams of long-lived neutral K mesons, one attenuated and the other coherently regenerated from K_1^0.

Proceding in the standard manner (cf., e.g., [3]), we can write down the wave function of the K^0 meson in the following manner:

$$|K^0> \sim e^{-iM_1 t}\left\{e^{-i(M_1 t_1 + M_1'\tau)} + \rho e^{-i(M_2 t_1 + M_2'\tau)}\right\}|K_1^0> +$$

$$+ e^{-iM_2 t}\left\{e^{-i(M_2 t_1 + M_2'\tau)} + \rho e^{-i(M_1 t_1 + M_2'\tau)}\right\}|K_2^0> ,$$

where t_1, τ, and t are the times of flight of the particle from the source to the front edge of the regenerator, inside the regenerator, and from the rear edge of the regenerator to the decay point, respectively,

$$\rho = \frac{\pi N}{m}\frac{f - \bar{f}}{M_2 - M_1}\left(1 - e^{i(M_2 - M_1)\tau}\right).$$

N is the number of nuclei per cm^3 of the regenerator, $M_{2,1} = m_{2,1} - i\Gamma_{2,1}/2$, $m_{2,1}$ and $\Gamma_{2,1}$ are the masses and widths of the K_2^0 and K_1^0 mesons, and f and $\bar{f}$ are the forward elastic scattering amplitudes of the K^0 and $\bar{K}^0$ mesons in the substance. The difference $f - \bar{f}$ is the regeneration amplitude,

$$M'_{2,1} = M_{2,1} - \frac{\pi N}{m}(f + \bar{f}), \text{ a } m = \frac{m_1 + m_2}{2} .$$

Far behind the regenerator, the intensity of the $K_2^0 \to F$ decay (where F is an arbitrary channel) is given by

$$I(K_2^0) \sim \Gamma_2(F)\, e^{-\Gamma_2(t+\tau)}\left\{e^{-\Gamma_2 t_1} + |\rho|^2 e^{-\Gamma_1 t_1} + 2|\rho|\, e^{-\Gamma_1 \frac{t_1}{2}} \cos(\phi_\rho + \Delta m t_1)\right\}$$

$\Delta m = m_2 - m_1$, and $\phi_\rho \equiv \arg \rho$.

It is seen from this expression that the contribution of the regenerated K_2^0 mesons to the intensity depends exponentially on the position of the regenerator. By measuring the intensity under conditions when the contribution of the regenerated K_2^0 mesons is large (at $\Gamma_1 t_1 \sim 2$ and in the presence of a thick regenerator this contribution may amount to 10%) and when it is negligibly small (at $\Gamma_1 t_1 \sim 8 - 10$), we can find the phase ϕ_ρ (and by the same token the regeneration phase)

$$\cos(\phi_\rho + \Delta m t_1) = \left\{ \frac{I_1}{I_2} e^{-\Gamma_2 t_1'} - e^{-\Gamma_2 t_1} - |\rho|^2 e^{-\Gamma_1 t_1} \right\} \frac{e^{\Gamma_1 \frac{t_1}{2}}}{2|\rho|} .$$

Here I_1 and I_2 are the intensities measured under the condtiions listed above, and t_1' is the time of flight of the particle from the source to the regenerator during the measurement of I_2. It is assumed that Δm is known.

Measurement of $|\rho|$ can be carried out in a beam of pure K_2^0 mesons (cf., e.g., Faissner et al. [4]).

We note that the regeneration phase can be determined, independently of the phases of the CP-violation parameters, from the time dependence of the charge asymmetry of the decays $K_2^0 \to \pi^\pm \ell^\pm \nu(\bar{\nu})$ behind the regenerator [5]. An advantage of the experiment proposed by us is that there is no need to plot the interference curve, and it suffices to measure the intensities I_1 and I_2, say of the decay of a long-lived K^0 meson into three pions.

In conclusion, I am grateful to B.A. Arbuzov and D.B. Kakauridze for stimulating discussions.

[1] J.V. Allaby, Yu.B. Bushnin, S.P. Denisov, et al., Phys. Lett. 30B, 500 (1969).
[2] K. Kleinknecht, Phys. Lett. 30B, 514 (1969); S.S. Gershtein, I.Yu. Kobzarev, and L.B. Okun', ZhETF Pis. Red. 11, 75 (1970) [JETP Lett. 11, 48 (1970)]; A.G. Anzauryan and L.D. Solov'ev , Inst. High-energy Phys. Preprint, 70-3 (1970).
[3] T. Lee and N. Wu, Weak Interactions, Academic, 1968.
[4] H. Faissner, H. Foeth, A. Staude, et al., Phys. Lett. 30B, 204 (1969).
[5] S. Bennett, D. Nygren, H. Saal, et al., Phys. Lett. 27B, 239 (1968); Phys. Lett. 29B, 317 (1969).

CONCERNING THE PROBLEM OF THE A_2 MESON

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Submitted 16 March 1970
ZhETF Pis. Red. 11, No. 9, 454 - 456 (5 May 1970)

1. The observation of the splitting of the A_2 meson into two components, A_2^L and A_2^H [1], and the absence of such a splitting in the case of K*(1400) [2] from the same 2^+ nonet (in the SU(3) scheme) leads to significant difficulties for the SU(3) symmetry scheme itself and for the quark model [3]. In any case, the most important problem [3] is whether the quantum numbers of A_2^H and A_2^L are the same or different. It must be emphasized that the usual methods of determining the quantum numbers presuppose a priori the existence of resonances (unstable particles) whose quantum numbers are to be determined. Therefore, the